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(54) **FOLDING WHEELCHAIR**

(57) The folding wheelchair (1) consists of a seat (2), drive wheels (3), a backrest (4) and a foot frame (5). Drive wheels (3) adapted for manual propulsion are detachably mounted on the wheelchair (1) on both sides. The backrest (4) is hinged to the seat (2) with the possibility of folding to the upper side of the seat (2). The foot frame (5) is provided with a footrest (6) and directional wheels (7) and is hinged to the seat (2) with the possibility of folding it to the underside of the seat (2). The rear side of the backrest (4) is provided with a first transport handle (8) for fixing the drive wheel (3). The underside of the seat (2) is provided with a second transport handle (9) for fixing the drive wheel (3). The drive wheels (3) can be fastened to the transport handles (8, 9) in the folded state of the wheelchair (1).

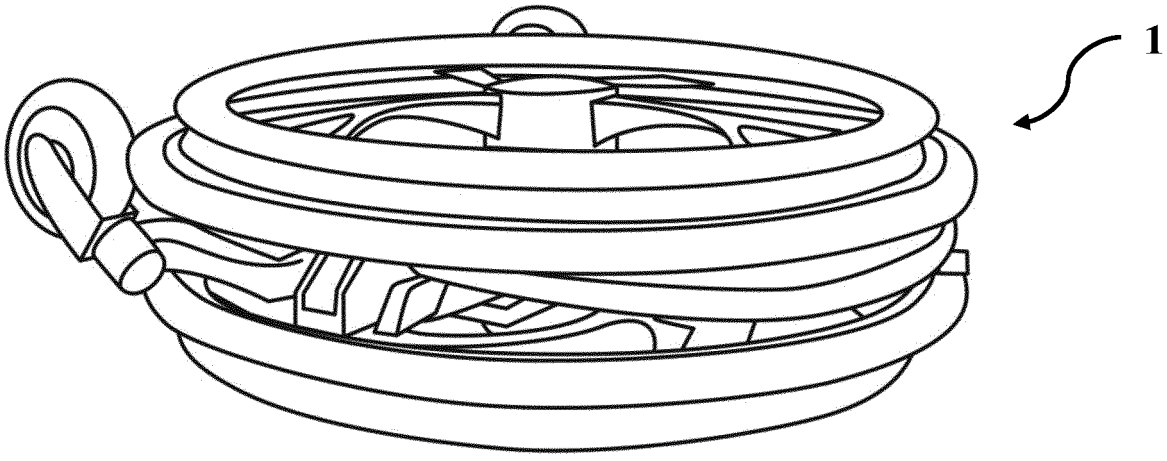


**Fig. 10**

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## Description

### Field of the Invention

**[0001]** The invention relates to a folding wheelchair for the transport of disabled persons and persons with affliction of the locomotor system.

### Background of the Invention

**[0002]** The wheelchair allows the transport of persons with physical disabilities or persons whose health condition does not allow them to walk safely. The basis of each such wheelchair is a seat and a propulsion system composed of at least three propulsion segments, typically wheels, in most cases four wheels mounted on a two-axle undercarriage system.

**[0003]** A large number of wheelchairs are known from technical practice, which are of solid construction or folding wheelchairs, with a system of setting in motion by the user manually, by means of an auxiliary drive or requiring another person to push the wheelchair. The folding function of the wheelchairs is more user-friendly as it enables the transport of a folded wheelchair, i.e. a wheelchair with significantly reduced dimensions, in the trunks of passenger cars, for example when the user travels greater distances.

**[0004]** Document EP 2896391 discloses a folding chair consisting of a tubular frame, a two-axle propulsion system, the tubular frame being provided with tilting mechanisms. The chair can thus be folded and carried relatively easily. The disadvantages of this system are mainly small wheels, which are only suitable for transport on paved roads and sidewalks (pavements, footpaths), and in addition with the need for another accompanying person pushing the chair.

**[0005]** Wheelchairs with large detachable drive wheels and a foldable seating part are particularly suitable for comfortable self-propulsion. The large drive wheels are driven manually, by the user's own power. The seating part of the wheelchair is typically folded in two ways, either by tilting its individual parts, such as the backrest, towards the main seating surface, or by crosswise folding. When folded crosswise, the seating part is folded so that the side parts of the wheelchair approach each other in a longitudinal vertical plane. In both cases, the result is similar: a folded basic frame and separate wheels. The disadvantage of these technical solutions is that the wheels must be separated from the rest of the wheelchair for folding and transport and thus transported separately.

**[0006]** An example of such a solution is the solution according to document WO 2015145475, describing a wheelchair with a folding backrest folded towards the seat from below. The wheels are detachable. The disadvantage of this solution is not only that the wheels are separated when folded. With this solution, the assembly of the folded wheelchair is not too small, which makes it difficult to transport it in vehicles with a small volume of trunk, or to place it on the rear seat of the vehicle without any problems. Also, the separation into three parts, which must be stored separately, is not optimal for the user.

**[0007]** However, there is a wheelchair which can be folded including wheels. This solution is described in document CN 106821625. However, it is a wheelchair equipped only with smaller wheels, which are not suitable for propulsion by the user's own power. The size of the folded wheelchair is again too large to be stored in a small car.

**[0008]** A combination of crosswise and endwise folding is described in document US 8152179. Here, the main parts of the wheelchair structure are folded in horizontal planes and the wheels are folded under the folded wheelchair in the transverse axis. This is again a wheelchair equipped only with smaller wheels, which is not suitable for propulsion by the user's own power.

**[0009]** Several types of folding wheelchairs can be found in non-patent documents, which are folded crosswise so that the sides of the wheelchair approach each other. Here, the drive wheels are always removed from the structure and stored separately from the wheelchair. Even such a folded wheelchair does not provide the required level of miniaturization for small vehicles.

**[0010]** The objective of the present invention is to design a folding wheelchair with large drive wheels allowing the wheelchair to move by the power of the user's arms. The folded wheelchair should be easily and conveniently storable in the luggage compartment of a small vehicle with a small trunk or on the rear seat of that vehicle. The resulting assembly should be one-piece and contain both the frame and its propulsion parts, especially the large wheels.

