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AL BA MK RS(30) Priority: **18.07.2007 GB 0713964****26.03.2008 GB 0805440**(71) Applicant: **Brotherwood, Rodney John****33 Bowleaze Coveaway****Preston, Weymouth****Dorset, DT3 6PL (GB)**(72) Inventor: **Brotherwood, Rodney John****33 Bowleaze Coveaway****Preston, Weymouth****Dorset, DT3 6PL (GB)**(74) Representative: **Harris, David James****Barker Brettell LLP****138 Hagley Road****Edgbaston****Birmingham****B16 9PW (GB)**(54) **Wheelchair restraints**

(57) A wheelchair restraint for use in a vehicle, comprising: first and second spools (15) arranged to be fixed rotatably to the vehicle, for each spool, a member (1) being capable of being wound onto the spool, connected at a captive end to the spool and being provided at the other, free end, with attachment means (16) for attaching the windable member to a wheelchair, in which there is provided a common drive means (2) spaced from each spool (15) and arranged to apply, in use, a force to the spools (15) so as to act to wind the members (1) onto

the spools (15). The restraint can further comprise a further motor (55) arranged so as to be able to retract the windable members (1), the further motor being capable of exerting sufficient force on the members (1) so as to be able to load a wheelchair carrying a person into the vehicle. Also, the common drive means (2) can be arranged such that, in use, the force applied by the members (1) on the wheelchair is sufficient to coil the members on the spools (15) as the wheelchair is moved into the vehicle but is not sufficient to pull the wheelchair into the vehicle.

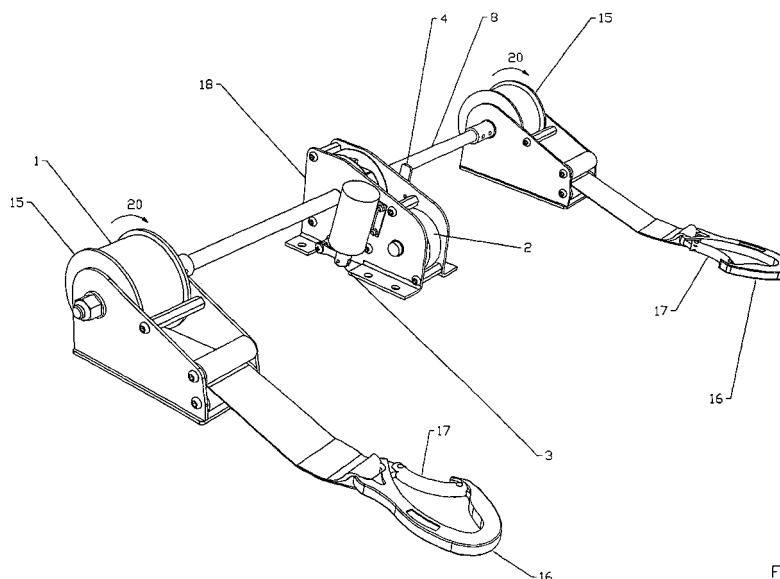


FIG 1

EP 2 016 925 A1

Description

[0001] This invention relates to wheelchair restraints.

[0002] The problem of safely transporting wheelchair-bound passengers seated in their wheelchairs is well known. A number of manufacturers produce webbing restraint systems for this purpose, in which four seatbelt type webbing assemblies are attached to the wheelchair, typically by hooks or a seatbelt type buckle and tongue arrangement. Such a restraint is well known in the art and will be referred to hereafter as a "four-point webbing wheelchair restraint".

[0003] In such a system, two belts are secured to the front of the wheelchair and two to the rear. Belt lengths are adjusted to suit the wheelchair and the front belts are locked. The rear belts are normally fitted with a tensioning device, which prevents the wheelchair from moving around in transit.

[0004] Many different types of four-point webbing wheelchair restraints exist; in one common type, the front restraints comprise a pair of spools containing seat belt webbing which have a hook or karabiner or buckle and tongue arrangement fitted to one end for attachment to the wheelchair. The spools are fitted into frames and are spring loaded, causing webbing to be wound onto the spool.

