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(54) **Tiltable wheelchair having a supporting spring member**

(57) In order to make it easier to stand up from wheelchair (1), the top part (3) of the wheelchair (1) is arranged tiltable with respect to the bottom part (2). A spring element (4), which comprises a gas spring (7), assists with the forwards tilting. According to the invention, the spring element (4) also comprises a coil spring (8) with a preferably adjustable free travel (A). This facilitates moving the top part (3) upwards from the rear position without making the backwards tilting significantly more difficult. The coil spring (8) also ensures that a spring action is always maintained, even if the gas spring (7) should fail.

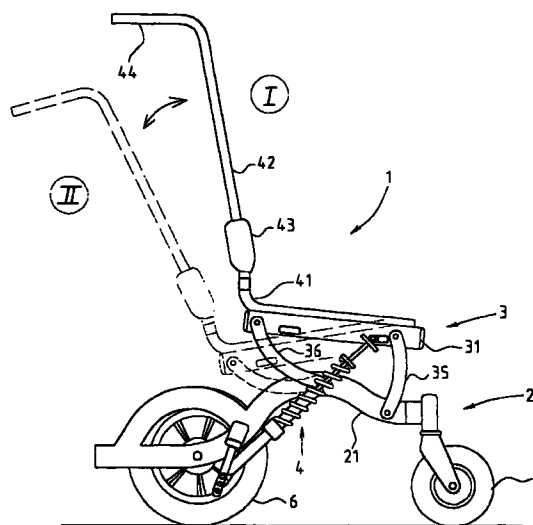


FIG. 1.

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Description

[0001] The invention relates to a wheelchair, comprising a bottom frame provided with wheels and a top frame for mounting a seat thereon, the bottom and top frames being connected to one another tiltably, in such a manner that the top frame is able to adopt at least a front and a rear position, and at least one spring element being arranged between the bottom and top frames in such a manner that the spring element assists with the movement from the rear position to the front position, which spring element comprises a first spring. A wheelchair of this nature is known from United States Patent US 4,519,649.

[0002] In this known wheelchair, the top frame is arranged tiltably, in such a manner that a user is pushed upwards and forwards when moving towards the front position. This makes it considerably easier for the user to get out of the wheelchair. On the other hand, it is also easier for a user to get into the wheelchair if the top frame firstly assumes the front position and, partly under the influence of the weight of the user, is moved into the rear position, which is the normal position of use. When the top frame is moved into the rear position, the spring element, a gas spring, is compressed.

[0003] The problem with wheelchairs of this nature is that a relatively great force is required in order for them to move out of the rear (lower) position. Although the movement into the front (upper) position is assisted by the spring element, it has nevertheless been found to require relatively high levels of force to move the top frame out of the rear position. This represents a considerable strain, in particular on the back, for a nurse or other carer who is behind the wheelchair and wishes to tilt a relatively heavy wheelchair user forwards.

[0004] In order to facilitate moving the top frame of the wheelchair out of the rear position, it is, of course, possible to employ a relatively strong spring (such as a gas spring) or two parallel (gas) springs as the spring element. However, this has the drawback that a relatively high level of force will be required for relatively lightweight wheelchair users to move the top frame from the front position to the rear position, since in so doing it is necessary to compress the relatively strong or double spring.

[0005] United States Patent US 5,513,867 discloses a wheelchair having a mechanism to assist the user when getting up. This known mechanism comprises a combination of a hydraulic cylinder, coil springs and cables connected to the coil springs and running over cams. This mechanism is relatively complicated and involves risks. The cables must carefully be maintained under tension to prevent them from being pushed from the cams. In addition the possibility exists that the fingers of the user are trapped between the cables and the cams, thus endangering the safety of the user.

[0006] In order to eliminate the abovementioned and other drawbacks of the Prior Art, according to the inven-

tion a wheelchair of the type mentioned in the preamble is designed in such a manner that the spring element additionally comprises a second spring which has a free travel which is such that the second spring assists the action of the first spring over part of the spring path of the latter.

