(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
05 March 2020 (05.03.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/044282 A1

(51) International Patent Classification:
B62J 7/00 (2006.01) *B60R 9/06* (2006.01)
B62J 1/16 (2006.01) *B62D 37/04* (2006.01)
B62J 1/28 (2006.01) *B62J 99/00* (2009.01)

(21) International Application Number:
PCT/IB2019/057288

(22) International Filing Date:
29 August 2019 (29.08.2019)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
102018000008247 30 August 2018 (30.08.2018) IT

(71) Applicant: **E-NOVIA S.P.A.** [IT/IT]; Via San Martino 12, 20122 Milano MI (IT).

(72) Inventors: **BONIOLO, Ivo Emanuele Francesco**; Via Comasinella 97, 20813 Bovisio Masciago MB (IT). **CEREDA, Gianmarco**; Via Timavo 150, 20099 Sesto San Giovanni MI (IT). **COLOGNI, Alberto Luigi**; Via Lorenzo Lotto 14, 24040 Osio Sopra BG (IT). **MORO, Federico Lorenzo**; Via Sebenico 21, 20124 Milano MI (IT).

(74) Agent: **CONCONE, Emanuele**; Società Italiana Brevetti S.p.A., Via Carducci 8, 20123 Milano MI (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

(54) Title: LOAD CARRYING DEVICE FOR THE TRANSPORT AND BALANCING OF LOADS PLACED ON A TWO-WHEELED VEHICLE

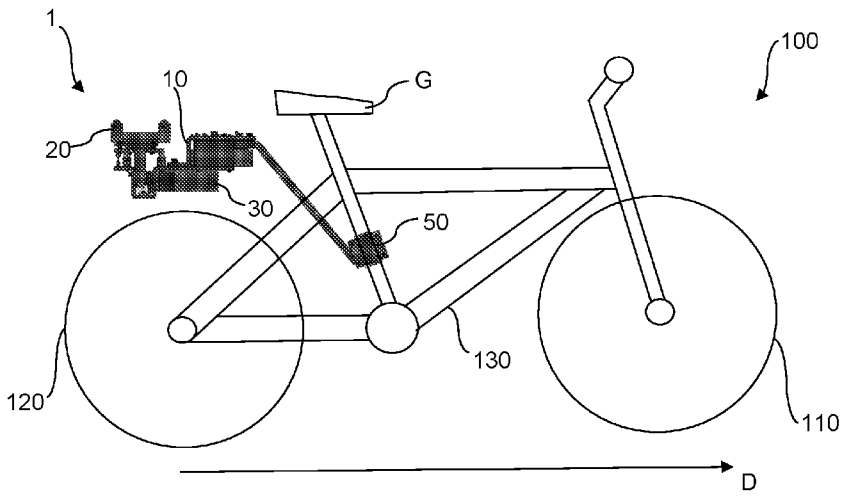

Fig.1

(57) Abstract: The present disclosure concerns a load carrying device (1) for the transport and balancing of loads placed on a vehicle (100), fitted with two wheels (110, 120) and a saddle (G), to which it is reversibly fixed in a position rearward or forward with respect to the saddle (G), the load carrying device (1) comprising a support structure (10) designed to support a load support element (20), where the support element (20) is mounted mobile in relation to that support structure (10), and an actuator device (30) capable of changing the position of the support element (20) in relation to the support structure (10) in a direction of traversal (S) orthogonal to the forward direction (D) of the vehicle (100), and/or of rotating the load support element (20) in relation to the forward direction (D) of the vehicle (100).

WO 2020/044282 A1

[Continued on next page]

SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

LOAD CARRYING DEVICE FOR THE TRANSPORT AND BALANCING OF LOADS PLACED ON A TWO-WHEELED VEHICLE

The present invention refers to a load carrying device for the transport of loads placed on a two-wheeled vehicle such as, for example, a bicycle or a scooter, and in particular to a load carrying device capable of automatically balancing the load according to the dynamics of the vehicle.

In general, prior art load carriers that can be installed on two-wheeled vehicles are made up of a number of bars, mechanically engaged with each other and with the vehicle, so as to form the basis of support for the loads to be carried, which in turn are secured to the carrier by the use of means of retention such as straps, elastics or ropes.

A different type of prior art load carrier, mainly used in two-wheeled motor vehicles, consists of a trunk or rigid or flexible side bags with the aim of containing the loads protected from the elements, also this type of load carrier being obviously fixed to the vehicle.

In addition, bicycles can be equipped with a child seat secured to the frame of the bicycle in a position forward of the bicycle saddle or in a position rearward of the saddle.

All of the above types of carrier have a number of drawbacks, the most obvious of which is that when the vehicle on which the carrier is mounted tilts to one side and/or when the load on the carrier moves sideways. In these situations, in fact, two-wheeled vehicles can become unbalanced, increasing the risk of a loss of balance and a consequent fall for the rider of the vehicle.