### Summary of the Invention

**[0011]** The shortcomings of the currently known technical devices are overcome by the proposed folding wheelchair according to the present invention. Wheelchair consisting of seat, drive wheels, backrest and foot frame. Drive wheels are detachably attached to the seat from both sides, which are adapted for manual propulsion of the wheelchair and are detachable. The backrest is hinged to the seat. This attachment allows the backrest to be folded down to the top of the seat when the wheelchair is folded. The foot frame of the wheelchair is equipped with a footrest and directional wheels. At the same time, the foot frame is hinged to the seat with the possibility of folding it to the underside of the seat in the folded position of the wheelchair. In this embodiment of the invention, the back of the backrest is provided with a first transport handle. This transport handle is used to attach the drive wheel to the folded wheelchair. Simultaneously with the transport handle on the backrest, the underside of the seat is provided with a second transport handle for fixing the second drive wheel to the folded wheelchair. The transport handles thus only serve to fasten the drive wheels to the wheelchair assembly in the

folded state.

**[0012]** In a preferred embodiment, the seat is provided with support arms. The support arms are used for detachable mounting of the drive wheels. The support arms are hinged to the seat. This attachment allows the support arms to be folded down to the bottom side of the seat when the wheelchair is folded.

**[0013]** In another preferred embodiment, the support arms are provided with shafts for fitting the drive wheel hub to the wheelchair. The shape of these shafts at the point of the drive wheel hub suspension corresponds in shape to the shape of the transport handles at the point where the drive wheel hubs are suspended on the handles.

**[0014]** In another preferred embodiment, the seat is provided on its underside with at least one rear locking sleeve for hinging the backrest and with at least one front locking sleeve for hinging the foot frame. At the same time, the seat is provided on its underside with at least two side locking sleeves for hinging the support arms.

**[0015]** In the following preferred embodiment, the folding wheelchair is further provided with a locking lever and rods. In this preferred embodiment, the rods are attached to the locking lever at one end. At the other end, the rods are fixed to at least one of the above-mentioned locking sleeves. The rods are used to lock or release the fixed part of the wheelchair and to allow the folding of this part to the position which is taken by the given part in the folded state of the wheelchair.

**[0016]** In another preferred embodiment, the rods are formed by steel or textile cables or a combination thereof housed in a flexible protective sleeve.

**[0017]** In another preferred embodiment, the support arms in the folded state of the wheelchair are arranged inside the space defined by the foot frame.

**[0018]** In another preferred embodiment, the foot frame is designed such that, when the wheelchair is folded, the directional wheels project beyond the circumference of the seat.

**[0019]** In the following preferred embodiment, the folding wheelchair is further provided with mudguards. The mudguards are hinged on the side locking sleeves, and these mudguards can be folded down onto the upper part of the seat when the wheelchair is folded.

**[0020]** In another preferred embodiment, the drive wheel of the folding wheelchair is formed by a rim with an integrated hoop, a tire, spokes or a load-bearing frame and a wheel hub with a lever clamping mechanism. The integrated hoop is used for manual propulsion of the wheelchair by the wheelchair user.

**[0021]** The main advantage of the present invention is that the present folding wheelchair can be folded quickly and easily and unfolded again thanks to the combination of crosswise and endwise folding. The resulting folded wheelchair, in contrast to the current state of the art, forms a one-piece unit consisting of all parts of the wheelchair, including drive wheels. The drive wheels are simply clamped, to this unit, by means of transport handles. No additional tools or jigs are required to fold the wheelchair. In addition, the folded wheelchair reaches very small dimensions. Therefore, it is possible to place and transport a folded wheelchair without difficulty even in vehicles which have only a small trunk. The wheelchair can be easily placed and transported on the rear seats of vehicles.

## Explanation of drawings

**[0022]** The invention will be explained in detail by drawings which illustrate:

Fig. 1 a perspective view of the wheelchair in a completely unfolded state;
Fig. 2 a perspective view of the first phase of folding the wheelchair, unlocking the lock by moving the locking lever and folding the mudguards onto the seat;
Fig. 3 a perspective view of the second phase of folding the wheelchair, removing the drive wheels and folding the backrest onto the seat above the mudguards;
Fig. 4 a bottom perspective view of the wheelchair without drive wheels after the second phase of folding the wheelchair;
Fig. 5 a bottom perspective view of the wheelchair without drive wheels after the third phase of folding the wheelchair, folding the support arms under the seat;
Fig. 6 a bottom perspective view of the wheelchair without drive wheels after the fourth phase of folding the wheelchair, folding the foot frame under the seat;
Fig. 7 a bottom perspective view of the wheelchair after the fifth phase of folding the wheelchair, i.e. after mounting one drive wheel on the transport handle of the seat;
Fig. 8 a top perspective view of the wheelchair after the fifth phase of folding the wheelchair;
Fig. 9 a top perspective view of the wheelchair after the sixth phase of folding the wheelchair, i.e. after mounting the second drive wheel on the transport handle of the backrest;
Fig. 10 a side view of the folding wheelchair in folded position;
Fig. 11 an assembly showing a shaft or a transport handle and a drive wheel hub.

## Examples of the invention embodiments

**[0023]** The folding wheelchair **1** according to this exemplary embodiment of the invention, which is shown in Figs. 1 to 10, consists of a seat **2,** drive wheels **3,** a backrest **4** and a foot frame **5.** As shown in Figs. 1 to 3, the drive wheels **3** are detachably attached to the seat **2** on both sides. The drive wheels **3** are adapted for manual propulsion of the wheelchair **1.** The backrest **4** is hinged to the seat **2,** this attachment allowing the backrest **4** to

be folded onto the upper side of the seat **2** in the folded state of the wheelchair. The foot frame **5** of the wheelchair **1** is equipped with a footrest **6** and directional wheels **7**. At the same time, the foot frame **5** is hinged to the seat **2** with the possibility of folding it to the underside of the seat **2** in the folded position of the wheelchair **1**. In this exemplary embodiment of the invention, the rear side of the backrest **4** and the underside of the seat **2** are provided with transport handles **8**, **9**. These transport handles **8**, **9** only serve to fasten the drive wheels **3** to the assembly of the folded wheelchair **1**.

**[0024]** As shown in Figs. 1 to 10, the seat **2** is provided with support arms **10** hinged to the seat **2**. This attachment allows the support arms **10** to be folded down to the bottom side of the seat **2** in the process of folding the wheelchair **1.** The support arms **10** are used for detachable mounting of the drive wheels **3**.