[0007] Because of the fact that the spring element comprises a second spring which is active over only a limited path it is achieved that the forward movement of the top frame is assisted, at least initially, by two springs, while when moving the top frame towards the rear position initially the resistance of only one spring has to be overcome. This eliminates the so-called 'dead spot' in the rear position without causing a 'dead spot' in the front position for lightweight wheelchair users. It will be clear that the result is a wheelchair having a considerably increased ease of use. In addition, a wheelchair of this nature can be easily and safely implemented.

[0008] Advantageously, the wheelchair according to the invention is designed in such a manner that the spring element comprises an adjustment element for adjusting the free travel of the second spring. As a result, it becomes possible to adapt the spring action of the spring element to, for example, the weight of the user.

[0009] Preferably, the first spring is formed by a gas spring and the second spring is formed by a coil spring. A gas spring is suitable for assisting the relatively long total spring path, while a coil spring is suitable for assisting the relatively short additional spring path. Moreover, the combination of a gas spring and a coil spring ensures that at least some spring action is always maintained even if the gas spring were to become defective, for example as a result of damage, and lose its spring action. Preferably, a wheelchair of this nature is designed in such a manner that the coil spring is arranged around the gas spring. This provides a compact and efficient structure in which the spring forces can act on the same axis. However, the coil spring, or a combination of coil springs, may also be arranged next to or in line with the gas spring.

[0010] It is noted that the combination of a gas spring and a coil spring for use in a wheelchair is known per se from European Patent Application EP 0 800 809. In that particular case, however, a spring element is involved which is used to resiliently suspend the wheels of the wheelchair relative to the bottom frame, rather than allowing a relative movement of the upper and lower frames. In addition, there is no free travel.

[0011] It will be clear that the second spring may also be formed by an additional gas spring or that both the first and second springs may be coil springs.

[0012] If the second spring is a coil spring which is arranged around the gas spring, the adjustment element is preferably formed by a ring arranged around the gas spring and a locking screw which projects through the ring. In this case, the locking spring may, if appropriate, engage directly on the gas spring if the ring is a

continuous ring. The ring may also be an open ring (horseshoe), the ends of which are moved towards one another by the locking screw.

[0013] In order to prevent damage to the spring element, it may be accommodated in a telescopic housing.

[0014] The invention will be explained in more detail below with reference to the figures, in which:

Fig. 1 shows, in part and in side view, a wheelchair according to the invention, in a front and a rear position;

Fig. 2 shows a perspective view of part of the wheelchair according to the invention;

Fig. 3 shows a side view of a spring element for use in the wheelchair according to the invention;

Fig. 4 shows a plan view of connecting arms, with which the top and bottom frames of the wheelchair according to the invention can be connected to one another.

[0015] The wheelchair 1, which is illustrated by way of example in Fig. 1 and a few parts of which have been omitted for the sake of clarity of the drawing, comprises a bottom frame 2 and a top frame 3. In the embodiment illustrated, a pivotable front wheel 5 and a non-pivotable rear wheel 6 are arranged on a longitudinal support 21 of the bottom frame 2. The top frame 3 comprises a longitudinal support 31 on which a seat is arranged. In the case illustrated, the seat comprises first seat elements 41 and second seat elements 42 which are connected to one another by means of coupling pieces 43. The second seat elements 42 merge into handle 44. A cushion (not shown) may be placed on the seat.

[0016] The bottom longitudinal support 21 and the top longitudinal support 31 are tiltably connected to one another by means of connecting arms 35 and 36, which are pivotably attached to the longitudinal supports 21 and 22. A spring element 4 is arranged between the top frame 3 and the bottom frame 2 in a manner which will be explained in more detail in Fig. 2.

