



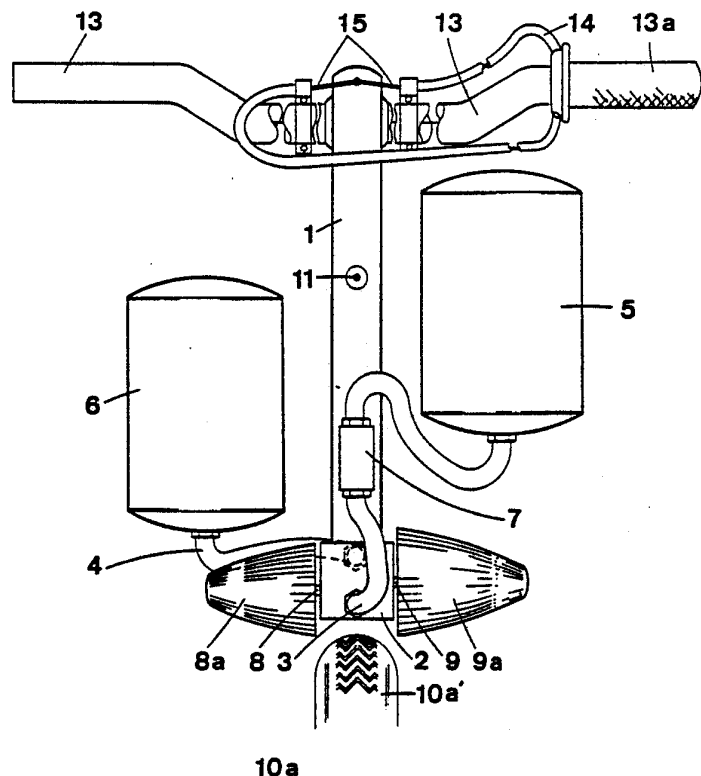
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(54) Title: ARRANGEMENT ON A BICYCLE

(57) Abstract

Arrangement on a bicycle (10) so adapted through operative connection to one of the bicycle wheels (10a) as to cause the storage of energy which is not being utilized for the time being for the propulsion of the bicycle (10), and the propulsion of same by utilizing previously stored energy. The arrangement in accordance with the invention comprises: a hydraulic device (2) of a kind which has two opposing, mutually parallel shafts (8, 9) which are capable of operating both as a pump and as a motor, a suspension arrangement for the hydraulic device (2) by means of which it is capable of being fitted to the cycle (10), on each of the shafts (8, 9) of the hydraulic device a drive roller (8a, 9a) so adapted as to be brought into engagement with the tyre (10a') of the bicycle wheel, a high-pressure accumulator (5) communicating with the aforementioned pressure side of the hydraulic device (2) by means of a first line (3), a low-pressure accumulator (6) communicating with the suction side by means of a second line (4), a valve (7) arranged in the aforementioned first line (3) between the pressure side and the high-pressure accumulator (5) and so adapted as to keep the line (3) open only when one of the rollers (8a, 9a) is in engagement with the tyre (10a') and control devices (13a, 14, 15) operatively connected to the suspension arrangement (1) for the purpose of adjusting the hydraulic device (2) to the desired angle of deflection.



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Arrangement on a bicycle

The present invention relates to an arrangement on a bicycle comprising a hydraulic device capable of being fitted to the bicycle by means of a suspension arrangement, which hydraulic device communicates via lines with a high-pressure accumulator and with a low-pressure accumulator and is so adapted through operative connection to one of the bicycle wheels, preferably the front wheel, as to cause the storage in the high-pressure accumulator of energy which is not being utilized for the time being for the propulsion of the bicycle, and the propulsion of same by utilizing previously stored energy.

Proposals for devices for utilizing the braking energy and the potential energy of a vehicle are previously disclosed in American patents 2,177,381, 3,729,213 and 4,078,816, although a commercially viable solution to the problem does not yet exist with regard to bicycles.