**[0025]** As shown in Figs. 3 to 8 and Fig. 11, the support arms **10** are provided with a shaft **11** for mounting the hub **12** of the drive wheel **3** on the wheelchair **1**. The shape of the shaft **11** at the point of suspension of the hub **12** of the drive wheel **3** in the unfolded state of the wheelchair **1** corresponds in shape to the shape of the transport handles **8**, **9** at the point where the hubs **12** of the drive wheels **3** are suspended on the transport handles **8**, **9** in the folded state of the wheelchair **1**.

**[0026]** As shown in Figs. 4, 5 and 6, the pivoting and folding function of the backrest **4**, the foot frame **5** and the support arms **10** is enabled by locking sleeves **13**, **14** and **15**, which are provided on the underside of the seat **2** and to which the backrest **4**, the foot frame **5** and support arms **10** are anchored. The seat **2** is thus provided on its underside with at least one rear locking sleeve **13** for hinging the backrest **4**, at least one front locking sleeve **15** for hinging the foot frame **5** and at least two side locking sleeves **14** for hinging the support arms **10**. The respective locking sleeves **13**, **14**, **15** provide a firm fixation of the unfolded backrest **4**, the foot frame **5** or the support arms **10** in the unfolded position and at the same time allow the locking to be unlocked and these parts of the wheelchair **1** folded into the final position of the folded wheelchair **1**.

**[0027]** According to one exemplary embodiment of the invention, the locking system of the locking sleeves **13**, **14** and **15** operates on the principle of a conical or wedge locking pawl fitting into an opposite recess on the backrest **4**, the foot frame **5** and the support arms **10**. In this way, the backrest **4**, the foot frame **5** and the support arms **10** are precisely and firmly secured in the unfolded position of the wheelchair **1**.

**[0028]** To control the locking function of the individual parts of the wheelchair **1** in the folded state, or vice versa to unlock the locked position and allow the wheelchair **1** to be folded into the folded shape, the folding wheelchair **1** is provided with a locking lever **16** and rods **17**. As shown in Figs. 4 to 6, according to one exemplary embodiment of the invention, the rods **17** are fastened to a locking lever **10** at one end. According to the same exemplary embodiment of the invention, the rods **17** are fastened at the other end to one of the locking sleeves **13**, **14**, **15.** The movement of the lever **16** between its two extreme positions actuates the rods **17**, which trigger or release the locking pawls, and thus actuate the locking function of the locking sleeves **13, 14, 15** of the wheelchair **1**. Releasing the locking pawls of the locking sleeves **13**, 1**4**, **15** allows the backrest **4**, the foot frame **5** and the support arms **10** of the wheelchair **1** to be folded into the position which is taken by the given part in the folded state of the wheelchair **1**.

**[0029]** As shown in Figs. 4, 5 and 6, the rods **17** on the wheelchair **1** are made of flexible materials, such as steel or textile cables or combinations thereof. The cables are housed in a flexible protective sleeve.

**[0030]** The folding wheelchair **1** is further provided with mudguards **18** protecting the user's legs from abrasion from the drive wheels **3**. The mudguards **18** are hinged on the side locking sleeves **14**, and these mudguards **18** can be folded down onto the upper part of the seat **2** when the wheelchair **1** is folded.

**[0031]** The process of folding the wheelchair **1** shown in Figs. 1 to 10 takes place in individual phases as follows: in the first phase, the locking lever **16** is moved from the locked position to the unlocked position and the locking sleeves **13**, **14**, **15** are unlocked through the rods **.**. In the same phase, the mudguards **18** are folded inwards onto the seat **2** of the wheelchair **1.** In the second phase, the backrest **4** is folded forward onto the seat **2,** above the mudguards **18**. At the same time, the drive wheels **3** are removed and the hub **12** is released from the shaft **11**. In the third phase of folding, the wheelchair **1** is turned upside down and the support arms **10** are folded towards the centre of the wheelchair **1** under the seat **2**. In the fourth phase, the foot frame **5** is also folded under the seat **2** so that the directional wheels **7** are mounted outside the seat **2**. In the fifth phase, one drive wheel **3** is fixed to the second transport handle **9** and after turning the folded wheelchair **1** upside down, in the sixth phase, the second drive wheel **3** is mounted to the first transport handle **8**. This completes the folding of the wheelchair **1**, all parts of the wheelchair **1** being in a folded form forming a single unit.

**[0032]** As shown in Figs. 1, 2, 3 and 11, the drive wheel **3** of the folding wheelchair **1** is formed by a rim **19** with an integrated hoop **20**, a tire **21**, spokes or a load-bearing frame **22** and a wheel hub **12** with a lever clamping mechanism **23**. The integrated hoop **20** is used for manual propulsion of the wheelchair **1** by the wheelchair **1** user.

## Industrial applicability

**[0033]** The folding wheelchair can be used wherever it is necessary to ensure the transport of persons with permanent or temporary disabilities, i.e. persons who are ill, disabled or old. The wheelchair can be used not only for transport by self-propulsion of the transported person, but it can be pushed by another person. The ability of

this wheelchair to be folded into a very small shape makes it easy to transport without significant requirements for transport storage space.

List of index reference numerals

**[0034]**

| | |
|---|---|
| 1 | folding wheelchair |
| 2 | seat |
| 3 | drive wheel |
| 4 | backrest |
| 5 | foot frame |
| 6 | footrest |
| 7 | directional wheel |
| 8 | first transport handle |
| 9 | second transport handle |
| 10 | carrier arm |
| 11 | shaft |
| 12 | drive wheel hub |
| 13 | rear locking sleeve |
| 14 | side locking sleeve |
| 15 | front locking sleeve |
| 16 | locking lever |
| 17 | rod |
| 18 | mudguard |
| 19 | rim |
| 20 | hoop |
| 21 | tire |
| 22 | load-bearing frame |
| 23 | lever clamping mechanism |

## Claims

1. Folding wheelchair (1) consisting of a seat (2), to which drive wheels (3) adapted for manual propulsion are detachably mounted on both sides, a backrest (4) which is hinged to the seat (2) with the possibility of folding it to the upper side of the seat (2) in the folded state of the wheelchair (1), and of a foot frame (5), which is provided with a footrest (6) and directional wheels (7) and is hinged to the seat (2) with the possibility of folding it to the underside of the seat (2) in the folded state of the wheelchair (1), **characterized in that** the rear side of the backrest (4) is provided with a first transport handle (8) for fixing the drive wheel (3), and the underside of the seat (2) is provided with a second transport handle (9) for fixing the drive wheel (3), the drive wheels (3) being able to be fastened to the transport handles (8, 9) in the folded state of the wheelchair (1).