[0017] As shown in Fig. 1, the wheelchair 1 may adopt a front position and a rear position. In the front position, indicated by I, the seat slopes forward, while in the rear position, indicated by II, it slopes backward. Moreover, in the front position I the seat is higher than in the rear position II. As a result, it will be relatively easy to get into the wheelchair or get out of the wheelchair in the front position, while the rear position offers a more comfortable sitting position.

[0018] Fig. 2 shows a perspective view of the wheelchair of Fig. 1, but with the seat having been omitted for the sake of clarity.

[0019] As shown in Fig. 2, the bottom frame comprises longitudinal supports 21 and 22 which are connected to one another by transverse supports 23 and 24. The top frame 3 likewise comprises longitudinal supports 31 and 32 which are connected to one another by transverse supports 33 and 34. Pivotably arranged

left-hand connecting arms 35 and 36 and right-hand connecting arms 37 and 38 respectively connect the longitudinal supports 31 and 21, on the one hand, and 32 and 22, on the other hand.

[0020] A spring element 4, which will be explained in more detail below with reference to Fig. 3, is arranged between the front transverse support 33 of the top frame 3 and the rear transverse support 24 of the bottom frame 2. The spring element 4 is connected to the rear transverse support 24 of the bottom frame 2 with the aid of adjustment members 27 which enable a plurality of predetermined adjustment positions to be reached. In the embodiment illustrated, the adjustment member 27 comprises small parallel plates with pre-drilled holes through which a bolt which also fits through one end of the spring element 4 can be arranged.

[0021] By placing the spring element 4 in the centre of the wheelchair, under the user's seat, it is virtually impossible for the user to touch the spring elements during the spring movement. In this way, a greater measure of user safety is provided.

[0022] The embodiment of a spring element 4 which is illustrated in Fig. 3 comprises a gas spring 7 (which is known per se) and a coil spring 8 (which is likewise known per se), the coil spring 8 being arranged at least partly around the gas spring 7. The gas spring 7 comprises a cylinder having an end 12 and a piston rod 16, with an end 13, which projects out of the cylinder in a displaceable manner. The cylinder forms the body of the gas spring 7. The pressure of the gas which is present inside the cylinder will press the piston rod outwards. Fig. 3 therefore shows the spring element 4 in the load-free position.

[0023] The spring element 4 comprises a stop 14 which is attached to the piston rod 16 by means of a nut 15. The coil spring 8 extends between the adjustment element 9 and a buffer plate 11. An opening for accommodating the nut 15 may be formed in the buffer plate 11. The adjustment element 9 is provided with a locking screw 10, by means of which it can be locked in a suitable position on the gas spring 7. With the aid of the adjustment element 9 it is possible to enlarge, if desired, the free travel to the extent that the coil spring 8 does not contribute at all to the assistance of the movement of the upper frame.

[0024] The construction of the illustrated embodiment of the spring element 4 is such that the forces exerted by both the gas spring 7 and the coil spring 8 are transmitted to the ends 12 and 13.

[0025] If the spring element 4 is compressed, over a first spring path it will only be necessary to overcome the pressure of the gas spring. This first spring path corresponds to the free travel A of the coil spring 8. Only if the piston rod has moved sufficiently far into the cylinder for the buffer plate 11 to rest against the stop 14 (or the nut 15) will the second spring (coil spring 8) also be compressed in the event of the first spring (the gas spring 7) being compressed further. Therefore, for this

further compression to take place it will be necessary to overcome the spring force of both the gas spring 7 and the coil spring 8. The end of the total spring path B is reached if the buffer plate 11 (or the nut 15) comes into contact with the piston 7. The addition spring path, over which it is therefore necessary to overcome the spring force of both the first spring 7 and the second spring 8, is thus formed by the distance $C=B-A$.

[0026] It can now be seen from Figs 1 and 3 how a wheelchair according to the invention makes it easier to move out of the rear (lower) position II due to the double spring action of path C, while moving out of the front (upper) position is counteracted only by the single spring action of path A.