Moreover, known load carriers do not allow the correct balancing of the weight of the load even when it is firmly attached to the vehicle and the latter is in a stable vertical position. For example, many of the loads carried are not uniform and, when placed on a carrier, tend to unbalance the vehicle to the right or left of the direction of movement of the vehicle. In other words, due to the uneven distribution of the weight of the load, the centre of gravity of the vehicle may not be centred but displaced laterally to the centre plane of the vehicle.

In this situation, in the absence of a load balancing device, the rider is forced to

balance the asymmetry of the vehicle weights with part of his body in order to have an overall balanced system along the direction of travel, and/or the rider is forced to tilt the vehicle laterally in order to compensate for its lateral imbalance.

Systems for lateral displacement of the saddle of a two-, three- or four-wheeled motor vehicle (i.e. motorcycle, tricycle, ATV) are already known to facilitate the driving of the vehicle when cornering, examples of such systems being described in US 2015/061312, US 2012/126565, ES 2326764 and WO 2017/063008. However, these prior art systems are complex and expensive systems that are integrated into the vehicle structure and cannot be reversibly mounted as a common load carrier, moreover they act only on the rider's saddle but not on any load mounted on the vehicle in a rearward or forward position with respect to the saddle.

The purpose of this invention is therefore to provide a load carrier that is free from the drawbacks described above. This is achieved by means of a load carrier comprising a support structure reversibly fixed to the vehicle, either in a rearward or forward position with respect to the saddle, a support element capable of carrying the load and mounted movable in relation to the support structure, an actuator device capable of changing the position of the support element in relation to the support structure, motion sensors capable of detecting the dynamics of the vehicle and a control unit capable of driving the actuator device on the basis of data received from the motion sensors. Further advantageous features of the device in question are specified in the dependent claims.

A first fundamental advantage of the load carrier according to the present invention is to realize a continuous and real-time redistribution of the weight of the load in order to facilitate the user in driving the vehicle and reduce the risk of loss of balance and, consequently, of falls. For example, the load carrier can carry a child seat and allow the vehicle to be balanced according to the movements of the child, compensating for these movements of the child by translating and/or rotating the seat in relation to the direction of travel of the vehicle.

A second significant advantage of this load carrier is that it is made with compact and lightweight components that allow it to be applied on any type of two-wheeled vehicle, also as an accessory that can be applied or removed as needed.

Further advantages and characteristics of the load carrier according to the present invention will be evident to those skilled in the art from the following detailed and non-limiting description of two embodiments thereof with reference to the annexed drawings in which:

- Figure 1 represents a side view of a first embodiment of a load carrying device according to the present invention mounted on a bicycle;
- Figure 2 represents a front perspective view of the load carrying device of Fig.1;
- Figure 3 shows a side view of the load carrying device of Fig.1;
- Figure 4 shows a front view of the load carrying device of Fig.1;
- Figure 5 shows a view similar to the previous one of the load carrying device with the support element in a position translated laterally to the maximum travel;
- Figure 6 shows a partial rear perspective view of a second embodiment of a load carrying device according to the present invention; and
- Figure 7 shows a partial rear view of the load carrying device of Fig.6 carrying a child seat.

With reference to figures 1 to 5, there is seen that a load carrying device 1 according to the present invention comprises a support structure 10 on which a support element 20 is mounted in a mobile way, capable of carrying a load and of being moved with respect to said support structure 10 by means of an actuator device 30, typically an electric motor.

In other words, the support structure 10 is a support frame for the elements that make up the load carrying device 1 and typically includes cylindrical or plate-like elements, preferably made of metal. The support structure 10 is also suitable for attaching the load carrying device 1 to a frame 130 of a vehicle 100 equipped with two wheels 110, 120 aligned along a forward direction D of the vehicle 100 (for example, a bicycle or a scooter).

In the case of a bicycle, as shown in Fig.1, the load carrying device 1 can for example be connected to the vertical seat tube of the frame, which supports the saddle of the bicycle, by means of a fixing element 50 so as to mount the load carrier 1 in a rearward position with respect to the saddle G on which the rider sits. Note that other types of fixing are possible depending on the position of the load carrier 1 and/or the

shape of the frame 130 of vehicle 100. For example, if the latter is already equipped with a rear luggage carrier, the support structure 10 could be fixed directly to that carrier, or if the load carrier 1 is positioned forward of saddle G it could be fixed to the top tube connecting the seat tube at the rear to the head tube.

As mentioned above, the load carrying device 1 according to the present invention includes a support element 20 for supporting loads such as, for example, panniers, bags, parcels, boxes, crates, pet carriers, child seats or other.