2. Folding wheelchair according to claim 1, **characterized in that** the seat (2) is provided with support arms (10) for detachable mounting of the drive wheels (3), the support arms (10) being hinged to the seat (2) with the possibility of folding them to the underside of the seat (2) when the wheelchair (1) is folded.

3. Folding wheelchair according to claim 2, **characterized in that** the support arms (10) are provided with shafts (11) for mounting the hub (12) of the drive wheel (3), the shape of the shafts (11) at the point of suspension of the hub (12) of the drive wheel (3) corresponding to the shape of the transport handles (8, 9) at the point of fitting of the handles (8, 9) by the hub (12) of the drive wheel (3).

4. Folding wheelchair according to any of claims 1 to 3, **characterized in that** the seat (2) is provided with at least one rear locking sleeve (13) for hinging the backrest (4), at least two side locking sleeves (14) for hinging the support arms (10), and at least one front locking sleeve (15) for hinging the foot frame (5).

5. Folding wheelchair according to claim 4, **characterized in that** it is further provided with a locking lever (16) and rods (17), the rods (17) being fixed to the locking lever (16) at one end and at the other end the rods (17) being fixed to one of the locking sleeves (13, 14, 15) for locking or releasing the fixed part of the wheelchair (1) for folding it into its position in the folded state of the wheelchair (1).

6. Folding wheelchair according to claim 5, **characterized in that** the rods (17) are formed by steel or textile cables or a combination thereof housed in a flexible protective sleeve.

7. Folding wheelchair according to any of claims 1 to 6, **characterized in that** the support arms (10) are arranged inside the space defined by the foot frame (5) in the folded state of the wheelchair (1).

8. Folding wheelchair according to claim 7, **characterized in that** the foot frame (5) is designed such that in the folded state of the wheelchair (1) the directional wheels (7) are arranged outside the seat (2).

9. Folding wheelchair according to any of claims 1 to 8, **characterized in that** it is further provided with mudguards (18) hinged on side locking sleeves (14) with the possibility of folding the mudguards (18) onto the upper part of the seat (2) in the folded state of the wheelchair. (1).

10. Folding wheelchair according to any of claims 1 to 9, **characterized in that** the drive wheel (3) is formed by a rim (19) with an integrated hoop (20) for manual propulsion, a tire (21), spokes or a load-bearing frame (22) and hub (12) with a lever clamping mechanism (23).

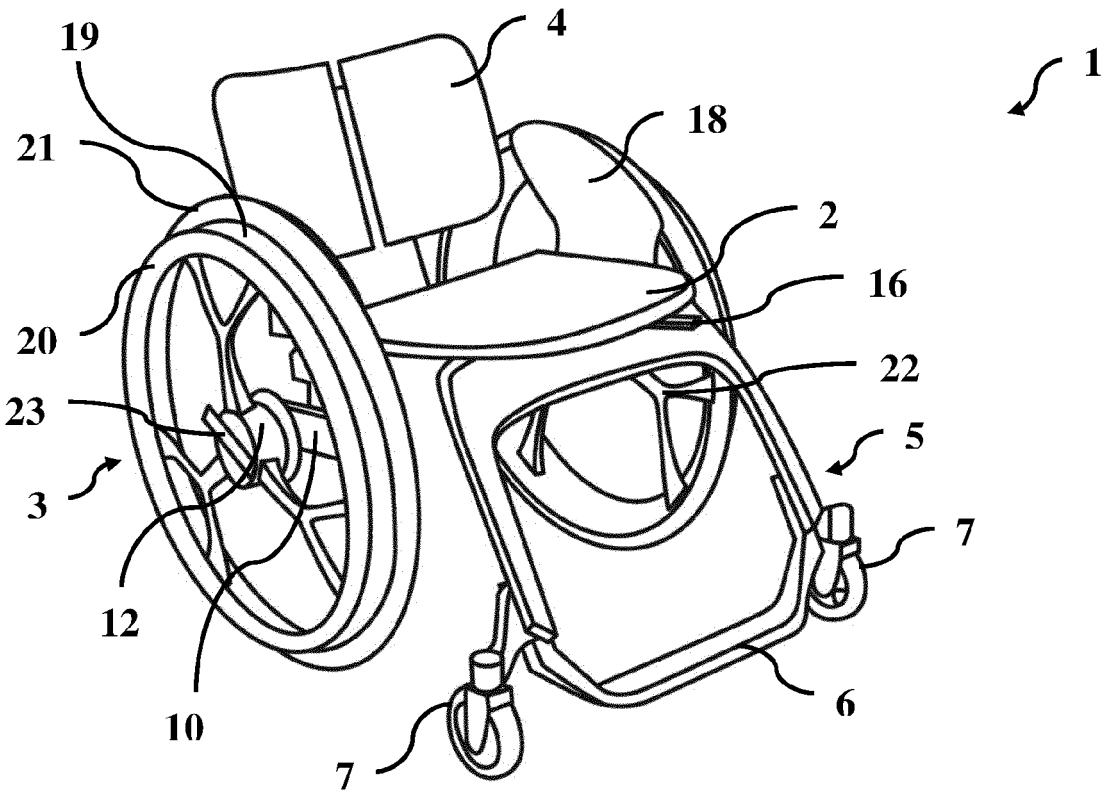
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Fig. 1