[0005] A ratchet mechanism prevents the webbing from being unwound until a solenoid valve is operated which disengages the ratchet and allows the belts to be extended and fitted to the wheelchair outside the vehicle. Once the solenoid is de-energised, the ratchet is re-engaged and the wheelchair can be loaded into the vehicle. Springs wind the belts back onto the spools as this happens. The ratchet mechanism now prevents the belts from being unwound from the spools, preventing the wheelchair from rolling backwards.

[0006] Such spring-loaded, ratchet driven spools are known from the seatbelt systems of cabs of heavy goods vehicles, where the solenoid-controlled ratchet is used to prevent unwinding of the driver's seatbelt and hence restrain the driver in the event of a crash, based upon the output of a deceleration sensor fitted to the vehicle cab. As such spools are generally used in prior-art wheelchair restraint systems, they are made in large volumes for the heavy goods vehicle market and are available relatively cheaply.

[0007] A problem with this type of restraint is that the webbing capacity is too little to allow fitting to the wheelchair outside a large vehicle. It is not considered practical simply to provide higher capacity spools, as it is not considered economic in the niche market relating to wheelchair restraints to set up the tooling etc required to make the spool and retraction mechanism combined. Another problem is that there is no manual override to the solenoid valve, failure of which renders the belts unusable.

[0008] According to the present invention, there is provided a wheelchair restraint for use in a vehicle, comprising:

first and second spools arranged to be fixed rotatably to the vehicle,

for each spool, a member being capable of being wound onto the spool, connected at a captive end to the spool and being provided at the other, free end, with attachment means for attaching the windable member to a wheelchair,

in which there is provided a common drive means spaced from each spool and arranged to apply, in use, a force to the spools so as to act to wind the members onto the spools.

[0009] This invention therefore removes the need for a complicated spring-return mechanism within each spool; the spools can be driven relatively simply by the common drive means. This means that the spools can be of any desired size, as manufacture of the spools of differing sizes without the need to generate correspondingly different size return mechanisms within the spool would be easier than the prior art manufacturing situation described above.

[0010] The spools may be linked together by a shaft. The spools may be linked by the shaft such that they rotate together. The use of such a shaft is convenient, as it means that the spools will rotate at the same speed, therefore drawing in their respective members at the same rate. This is likely to prevent the two members retracting at different speeds to one another, which could lead to the wheelchair being unevenly restrained. The common drive means may be operatively coupled to, and may be situated on, the shaft.

[0011] The common drive means may be arranged such that, in use, the force applied by the members on the wheelchair is sufficient to coil the members on the spools as the wheelchair is moved into the vehicle but is not sufficient to pull the wheelchair into the vehicle. In one embodiment, the maximum force applied on each of the members by the action of the common drive means in use is less than 50N, and is preferably less than 30N. The torque applied by the common drive means on the spools may be substantially constant as the members are coiled on the spools, and may generate a force of 25N on each of the members when the members are fully coiled.

[0012] The common drive means may comprise a spring motor, typically a constant force spring motor. Alternatively, the common drive means may comprise an electric or hydraulic motor; in such a case the electric or hydraulic motor may be provided with a clutch that can selectively disengage the motor from the spools. This can be advantageous, as it means that the motor does not necessarily have to be back-wound when releasing the windable members from the spools.

[0013] The restraint may also be provided with a common ratchet having two states; a first state in which it acts to prevent the members being uncoiled from the spools by preventing rotation of the spools in a first sense, but allows rotation of the spools in a second, opposite

sense, and a second state where it allows rotation of the spools in either sense. Accordingly, a ratchet does not have to be provided in each spool. The ratchet may be provided in the same housing as the common drive means.

[0014] The ratchet may comprise a solenoid, which is arranged to switch the ratchet between the first and second states. Additionally or alternatively, the ratchet may be provided with a release handle, arranged to switch the ratchet between the first and second states. The ratchet may comprise a toothed wheel mounted on the shaft and at least one pawl biased into contact with the toothed wheel in the first state; as is common with ratchet mechanisms, the shape of the toothed wheel may be such that in the first state the pawl rises over the teeth of the toothed wheel as the shaft rotates in the first sense but locks against the teeth as the shaft rotates in the second sense. At least one of any solenoid and any release handle may be operatively coupled to the pawl so as to force the pawl out of engagement with the toothed wheel in the second state. Having both a solenoid and manual handle operation is convenient, as the manual handle provides a backup should the solenoid fail.