According to a first embodiment of the present invention, shown in particular in figures 2 to 5, the support element 20 comprises a pair of cylindrical elements, specifically a first cylindrical element 21 and a second cylindrical element 22 joined by a connecting element 23. Preferably, in use, these first and second cylindrical elements 21, 22 are arranged parallel to the surface on which the vehicle 100 moves and perpendicular to the direction of travel D of the vehicle. Support element 20 may also include a plate element (not shown in the figures) which is capable of connecting said first and second cylindrical elements 21, 22 in such a way as to form a supporting plane placed, in use, parallel to the surface on which the vehicle 100 moves.

The support element 20 is mounted movable in relation to the support structure 10 in such a way that their relative position can change and therefore, the support structure 10 being fixed to vehicle 100, the position of the support element 20 in relation to said vehicle 100 can change. More specifically, the support element 20 can translate along a direction of movement S perpendicular to the direction of travel D of the vehicle and parallel to the surface on which the vehicle 100 moves (Fig.4).

In detail, the support element 20 comprises, according to this embodiment, a pair of cylindrical shafts 24 fixed to the connecting element 23 in parallel with cylindrical elements 21 and 22. These shafts 24 slide through corresponding guide elements 11, integral with the support structure 10, including a through-hole with an axis parallel to the above mentioned direction of movement S, so that the load carrying element 20 slides in the direction S. In particular, Fig.5 shows a rear view of a load carrying device 1 in which the load carrying element 20 is translated laterally with respect to the support structure 10 up to the maximum of its travel.

The support element 20 moves under the action of an actuator device 30, typically an electric motor, fixed to the support structure 10 and connected to the support element 20 through motion transmission means. In this case, the load carrying device 1 further includes a source of energy, such as a battery, to power the electric motor.

In the case of the first embodiment described above and represented in figures 2 to 5, the actuator device 30 comprises an electric motor, a system of pulleys, a belt tensioner and a belt 31 as a means of transmitting motion. Other types of connections known to the person skilled in the art to connect the actuator device 30 to the support element 20 are obviously possible.

An algorithm, stored in a control unit 40, controls the motor actuation on the basis of data coming from sensor means 60 including an inertial platform suitable to detect accelerations and rotations (with accelerometers, gyroscopes, etc.), a vehicle speed sensor, load cells to detect the weight distribution of the load on the support element 20 and a motor position sensor.

In other words, the actuator device 30 is controlled by a control unit 40, such as an electronic control unit, which operates on the basis of the detection of the status of the vehicle/load system. The control unit 40 can, for example, implement a system of prediction of an unbalanced load or a fall of the user that allows an early identification of the aforementioned event and a reliable prediction thereof by means of sensors 60 and a processing unit of the signals produced by said sensors. In this context, the control unit 40 controls the activation of the actuator device 30 so that the latter moves the load carrying element 20 with respect to the support structure 10 in order to rebalance the vehicle/load system following an imbalance of the latter.

The sensor means 60 can be integrated into the load carrying device 1, typically on the support structure 10, and/or placed outside the load carrying device 1 on vehicle 100, preferably on frame 130.

In the second embodiment illustrated in figures 6 and 7, the support element 20' is mounted mobile with respect to the support structure 10' so that it can rotate around an axis of rotation A parallel to the direction of travel D of vehicle 100, as indicated by arrow R in figure 7. According to this embodiment, the support structure 10' is a

cylindrical body with an axis coinciding with said axis of rotation A and containing the actuator device, the control unit and the sensors (not shown).

The support element 20' comprises a tubular body 25, concentric with respect to the cylindrical body of the support structure 10' and arranged externally thereto so that it can rotate around axis A. A plate 26 is integral with said tubular body 25 and is suitable for fixing the load, in the example shown a child seat B.

The actuator is preferably an electric motor in which the drive shaft is arranged along the rotation axis A and is connected to the support element 20', for example by means of an arm that extends radially from the drive shaft and engages said support element 20', or a toothed wheel fixed to the drive shaft and engaged with a corresponding crown gear inside the tubular body 25.

According to one aspect of the present invention, the two above-described movements of the support element with respect to the support structure, i.e. the movement in the direction S and the rotation around the rotation axis A, can be envisaged in combination in a third embodiment of the load carrying device 1.

The present invention also concerns a method of balancing loads placed on a two-wheeled 100 vehicle capable of moving in one direction of travel D. This method includes in particular a phase of mounting of a load carrying device 1 as described above and a phase of modification of the position of the support element 20, 20' with respect to the support structure 10, 10' by means of the actuator device 30. This change in the position of the support element 20, 20' includes a translation in a direction of displacement S perpendicular to the direction of travel D of vehicle 100 and/or a rotation about an axis A parallel to said direction D.

It is clear that above-described and illustrated embodiments of the load carrying device according to the invention are only examples susceptible to numerous variations. In particular, the exact shape and arrangement of the elements that make it up may vary somewhat depending on specific construction requirements as long as the general structure described above is maintained. Furthermore, it is obvious that even if the actuator device 30 is generally of the electric type, it could be of any type suitable for the purpose (hydraulic, pneumatic, magnetic, etc.), and that the means of transmission

of motion between said actuator device 30 and the support element 20, 20' will be adapted accordingly.