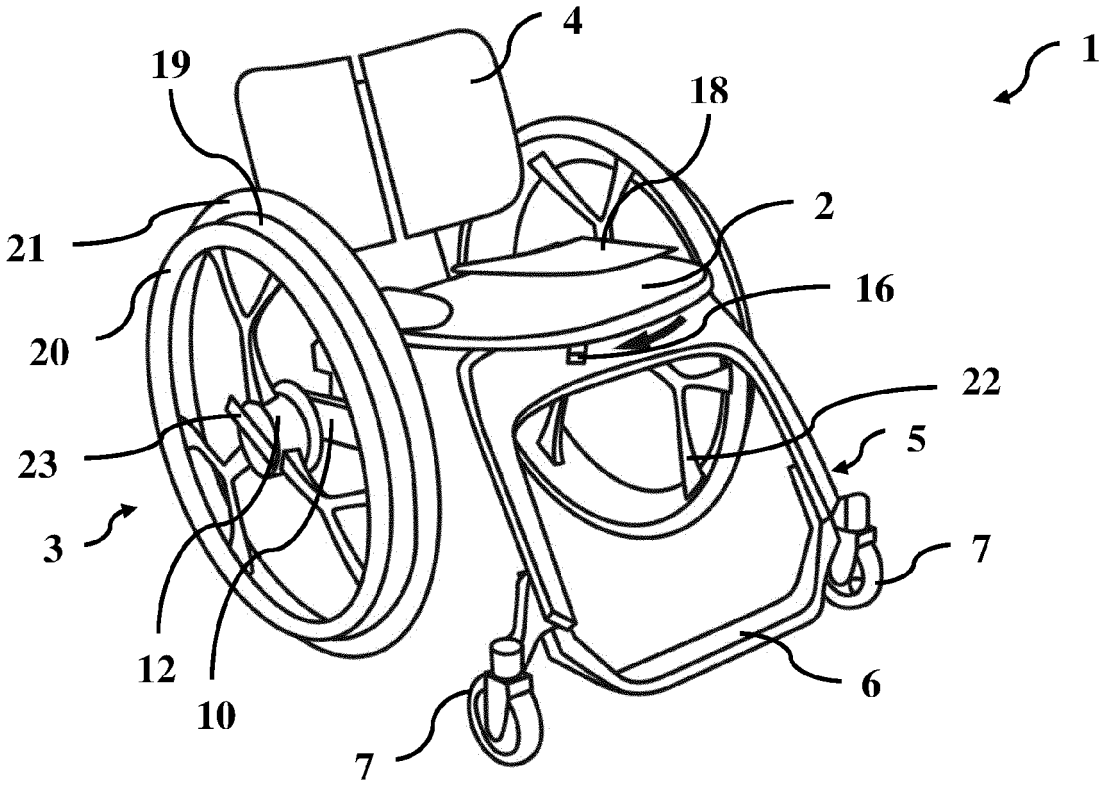
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Fig. 2

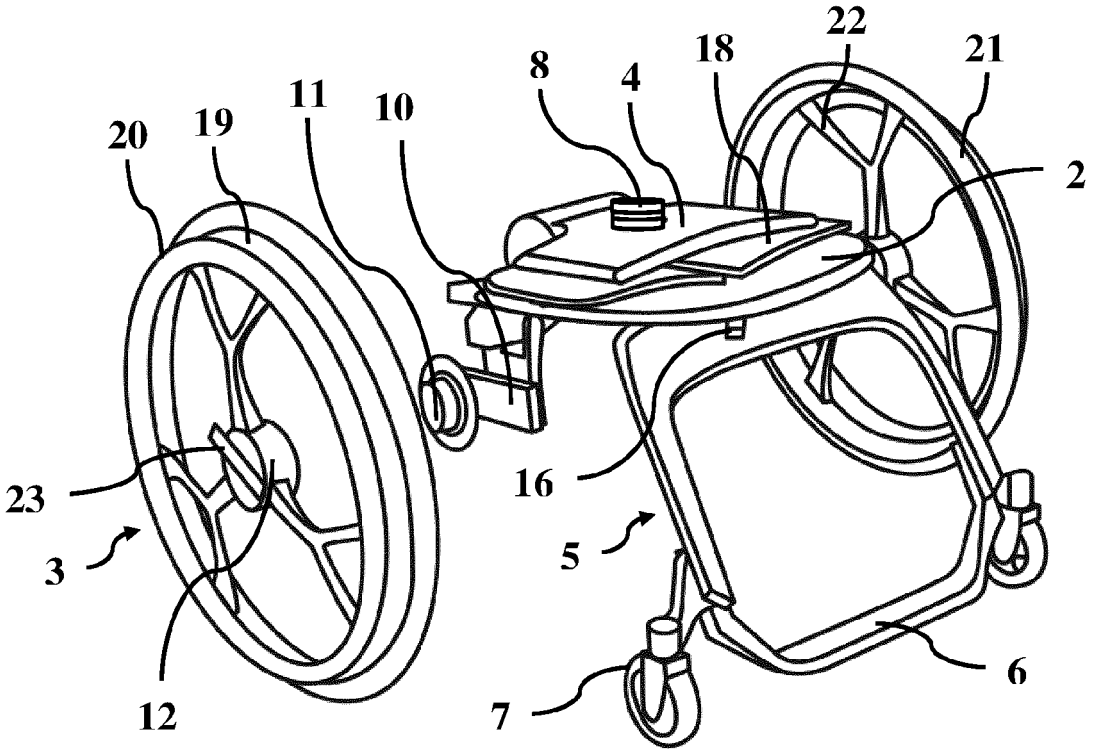
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Fig. 3

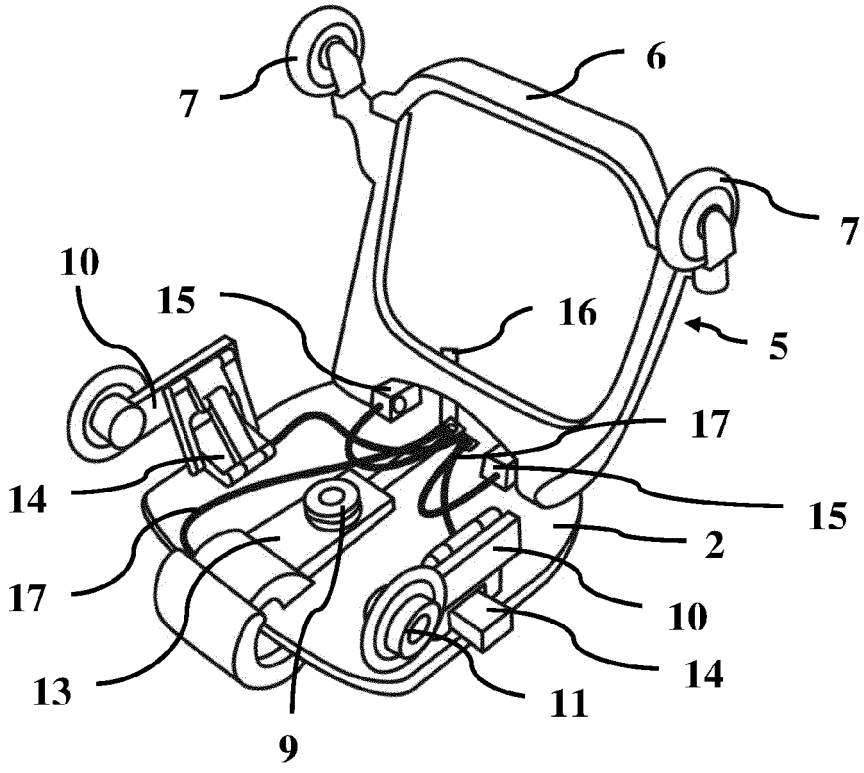
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Fig. 4