The present invention relates to an arrangement of the above-mentioned kind, which is able by the use of comparatively simple technology to utilize surplus energy when cycling on level ground or downhill, in order to apply the utilized energy when cycling uphill. This is made possible in that the aforementioned hydraulic device is of a kind which has two opposing, mutually parallel shafts with opposite directions of rotation, in which case the device, when one of the shafts is driven in a certain direction of rotation, operates as a pump with a pressure side and a suction side, and when a pressure is applied to the pressure side, the device operates as a motor, in which case the second shaft has the aforementioned direction of rotation, in that the hydraulic device is capable of being pivoted by means of the suspension arrangement along a circular arc in a plane cross-wise to the plane of the wheel, in that there is present on each of the shafts of the hydraulic device a drive roller so adapted by means of the aforementioned ability of the hydraulic device to pivot as to be

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brought alternately into engagement with the tyre of the bicycle wheel, which drive rollers taper in a direction outwards from the hydraulic device in such a way that the generatrix of the surface of the rollers which engages with the tyre follows the
5 aforementioned circular arc, in that there is arranged in the line between the pressure side and the high-pressure accumulator a valve which is operatively connected to the suspension arrangement and is so adapted as to keep the line open only when one of the rollers is in engagement with the tyre, that is to say so as to cut off the
10 line when the wheel is situated between the rollers, and in that control devices which are operatively connected to the suspension arrangement are provided for the purpose of adjusting the hydraulic device to the desired angle of deflection, in which case the control device has a neutral position corresponding to the position
15 adopted by the hydraulic device when the valve is closed.

According to a particular characteristic feature of the invention one of the drive rollers is of larger diameter than the other. That drive roller which, when surplus energy is being utilized, is in
20 engagement with the bicycle wheel viewed in the direction of travel may conveniently lie behind the drive roller which, when stored energy is being utilized, is in engagement with the bicycle wheel.

The invention is described below in more detail with reference to
25 the accompanying drawing, in which Fig. 1 illustrates schematically in a front view an illustrative embodiment of an arrangement in accordance with the invention. Fig. 2 illustrates a part of the arrangement in Fig. 1, viewed from above, and Fig. 3 illustrates a plan view from the side of a part of the arrangement in accordance
30 with the invention fitted to a bicycle.

The arrangement in accordance with the invention comprises a hydraulic device 2 attached to a suspension arrangement 1, which hydraulic device is connected via lines 3, 4 to hydraulic
35 accumulators 5, 6. Connected in the line 3, which links the hydraulic device 2 to the accumulator 5, which is a high-pressure

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accumulator, is a valve 7, the function of which is described in greater detail below. The hydraulic device 2 is preferably of the gear type and is so adapted as to operate both as a pump and as a motor. It has two opposing and counter-rotating shafts 8, 9 equipped with drive rollers 8a, 9a. In a hydraulic device of this kind the relationship described below exists between the driving of the shafts 8, 9 and their directions of rotation on the one hand, and the positive and negative pressure in the lines 3, 4 on the other hand: when, for example, the shaft 8 is caused to rotate in an anti-clockwise sense, in which case the hydraulic device 2 operates as a pump, the other shaft 9 rotates in a clockwise sense, negative pressure is produced in that part of the hydraulic device 2 which communicates with the line 4, and positive pressure is produced in that part of the hydraulic device which communicates with the line 3. In a similar manner the shaft 9 will rotate in an anti-clockwise sense if positive pressure is applied to the line 3, in which case the hydraulic device 2 operates as a motor.

The hydraulic device 2 is capable of being fitted by means of the suspension arrangement 1 to a bicycle 10 (see Fig. 3), and of being pivotally mounted on a shaft 11 in such a way that it is capable of being pivoted along a circular arc in a plane cross-wise to the plane of the bicycle wheel 10a. The drive rollers 8a, 9a are so adapted as to be brought into engagement with the tyre 10a' and are executed for this purpose so that they taper in a direction outwards from the hydraulic device in such a way that the generatrix of the surface of the rollers 8a, 9a which engages with the tyre 10a' follows the aforementioned circular arc. The shaft 11 projects outwards from a bracket 12.

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In order to achieve the deflection of the suspension arrangement 1, this is operatively connected to an actuating device in the form of a handle 13a pivotally arranged on the handlebars 13 of the bicycle. The operative connection consists of double Bowden cables 14 of a previously disclosed kind, with wires 15 attached to the suspension arrangement 1. By rotating the handle 13a it is possible

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to cause the suspension arrangement 1 to deflect in the manner of a pendulum to either side of a central position in which neither of the drive rollers 8a, 9a is in engagement with the tyre 10a, in conjunction with which one of the aforementioned rollers 8a, 9a is brought into engagement with the tyre 10a'. It can be noted that the more or less conically reducing diameter of the drive rollers 8a, 9a has the effect of increasing the gearing ratio between these and the tyre 10a' as the angle of deflection of the suspension arrangement 1 increases.