CLAIMS

1. Load carrying device (1) for a vehicle (100) with two wheels (110, 120) suitable to move in a forward direction (D) and centrally provided with a saddle (G) for a rider, said load carrying device (1) comprising elements (50) for its reversible securing to said vehicle (100), in a rearward or forward position with respect to said saddle (G), and a support structure (10; 10') capable of carrying a load, characterized in that it further includes a support element (20; 20') capable of carrying said load and mounted mobile on said support structure (10; 10'), an actuator device (30) capable of modifying the position of said support element (20; 20') with respect to the support structure (10; 10') by translation in a direction of traversal (S) substantially orthogonal to said forward direction (D) and/or rotation about an axis (A) substantially parallel to the forward direction (D), sensor means (60) capable of detecting the dynamics of the vehicle (100) and the load weight distribution, as well as a control unit (40) operatively connected to said sensor means (60) and to said actuator device (30) and capable of driving the latter on the basis of data received from the sensor means (60).

2. Load carrying device (1) according to claim 1, characterized in that the sensor means (60) include one or more of accelerometers, gyroscopes, vehicle (100) speed sensors, load cells, actuator device (30) position sensors.

3. Load carrying device (1) according to claim 1 or 2, characterized in that the load support element (20) is mounted mobile on one or more guide elements (11) of said support structure (10).

4. Load carrying device (1) according to claim 3, characterized in that each guide element (11) includes a through hole having an axis orthogonal to the forward direction (D) and suitable to receive a cylindrical shaft (24) of the load support element (20), said cylindrical shaft (24) being capable of translating in said through hole of the guide element (11).

5. Load carrying device (1) according to claim 4, characterized in that the actuator device (30) includes an electric motor, a pulley arrangement, a belt tensioner and a belt (31) as means of transmission of the motion to the support element (20).

6. Load carrying device (1) according to claim 1 or 2, characterized in that the

support structure (10') is a cylindrical body with an axis coinciding with the axis of rotation (A) and containing the actuator device, the control unit and the sensor means, while the support element (20') includes a tubular body (25) mounted concentric with respect to said cylindrical body of the support structure (10') and arranged externally thereto such that it can rotate around the axis of rotation (A), a plate (26) suitable for securing the load being integral with said tubular body (25).

7. Vehicle (100) comprising a pair of wheels (110, 120), a frame (130) capable of supporting said pair of wheels (110, 120) and a saddle (G) for a rider, as well as a load carrying device (1) according to any of the preceding claims secured on said frame (130) in a rearward or forward position with respect to said saddle (G).

8. Method for transporting and balancing loads placed on a vehicle (100) with two wheels (110, 120) suitable to move in a forward direction (D) and centrally provided with a saddle (G) for a rider, characterized in that it includes the steps of:

a) mounting on said vehicle (100), in a rearward or forward position with respect to said saddle (G), a load carrying device (1) according to any of claims 1 to 6;

b) modifying the position of the support element (20; 20') with respect to the support structure (10; 10') by translation in a direction of traversal (S) substantially orthogonal to the forward direction (D) and/or rotation about an axis (A) substantially parallel to the forward direction (D), by actuating the actuator device (30) through the control unit (40) on the basis of data received from the sensor means (60).