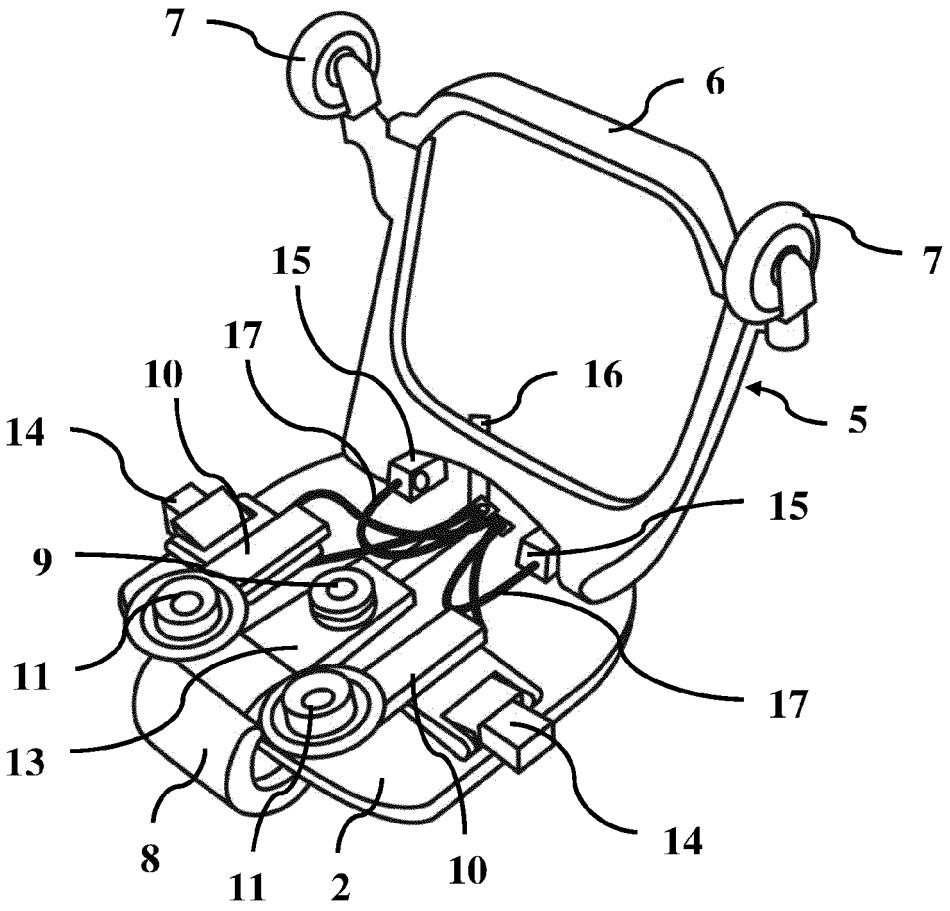
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Fig. 5

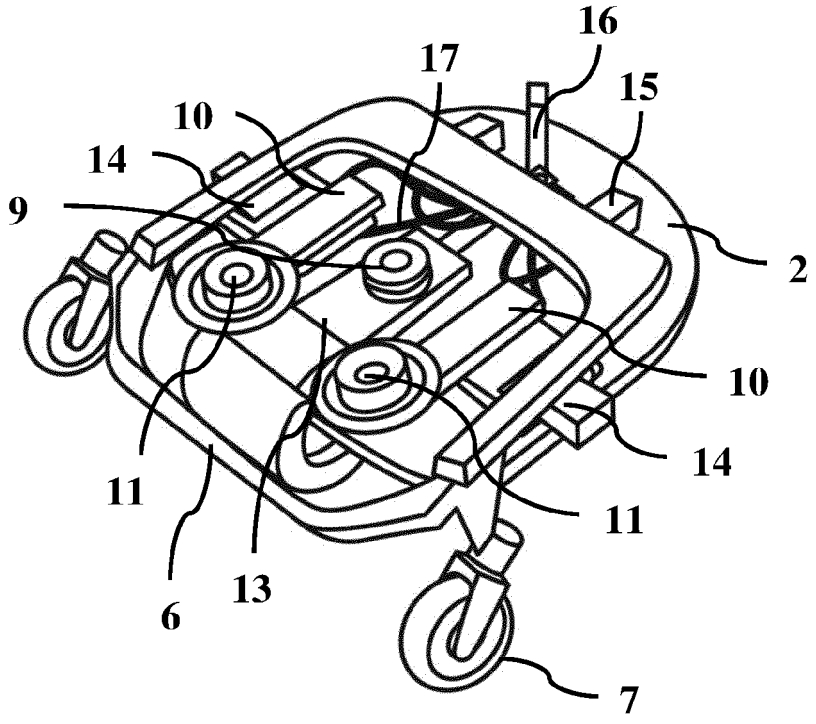
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Fig. 6