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The valve 7 is so arranged as to keep the line 3 open only when one of the rollers 8a, 9a is in engagement with the tyre 10a'. For this purpose it is capable of mechanical actuation from outside by means of a pin-like projection 16, which, when the suspension arrangement 1 is fitted to a bicycle, is so adapted as to be actuated by a part of the bicycle so that the above-mentioned function is achieved.

The mode of operation of an arrangement in accordance with the invention is now explained with reference to the Figures contained in the drawings, in conjunction with which it must first be assumed that the bicycle is being ridden downhill. In order to be able to utilize the surplus energy, the handle 13a is rotated so that the suspension arrangement 1, when viewed from the front, is caused to rotate in a clockwise direction, i.e. so that the hydraulic device 2 is deflected outwards to the left in Fig. 2, in conjunction with which the drive roller 9a is brought into engagement with the tyre 10a' and is driven by it. The rotational movement of the handle 13a is converted in this case into a linear movement, which is transferred by the wires 15 to the suspension arrangement 1. The valve 7 is opened, and oil is now pumped from the low-pressure accumulator 6 to the high-pressure accumulator 5 and gives rise to a positive pressure which represents the stored energy. The greater the angle of deflection, that is to say the further out towards the tip of the drive roller 9a the tyre 10a' is in engagement with the drive roller, the greater the gearing ratio and with it the rate of pumping, and the harder it is to pedal. Accordingly a higher

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gearing ratio is selected on a steep downhill section than on a level section.

Let us now assume that the downhill section levels out and perhaps even changes into a slight uphill incline. Too much effort will now be demanded of the rider to drive the hydraulic device, for which reason this is returned to the neutral position in which the valve 7 is closed, thereby preventing the oil stored in the high-pressure accumulator 5 from flowing back into the low-pressure accumulator 6.

If one were now to encounter such a steep uphill incline that one wished to utilize a part of the energy stored in the high-pressure accumulator 5, the handle 13a is rotated so that the drive roller 8a is brought into engagement with the tyre 10a'. In this case the valve 7 is opened, and the positive pressure stored in the high-pressure accumulator forces the oil via the line 3, through the hydraulic device 2 and onwards into the low-pressure accumulator 6 via the line 4. The hydraulic device 2 now operates as a motor and in so doing helps to propel the bicycle forwards. It is now also possible to select the appropriate gearing ratio in a similar fashion to that described above.

As mentioned by way of introduction, the drive rollers 8a, 9a may conveniently have different diameters, which is made possible from the construction point of view by arranging the hydraulic device 2 in the manner illustrated in Fig. 2. In this way different gearing ratios are provided for the storage of energy and for the utilization of the stored energy.

By means of the arrangement in accordance with the invention it is possible on a downhill incline to utilize and store surplus energy, which can then be used to facilitate propulsion on an uphill incline.

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Patent Claims

1. Arrangement on a bicycle (10) comprising a hydraulic device (2) capable of being fitted to the bicycle by means of a suspension arrangement, which hydraulic device communicates via lines (3, 4) with a high-pressure accumulator (5) and with a low-pressure accumulator (6) and is so adapted through operative connection to one of the bicycle wheels, preferably the front wheel (10a), as to cause the storage in the high-pressure accumulator of energy which is not being utilized for the time being for the propulsion of the bicycle (10), and the propulsion of same by utilizing previously stored energy, characterized in that the aforementioned hydraulic device is of a kind which has two opposing, mutually parallel shafts (8, 9) with opposite directions of rotation, in which case the device (2), when driving one of the shafts (8) in a certain direction of rotation, operates as a pump with a pressure side and a suction side, and when a pressure is applied to the pressure side, the device operates as a motor, in which case the second shaft (9) has the aforementioned direction of rotation, in that the hydraulic device (2) is capable of being pivoted by means of the suspension arrangement along a circular arc in a plane cross-wise to the plane of the wheel (10a), in that there is present on each of the shafts (8, 9) of the hydraulic device a drive roller (8a, 9a) so adapted by means of the aforementioned ability of the hydraulic device (2) to pivot as to be brought alternately into engagement with the tyre (10a') of the bicycle wheel, which drive rollers (8a, 9a) taper in a direction outwards from the hydraulic device (2) in such a way that the generatrix of the surface of the rollers (8a, 9a) which engages with the tyre (10a') follows the aforementioned circular arc, in that there is arranged in the line (3) between the pressure side and the high-pressure accumulator (5) a valve (7) which is operatively connected to the suspension arrangement and is so adapted as to keep the line (3) open only when one of the rollers (8a, 9a) is in engagement with the tyre (10a'), that is

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to say so as to cut off the line (3) when the wheel (10a") is situated between the rollers (8a, 9a), and in that control devices (13a, 14, 15) which are operatively connected to the suspension arrangement (1) are provided for the purpose of
5 adjusting the hydraulic device (2) to the desired angle of deflection, in which case the control device (13a, 14, 15) has a neutral position corresponding to the position adopted by the hydraulic device (2) when the valve (7) is closed.