[0015] Each of the members may comprise a band of webbing, typically of the kind commonly employed in vehicular seat belts. The attachment means may comprise a hook, buckle or karabiner or other such attachment hardware.

[0016] Where the common drive means comprises a spring motor, the restraint may further comprise a further motor arranged so as to be able to retract the windable members, the further motor being capable of exerting sufficient force on the members so as to be able to load a wheelchair carrying a person into the vehicle. Accordingly, the motor may be arranged so as to be able to exert a force of at least 2500 N on the members. Typically, the motor would be arranged to drive the shaft.

[0017] The further motor may be provided with a clutch, so as to enable the motor to be selectively engaged to drive the spools. This may enable the motor to be disengaged from the spools when the members are being unwound from the spools, hence avoiding back-winding the motor.

[0018] In such a case, if the further motor fails, due to an internal failure, a failure of its power supply or so on, the spring motor (and, if provided, the common ratchet) will still function to provide a restraint against movement of the wheelchair.

[0019] According to a second aspect of the invention, there is provided a vehicle fitted with the wheelchair restraint of the first aspect of the invention.

[0020] The members may be of sufficient length to reach a wheelchair outside the vehicle when they are fully uncoiled from the spools.

[0021] According to a third aspect of the invention, there is provided a combination of the vehicle of the second aspect of the invention and a wheelchair, the attachment means of the wheelchair restraint being attached

to the wheelchair.

[0022] According to a fourth aspect of the invention, there is provided a method of loading a wheelchair into a vehicle according to the second aspect of the invention, comprising attaching the attachment means to the wheelchair and moving the wheelchair into a desired position, allowing the common drive means to rotate the spools so as to coil the members on the spools. Accordingly, the wheelchair can be located correctly in the vehicle and then the slack in the members taken up.

[0023] The method may comprise the step of extending the members to reach the wheelchair in the second position of the ratchet, typically by uncoiling them from the spools. Once the members are attached to the wheelchair, the method may comprise placing the ratchet in the first position whilst the wheelchair is moved into the desired position. This means that the wheelchair will be prevented in moving in the direction away from the spools - typically backwards - whilst it is being moved into the desired position.

[0024] The wheelchair may be positioned outside the vehicle when the members are attached; the desired position may be inside the vehicle, typically a driving position in front of the controls of the vehicle.

[0025] There now follows by way of example description of an embodiment of the invention described with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of a wheelchair restraint according to a first embodiment of the invention;

Figure 2 shows a perspective view of the wheelchair restraint of Figure 1 from the opposite side;

Figure 3 shows a perspective view of the manual ratchet release mechanism of the wheelchair restraint of Figure 1;

Figure 4 shows a perspective view from underneath the wheelchair restraint of Figure 1; and

Figure 5 shows a wheelchair being loaded into a vehicle using the wheelchair restraint of Figure 1;

Figure 6 shows a perspective view of a wheelchair restraint system according to a second embodiment of the invention; and

Figure 7 shows an enlarged view of the spring motor and solenoid of the system of Figure 6.

[0026] A wheelchair restraint according to a first embodiment of the present invention is shown in Figures 1 to 5 of the accompanying Figures. This restraint comprises two spools 15 with webbing 1 of the kind commonly used for vehicle seat belts coiled around them. A captive end (not shown) of each length of webbing 1 is held in

the respective spool 15. The other, free end of each length of webbing is fitted with a "karabiner" 16; that is a hook having a spring-loaded gate. This can be used to attach the free end of each length of webbing 1 to a suitable point on a wheelchair; the hook is passed over a strut or similar part of the wheelchair, and the spring-loaded gate 17 prevents the strut inadvertently escaping the hook.

[0027] The two spools 15 are linked by a shaft 8 which rotates in a housing 18 bolted to the vehicle floor in front of the desired wheelchair position. This shaft 8 is powered by a constant force spring motor 2. The shaft acts to rotate the spools 15 in a first sense shown by arrow 20 to cause the webbing 1 to be wound onto the spools 15. The motor 2 exerts a pull equivalent to the weight of a mass of approximately 2.5 kg (that is, about 25N) on each of the lengths of webbing 1. A ratchet 6 prevents rotation of the shaft and hence the spools in the sense opposite to that of arrow 20; hence the webbing is prevented from unwinding.