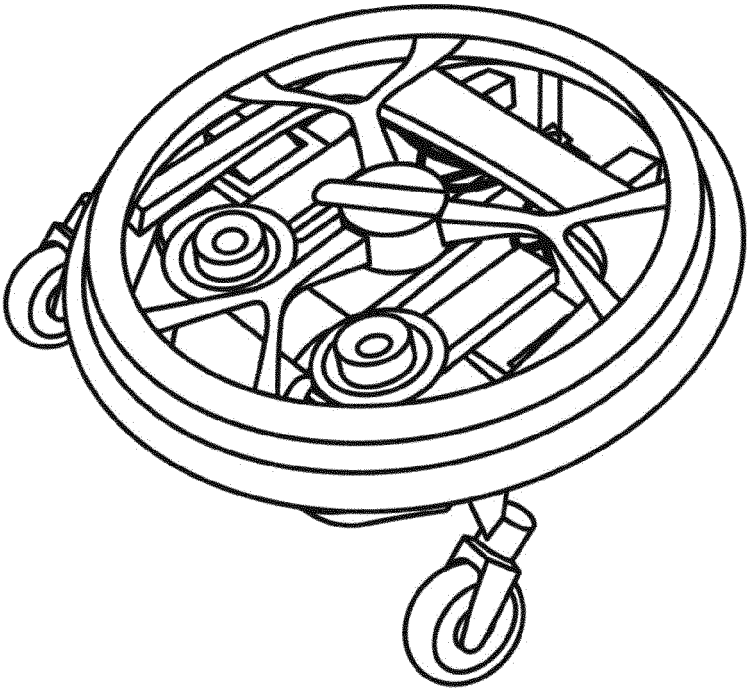

Fig. 7

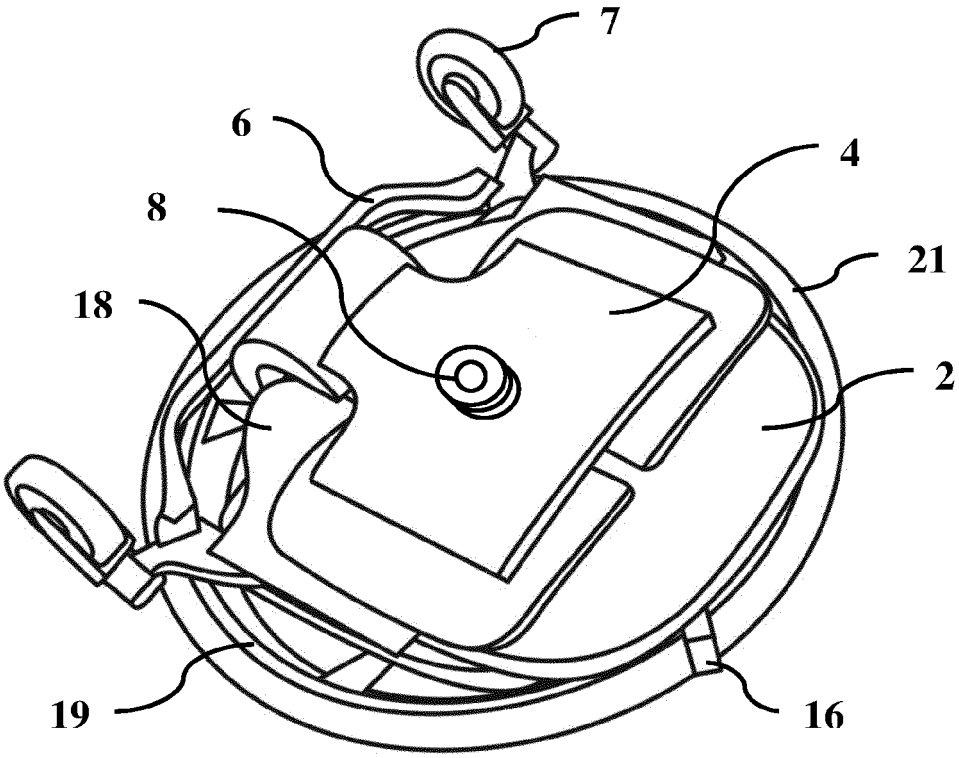


Fig. 8

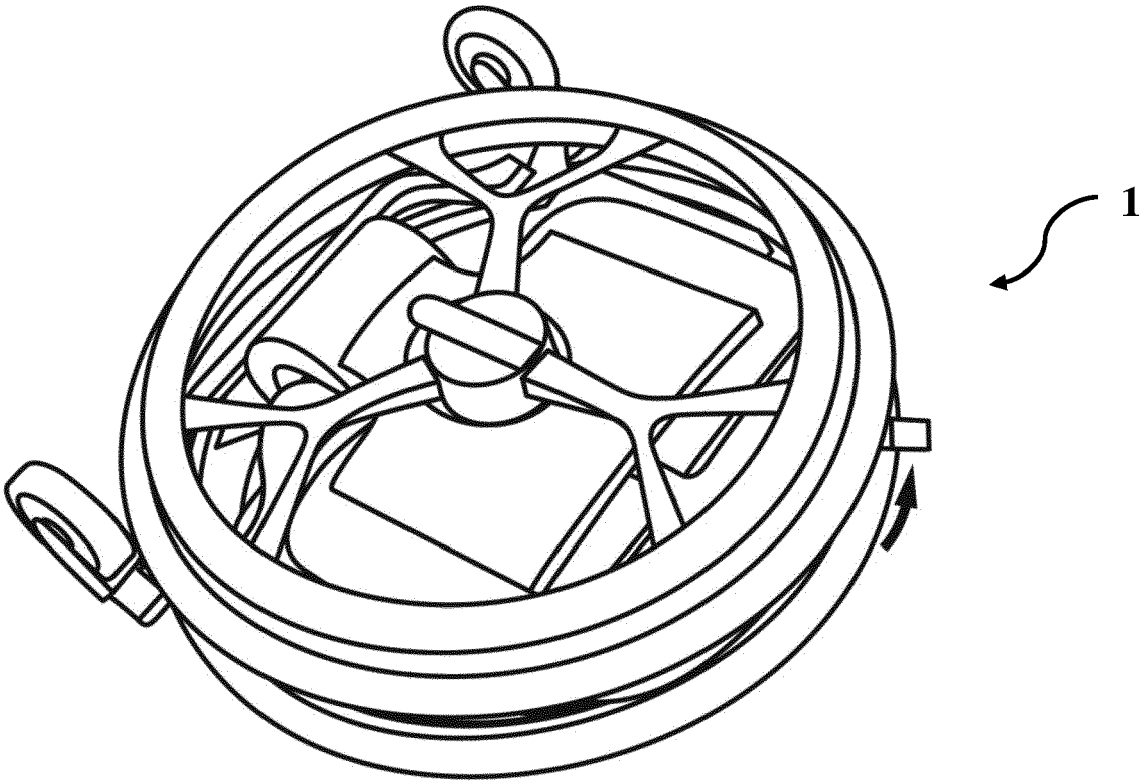


Fig. 9

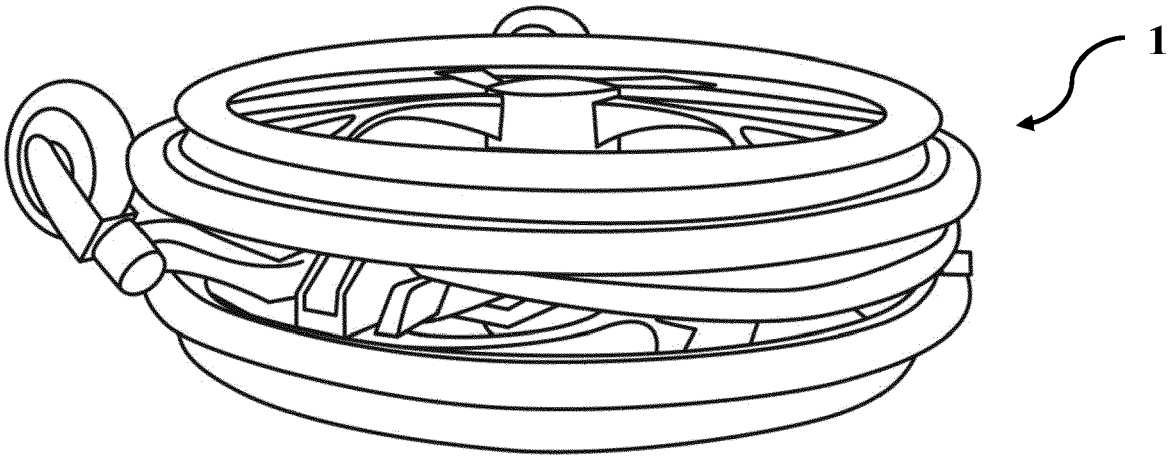


Fig. 10

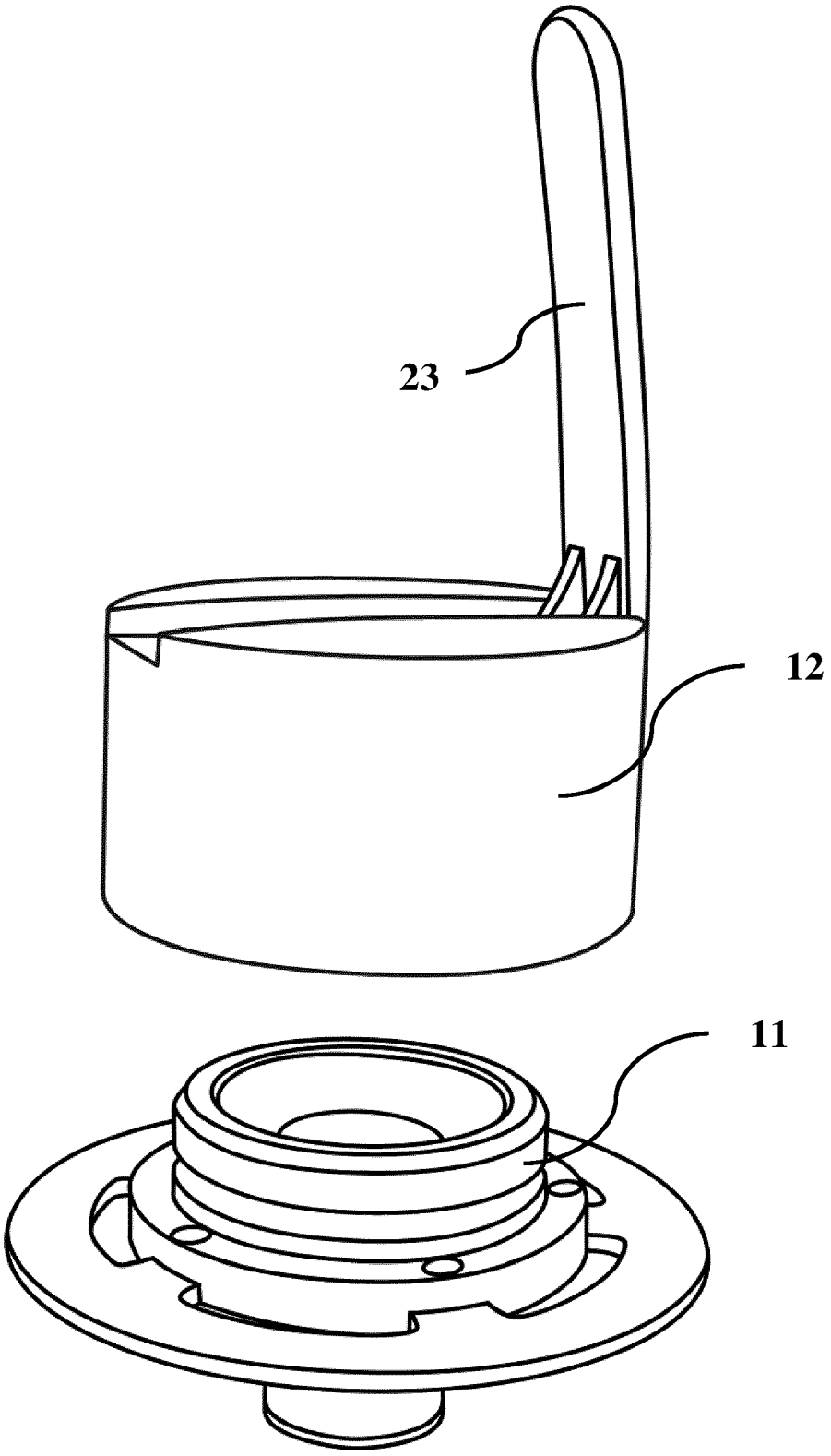


Fig. 11

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# EUROPEAN SEARCH REPORT

Application Number
EP 20 18 6175

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| A | WO 2007/099565 A1 (RAGONA GAETANO DANILO [IT]) 7 September 2007 (2007-09-07)<br>* abstract; figures 1-6 *<br>----- | 1-10 | INV.<br>A61G5/08<br>A61G5/12 |
| A | WO 2007/014042 A2 (CARLSBAD INTERNAT EXPORT INC [US]; CHONG EDWARD Y [US])<br>1 February 2007 (2007-02-01)<br>* abstract; figures 1-8 *<br>----- | 1-10 | |

TECHNICAL FIELDS SEARCHED (IPC)

A61G

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 7 December 2020 | Birlanga Pérez, J |

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 18 6175

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