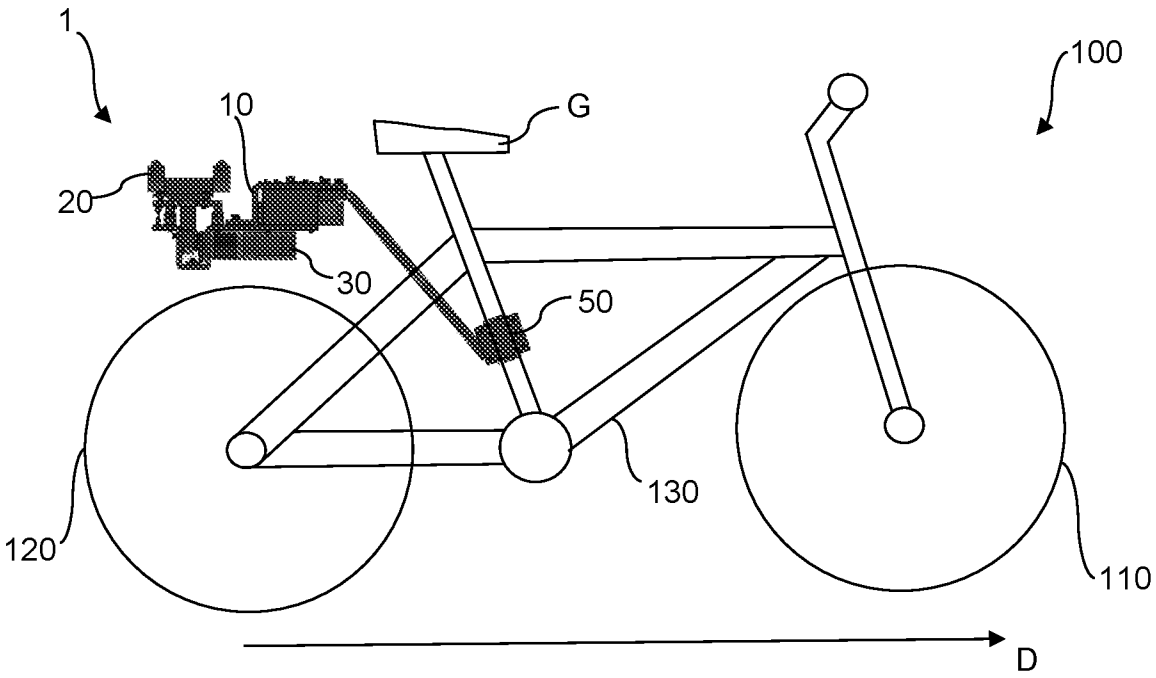

Fig.1

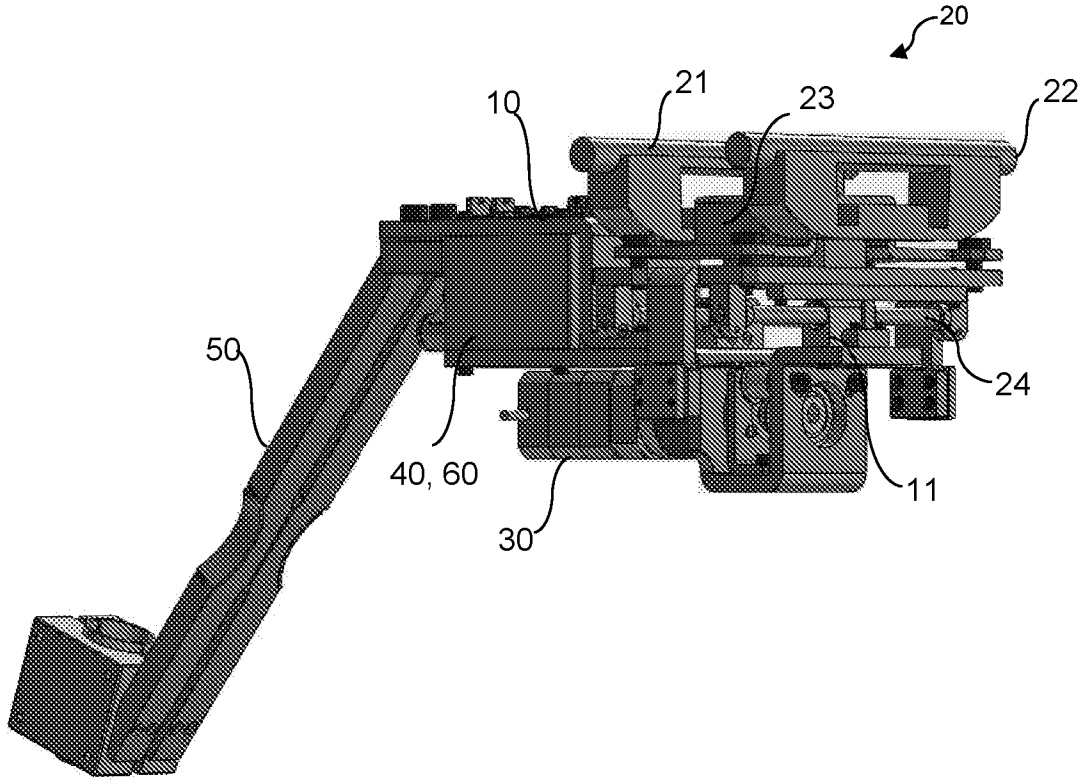

Fig.2

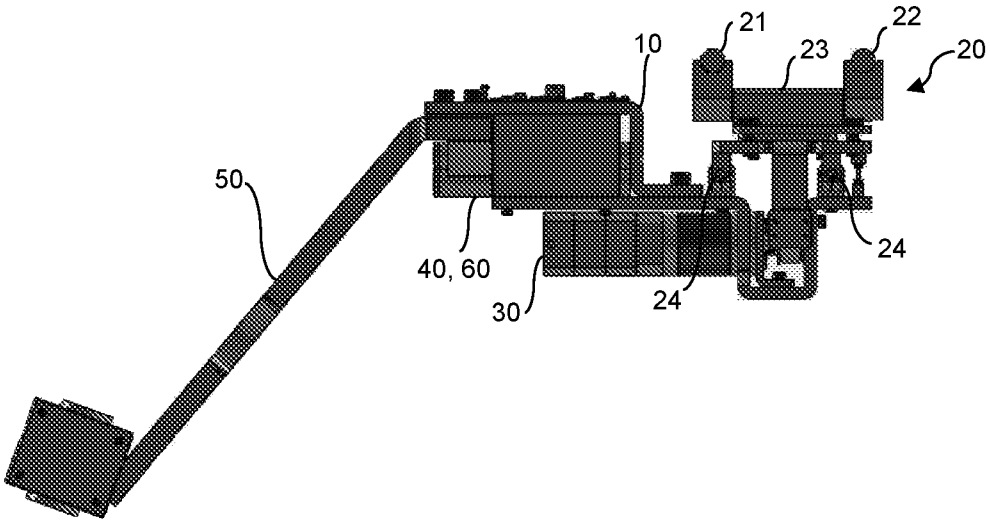

Fig.3

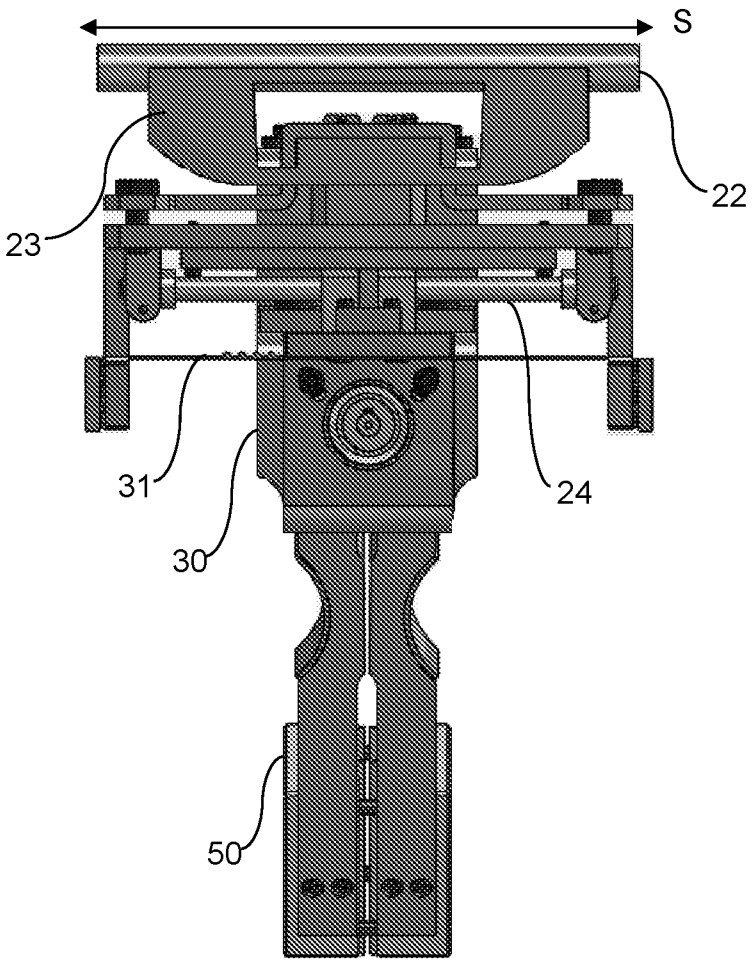

Fig.4

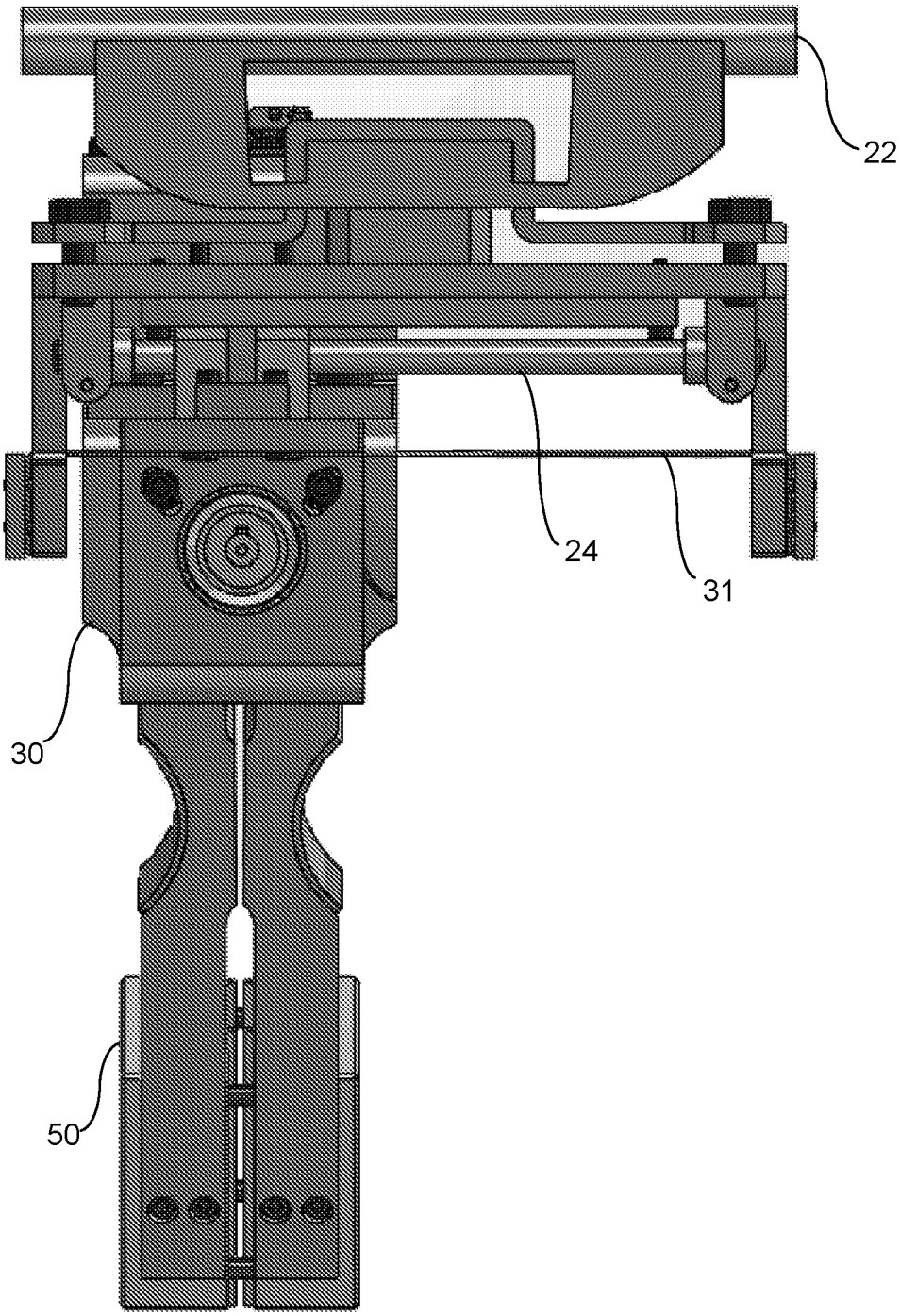

Fig.5

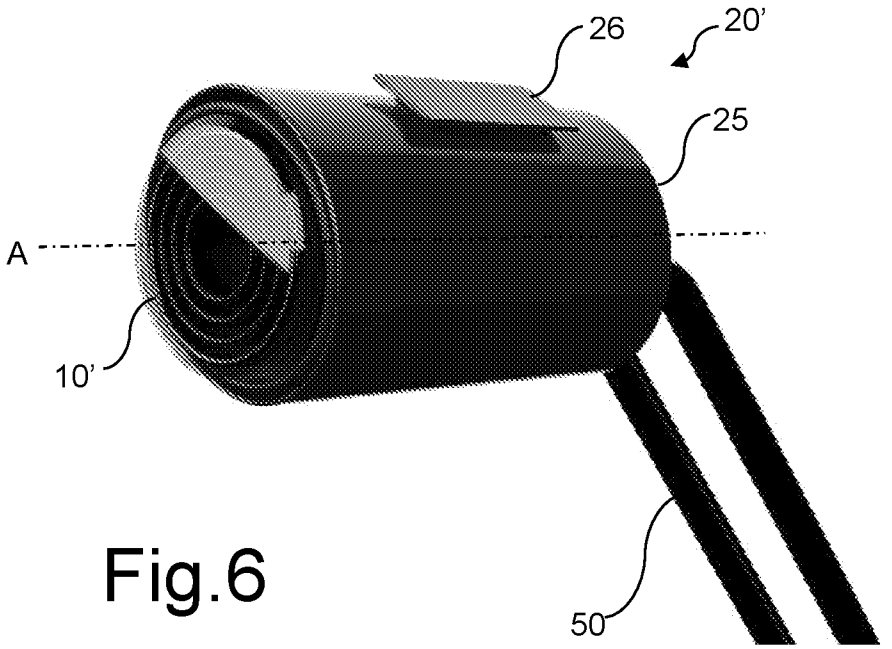

Fig.6

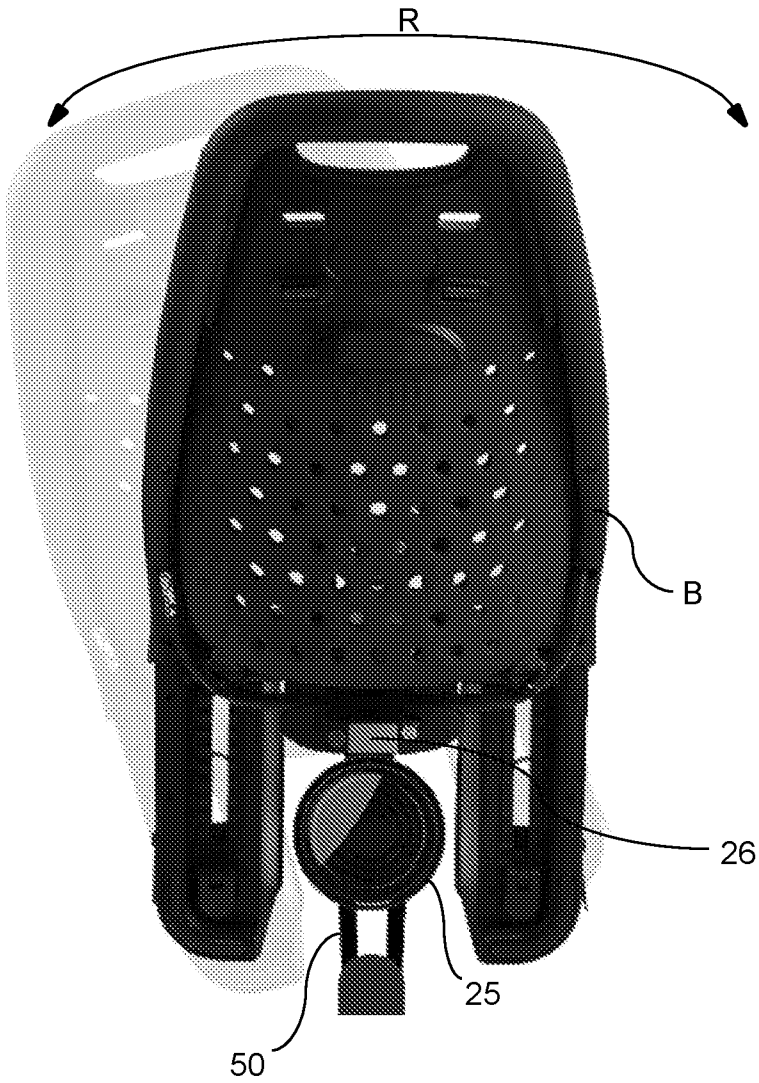

Fig.7

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/057288

A. CLASSIFICATION OF SUBJECT MATTER
INV. B62J7/00 B62J1/16 B62J1/28 B60R9/06 B62D37/04
ADD. B62J99/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B62J B62K B60R B62D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	DE 10 2018 201665 A1 (BOSCH GMBH ROBERT [DE]) 10 January 2019 (2019-01-10) the whole document	1-8