10 2. Arrangement according to Patent Claim 1, characterized in that one of the drive rollers (9a) is generally of larger diameter than the other (8a).

3. Arrangement according to Patent Claim 1, characterized
15 in that the drive roller (9a), which, when surplus energy is being utilized, is in engagement with the bicycle wheel (10a) viewed in the direction of travel, lies behind the drive roller (8a), which, when stored energy is being utilized, is in engagement with the bicycle wheel (10a).

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FIG 1

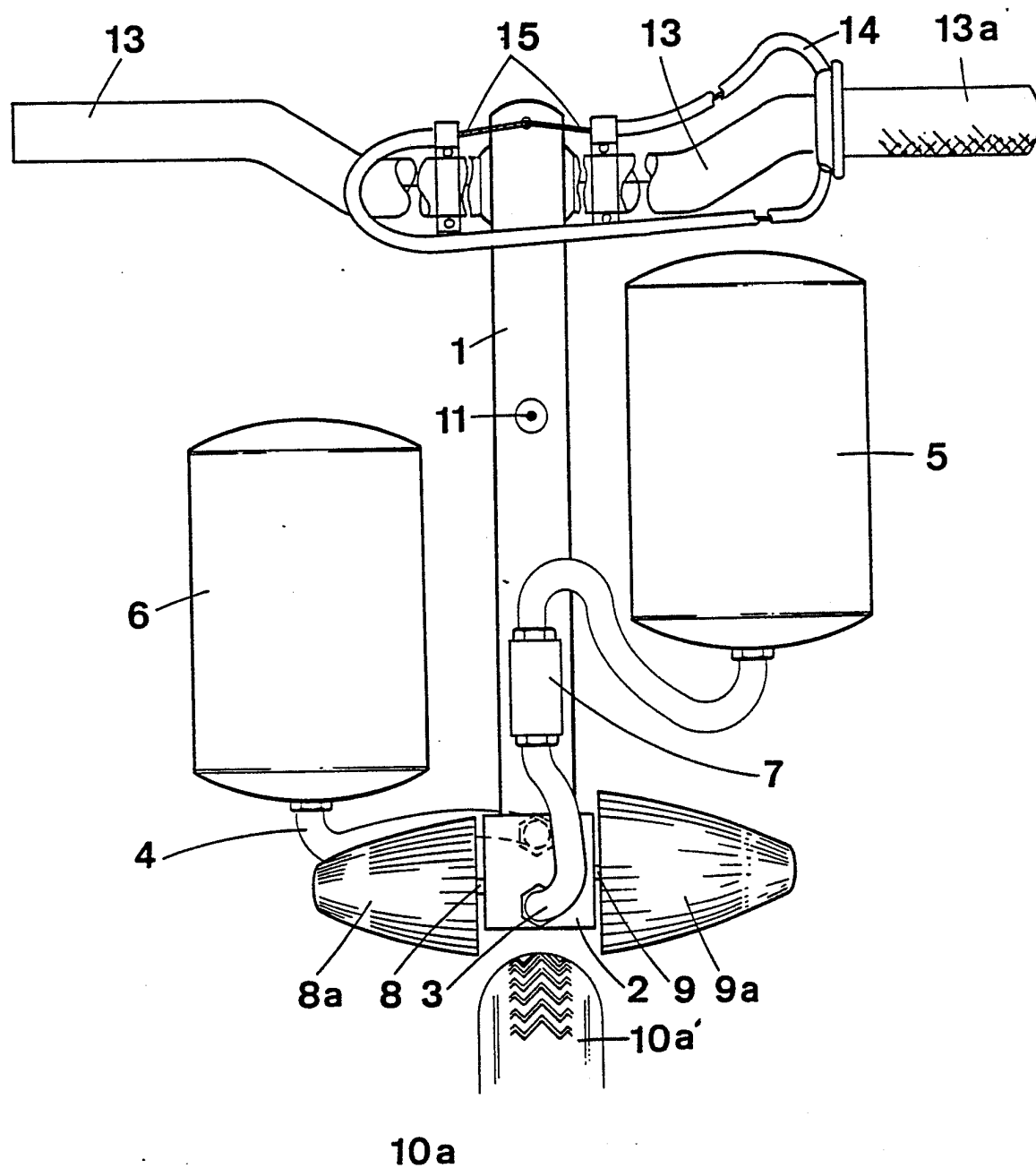


FIG 2

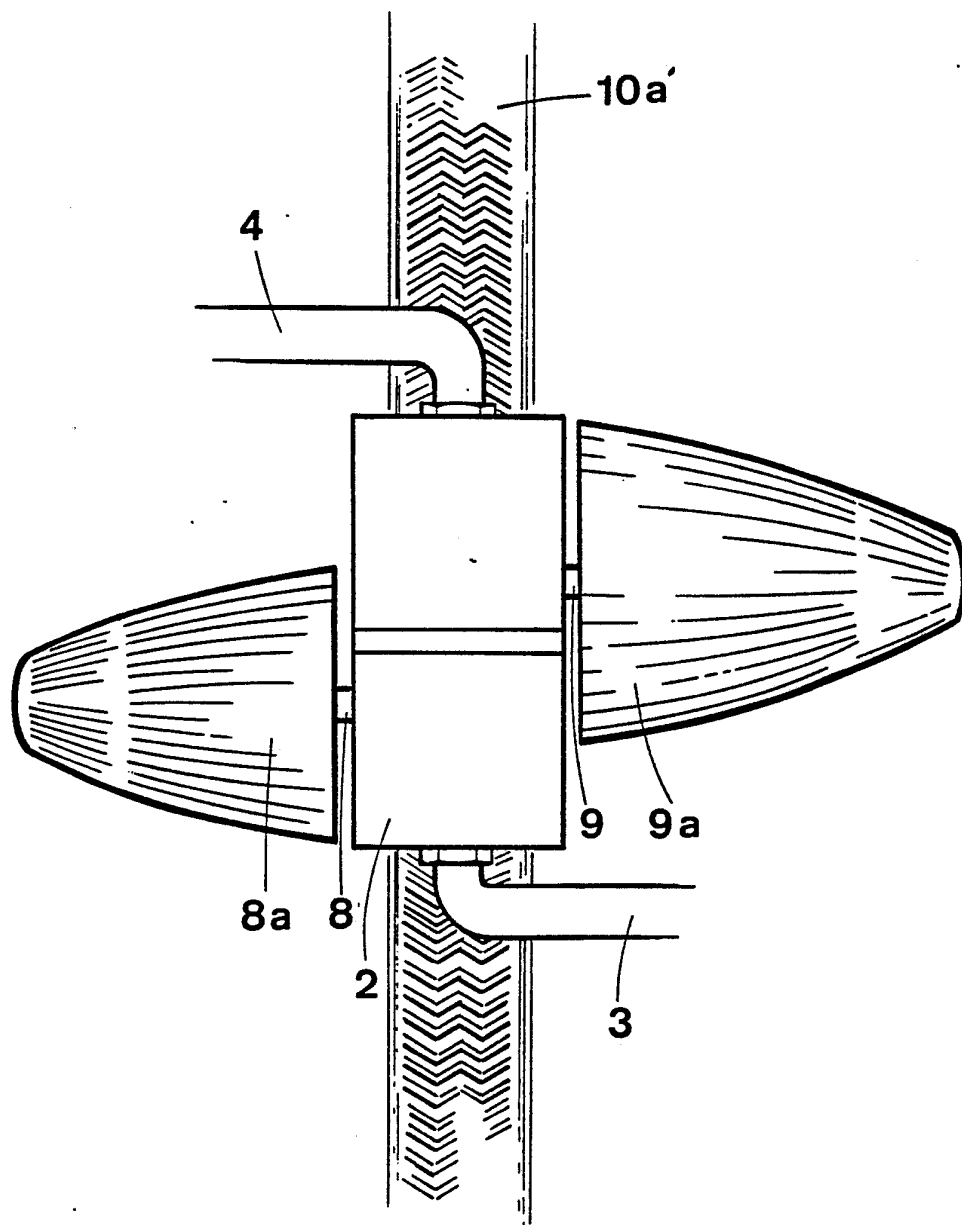
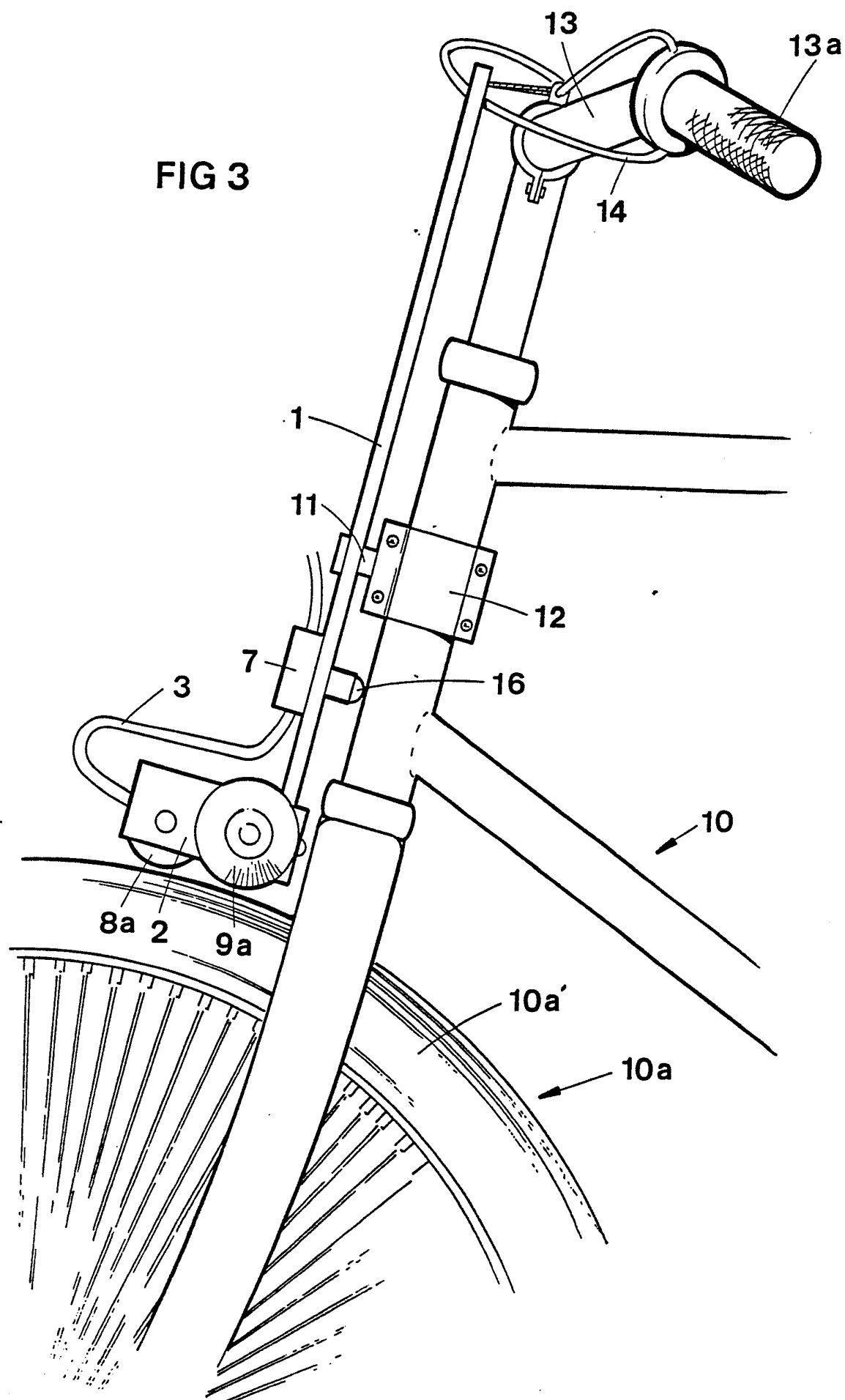
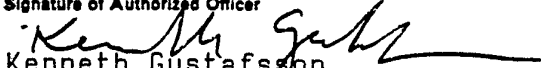


FIG 3



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE87/00222

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
B 62 M 1/10		4
II. FIELDS SEARCHED		
Minimum Documentation Searched *		
Classification System	Classification Symbols	
IPC 4	B 62 M 1/00, /10, 13/00, /02, /04, 19/00	
Nat C1	63K: 7/02, /8	
US C1	280:215, 216	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ** with Indication, where appropriate, of the relevant passages **	Relevant to Claim No. **
A	GB, A, 563 082 (E TIPS) 28 July 1944	1
A	FR, A, 1 014 803 (L GOUY) 22 August 1952	1
A	WO, A, 85/03266 (; STELZER) 1 August 1985	1
A	US, A, 2 177 381 (C BICHI) 24 October 1939	1
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