[0027] Fig. 4 shows the way in which the connecting arms 35 (and 36, 37 and 38) can be connected to the longitudinal support 21 (or 22) of the bottom frame 2. A spacer sleeve 39, which defines a distance D between the longitudinal support 21 and the connecting arm 35, is arranged between the connecting arm 35 itself and the longitudinal support 21. A bolt, which is secured by means of a nut, projects through the longitudinal support 21, the spacer sleeve 39 and the connecting arm 35. If appropriate, washers may also be provided. The connecting arms 35 and the spacer sleeve 39 may form a single unit.

[0028] The length of the spacer sleeve 39 is between approximately 2 and 8 cm, preferably approximately 6 cm. This ensures that the fingers of the user or carer cannot be trapped between the longitudinal support 21 and the connecting arm 35 when tilting the wheelchair. This provides additional safety for the users of the wheelchair.

[0029] As can be seen from Figs 1 and 2, the spring element 4 serves not only to assist with the tilting of the top frame but also to provide a resilient suspension for the top frame. Although it is possible to employ a lockable gas spring, it is preferable to use a non-lockable gas spring for the sake of this suspension.

[0030] It will be clear to the person skilled in the art that the invention is not limited to the exemplary embodiments illustrated and that numerous modifications and additions are possible without departing from the scope of the invention.

Claims

1. Wheelchair (1), comprising a bottom frame (2) provided with wheels (5, 6) and a top frame (3) for mounting a seat thereon, the bottom (2) and top (3) frames being connected to one another tiltably, in such a manner that the top frame (3) is able to adopt at least a front (I) and a rear (II) position, and at least one spring element (4) being arranged between the bottom and top frames in such a manner that the spring element (4) assists with the movement from the rear position to the front position, which spring element (4) comprises a first

spring (7), characterized in that the spring element (4) additionally comprises a second spring (8) which has a free travel (A) which is such that the second spring (8) assists the action of the first spring (7) over part (C) of the spring path (B) of the latter.

2. Wheelchair according to claim 1, characterized in that the spring element (4) comprises an adjustment element (9) for adjusting the free travel (A) of the second spring (8).

3. Wheelchair according to claim 1 or 2, characterized in that the first spring (7) comprises a gas spring and the second spring (8) comprises a coil spring.

4. Wheelchair according to claim 1, 2 or 3, characterized in that the coil spring (8) is arranged around the gas spring (7).

5. Wheelchair according to claim 4, characterized in that the adjustment element comprises a ring (9) arranged around the gas spring (7) and a locking screw (10) which projects through the ring.

6. Wheelchair according to any of the preceding claims, characterized in that the spring element (4) is accommodated in a telescopic housing.

7. Wheelchair according to any of the preceding claims, characterized in that at least two parallel spring elements (4) are arranged between the bottom (2) and top (3) frames.

8. Wheelchair according to any of the preceding claims, characterized in that each frame (2; 3) comprises two longitudinal supports (21, 22; 31, 32), which longitudinal supports are in each case connected by at least two transverse supports (23, 24; 33, 34), the at least one spring element (4) being arranged between the rear transverse support (24) of the bottom frame (2) and the front transverse support (33) of the top frame (3).

9. Wheelchair according to any of the preceding claims, characterized in that the spring element (4) is attached to the bottom frame (2) by means of adjustment means (27) which provide at least two different, predetermined positions.

10. Wheelchair according to any of the preceding claims, characterized in that the bottom (2) and top (3) frames are connected by pivotable connecting arms (35, 36, 37, 38) which are provided, at their bottom pivot points, with spacer sleeves (39), in such a manner that in each case a distance (D) between the bottom frame (2) and the connecting arms (35, 36, 37, 38) is ensured.

11. Wheelchair according to claim 10, characterized in that the distance (D) is between 2 and 10 cm and is preferably approximately 6 cm.