[0028] In order to be able to unwind the webbing 1 from the spools 15, a release mechanism is provided. In this example ratchet pawls 5 (Figure 4) are mounted on a shaft 21 in housing 18. A pair of toothed wheels 7 is fixed to shaft 8 and so rotate with it. The ratchet pawl shaft 21 has a lever at each end; a first one of these 9 is attached via a pin to a solenoid 3. The other lever 10 is fitted to a tension spring 11, which keeps the ratchet pawls 5 engaged with the toothed wheels 7. When the solenoid is energised, the spring force is overcome and the ratchet pawls are disengaged from the toothed wheel, allowing the spools to rotate in the sense opposite to the arrow 20 and so allowing the webbing 1 to be unwound.

[0029] In the event of solenoid failure, manual lever 4 can be used to disengage the ratchet pawls. In this example, the lever 4 swivels about the ratchet pawl shaft 21 and is mounted between two cylindrical rubber spacers 12, which hold the lever against a face cam 13. Rotating the lever causes the ratchet pawls to be disengaged. The lever 4 is held off by a notch 23 in the face cam 13.

[0030] The operation of the restraint can be seen in Figure 5 of the accompanying drawings. This depicts schematically a car 30 fitted with the wheelchair restraint 31 of Figures 1 to 4. In the situation of Figure 5 the ratchet 6 has been released by means of the solenoid 3 or manual release lever 4. The webbing 1 is substantially unwound from the spools 15 so that it reaches the wheelchair 33 to be loaded onto the vehicle 30. The karabiners 16 are used to fix the webbing 1 to the wheelchair 33.

[0031] The ratchet is then reengaged by allowing pawls 5 to come back into contact with toothed wheels 7. The webbing can therefore no longer be extended, and the constant force spring motor 2 will apply its force to tend to retract the webbing 1 onto the spools 15. The wheelchair 33 is then loaded into the vehicle 30 via ramp 34 towards desired location 32. As it is so loaded, the webbing retracts onto the spools by action of the motor

2; the ratchet prevents the wheelchair rolling backwards. Once the wheelchair is in the desired position, it is prevented from any backwards movement by the ratchet. Forwards movement can be restrained by using with any available rear tie-down and tensioning device.

[0032] A second embodiment of the invention is shown in Figures 6 and 7 of the accompanying drawings. In this embodiment, two spools containing seat belt webbing terminated at a free end with a "karabiner" 51 are linked by a shaft 58 which rotates in a framework bolted to the vehicle floor in front of the wheelchair. This shaft 58 is powered by a constant force spring motor 52 which, when engaged and as with the first embodiment, causes the belts to be fully wound onto the spools. The motor has been relocated with respect to the first embodiment of the invention, and is now located at an end of the shaft 58 adjacent to one of the spools. The spring motor 52 is designed to exert a pull of about 25N (equivalent to 2.5 kg) on the belts; a ratchet prevents the belts from unwinding until disengaged by a solenoid valve 53 or manual override lever 54. These release mechanisms allow the belts to be fully unwound from their spools and attached to a wheelchair outside the vehicle.

[0033] Once the ratchet is re-engaged, the belts are retracted by the spring motor 51 and cannot now be unwound, which prevents the wheelchair rolling backwards. This functionality corresponds to the method shown above with respect to Figure 5 of the accompanying drawings, and is particularly applicable to motorised wheelchairs; the force from the spring motor 52 is insufficient in itself to pull a wheelchair into the vehicle. This "front restraint" can be used with any available rear tie-down & tensioning device.

[0034] The ratchet mechanism is shown in more detail in Figure 7 of the accompanying drawings. In this embodiment, the ratchet pawls 59 are mounted on a shaft running through the spool housing 60. The spool is attached to a pair of toothed wheels 61. The ratchet pawl shaft 59 has a lever 54 at one end, which is attached via a pin to the solenoid 53. This lever 54 carries an extension, which acts as a manual override should the solenoid fail and is fitted to a tension spring 62 which keeps the ratchet pawls engaged with the toothed wheels. When the solenoid is energised, the spring force is overcome and the ratchet pawls are disengaged from the toothed wheel, allowing the safety belts 51 to be unwound.

[0035] In the event of solenoid failure, the extension to the lever 54 can be used to disengage the ratchet pawls.