X	US 2018/099717 A1 (GARCIA LAWRENCE [US]) 12 April 2018 (2018-04-12) the whole document	1-8
X	DE 10 2010 050425 A1 (BOETTIGER VOLKER [DE]) 12 May 2011 (2011-05-12) the whole document	1-8
A	US 2015/061312 A1 (ISHIGE SHINGO [JP]) 5 March 2015 (2015-03-05) paragraphs [0040] - [0045], [0074] - [0079], [0087]; figures 1-7	1-8

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 November 2019	02/12/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Molina Encabo, Aitor

2

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/126565 A1 (GONZALEZ CRISTIAN GUSTAVO [AR] ET AL) 24 May 2012 (2012-05-24) paragraph [0002] - paragraph [0009]; figures 1-5F	1-8
A	ES 2 326 764 A1 (FERNANDEZ DOTOR SANTIAGO [ES]) 19 October 2009 (2009-10-19) claims 1,8; figures 1-5	1-8
A	WO 2017/063008 A1 (PARMULA GMBH [AT]) 20 April 2017 (2017-04-20) claim 1; figures 1-5	1-8
A	EP 1 967 409 A1 (EQUOS RES CO LTD [JP]) 10 September 2008 (2008-09-10) figures 1-18B	1-8
A	EP 3 260 325 A1 (BOSCH GMBH ROBERT [DE]) 27 December 2017 (2017-12-27) claims 8-13; figures 1-5	1

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2019/057288

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102018201665 A1	10-01-2019	NONE	
US 2018099717 A1	12-04-2018	NONE	
DE 102010050425 A1	12-05-2011	NONE	
US 2015061312 A1	05-03-2015	CA 2847459 A1	03-03-2015
		JP 6180855 B2	16-08-2017
		JP 2015048019 A	16-03-2015
		US 2015061312 A1	05-03-2015
US 2012126565 A1	24-05-2012	AR 073062 A1	13-10-2010
		US 2012126565 A1	24-05-2012
		WO 2011018760 A1	17-02-2011
ES 2326764 A1	19-10-2009	NONE	
WO 2017063008 A1	20-04-2017	AT 517859 A1	15-05-2017
		WO 2017063008 A1	20-04-2017
EP 1967409 A1	10-09-2008	CN 102114881 A	06-07-2011
		EP 1967409 A1	10-09-2008
		EP 2213562 A2	04-08-2010
		US 2010017069 A1	21-01-2010
		WO 2007077690 A1	12-07-2007
EP 3260325 A1	27-12-2017	DE 102016210928 A1	21-12-2017
		EP 3260325 A1	27-12-2017