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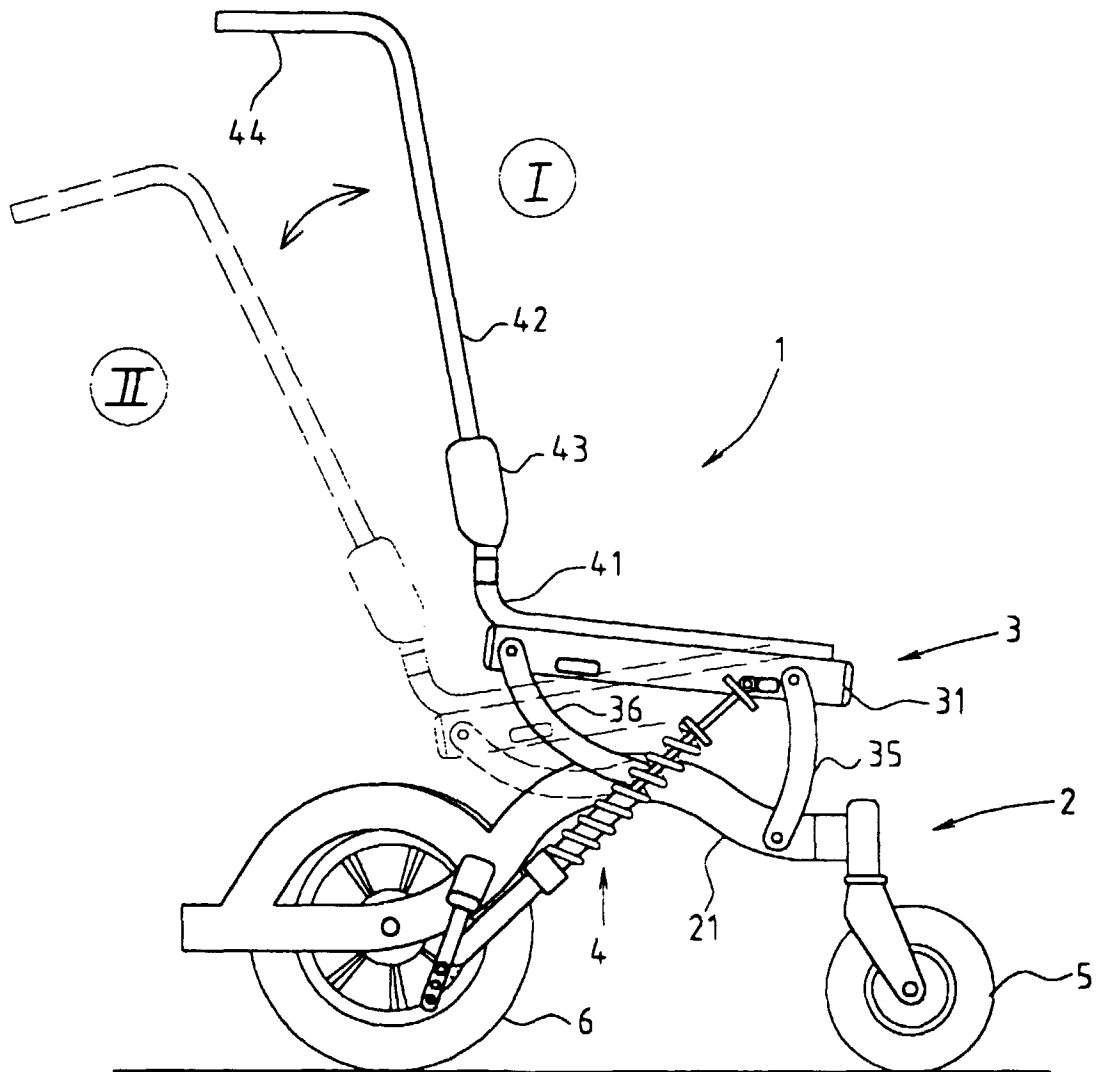


FIG. 1.

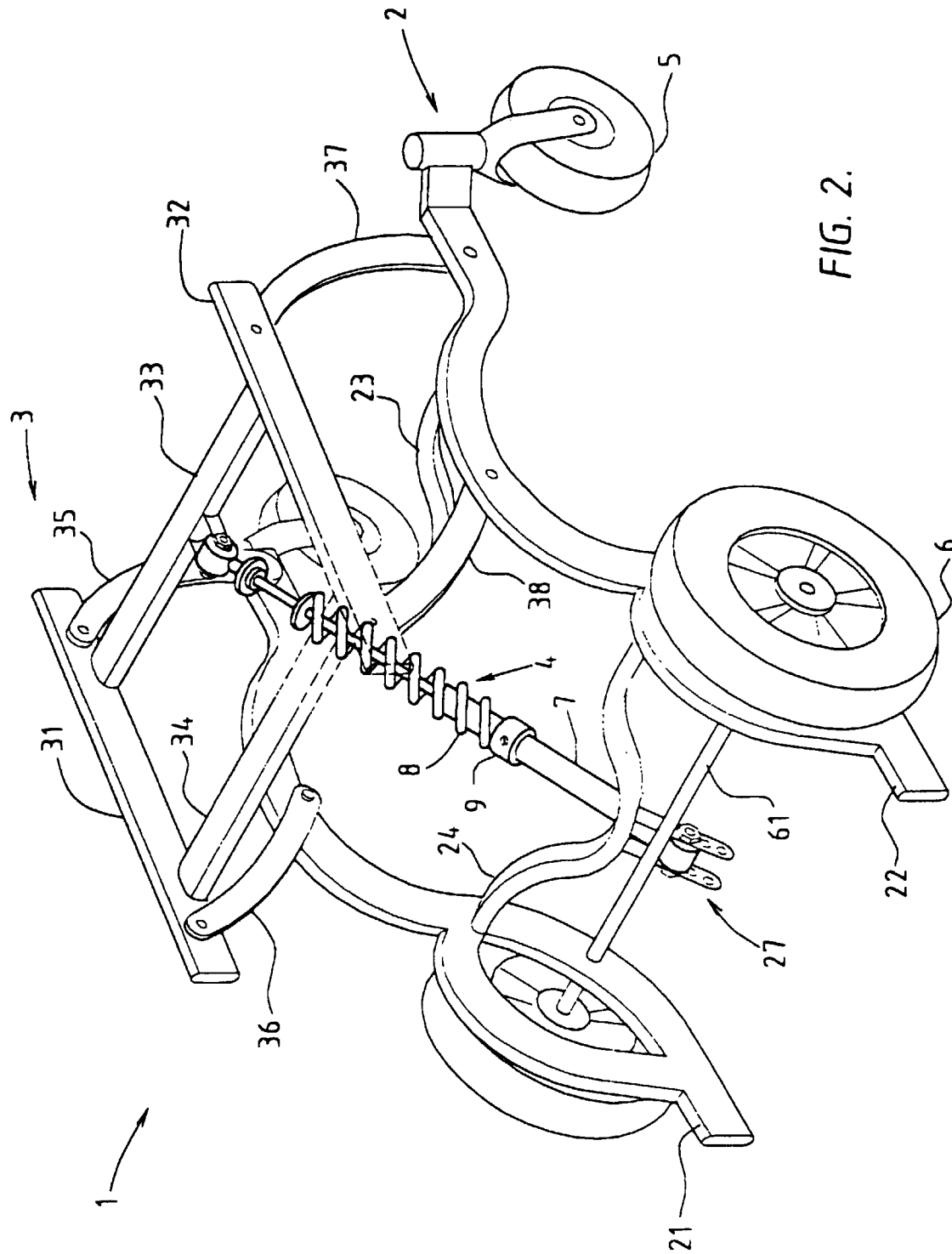
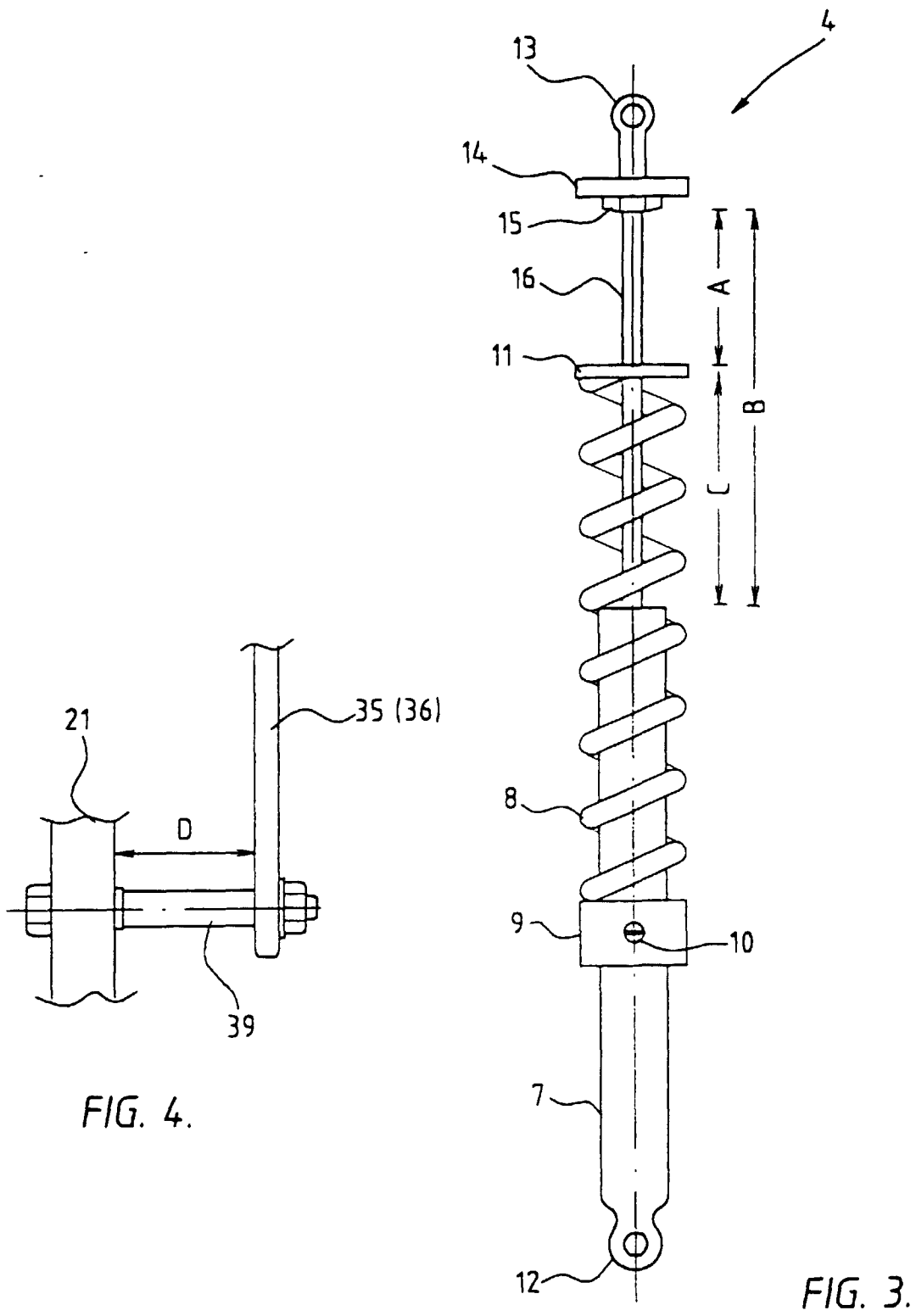


FIG. 2.





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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 0503

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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		13 July 1999	Baert, F
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date 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
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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