[0036] In addition to the function of the first embodiment of the invention, in this second embodiment the belts can be tensioned using an electric motor 55, fitted with a reduction gearbox 56 and a magnetic clutch 57. This electric motor 55 revolves the shaft 58 linking the webbing spools, tensioning the belts and preventing unwanted wheelchair movement. Clutch slippage prevents over tensioning of the belts and damage to the wheelchair. Once switched off, the motor is disengaged and

the restraint works as described previously.

[0037] In addition this motor 55 and clutch 57 assembly can be utilised as a device for winching non-motorised wheelchairs into the vehicle. This system has several advantages over conventional winch and restraint systems. With the clutch 57 disengaged, the belts can be withdrawn from the vehicle without having to back-wind the motor, and separate restraint belts do not have to be fitted.

Claims

1. A wheelchair restraint for use in a vehicle, comprising:

first and second spools arranged to be fixed rotatably to the vehicle,
for each spool, a member being capable of being wound onto the spool, connected at a captive end to the spool and being provided at the other, free end, with attachment means for attaching the windable member to a wheelchair,

in which there is provided a common drive means spaced from each spool and arranged to apply, in use, a force to the spools so as to act to wind the members onto the spools,

in which the restraint further comprises a further motor arranged so as to be able to retract the windable members, the further motor being capable of exerting sufficient force on the members so as to be able to load a wheelchair carrying a person into the vehicle.

2. A wheelchair restraint for use in a vehicle, comprising:

first and second spools arranged to be fixed rotatably to the vehicle,
for each spool, a member being capable of being wound onto the spool, connected at a captive end to the spool and being provided at the other, free end, with attachment means for attaching the windable member to a wheelchair,

in which there is provided a common drive means spaced from each spool and arranged to apply, in use, a force to the spools so as to act to wind the members onto the spools,

in which the common drive means is arranged such that, in use, the force applied by the members on the wheelchair is sufficient to coil the members on the spools as the wheelchair is moved into the vehicle but is not sufficient to pull the wheelchair into the vehicle.

3. The restraint of claim 1 or claim 2, in which the spools

are linked together by a shaft, such that they rotate together.

4. The restraint of claim 3 in which the common drive means is operatively coupled to the shaft.

5. The restraint of claim 1, in which the common drive means is arranged such that, in use, the force applied by the members on the wheelchair is sufficient to coil the members on the spools as the wheelchair is moved into the vehicle but is not sufficient to pull the wheelchair into the vehicle.

6. The restraint of claim 2 or claim 5, in which the maximum force applied on each of the members by the action of the common drive means in use is less than 50N, and is preferably less than 30N.

7. The restraint of any preceding claim, in which the torque applied by the common drive means on the spools is substantially constant as the members are coiled on the spools, the common drive means typically comprising a spring motor.

8. The restraint of claim 7, except as dependent from claim 1, in which the restraint further comprises a further motor arranged so as to be able to retract the windable members, the further motor being capable of exerting sufficient force on the members so as to be able to load a wheelchair carrying a person into the vehicle.

9. The restraint of claim 1 or claim 8, in which the further motor is arranged so as to be able to exert a force of at least 2500 N on the members.

10. The restraint of any of claims 1, 8 and 9, in which the further motor is provided with a clutch, so as to enable the motor to be selectively engaged to drive the spools.

11. The restraint of any preceding claim, further comprising a common ratchet having two states; a first state in which it acts to prevent the members being uncoiled from the spools by preventing rotation of the spools in a first sense, but allows rotation of the spools in a second, opposite sense, and a second state where it allows rotation of the spools in either sense.

12. The restraint of claim 11, in which the ratchet comprises a solenoid, which is arranged to switch the ratchet between the first and second states and in which the ratchet is provided with a release handle, arranged to switch the ratchet between the first and second states.

13. A vehicle fitted with the wheelchair restraint of any

preceding claim.

- 14.** A combination of the vehicle of claim 13 and a wheelchair, the attachment means of the wheelchair restraint being attached to the wheelchair. 5
- 15.** A method of loading a wheelchair into a vehicle according to claim 13, comprising attaching the attachment means to the wheelchair and moving the wheelchair into a desired position, allowing the common drive means to rotate the spools so as to coil the members on the spools. 10

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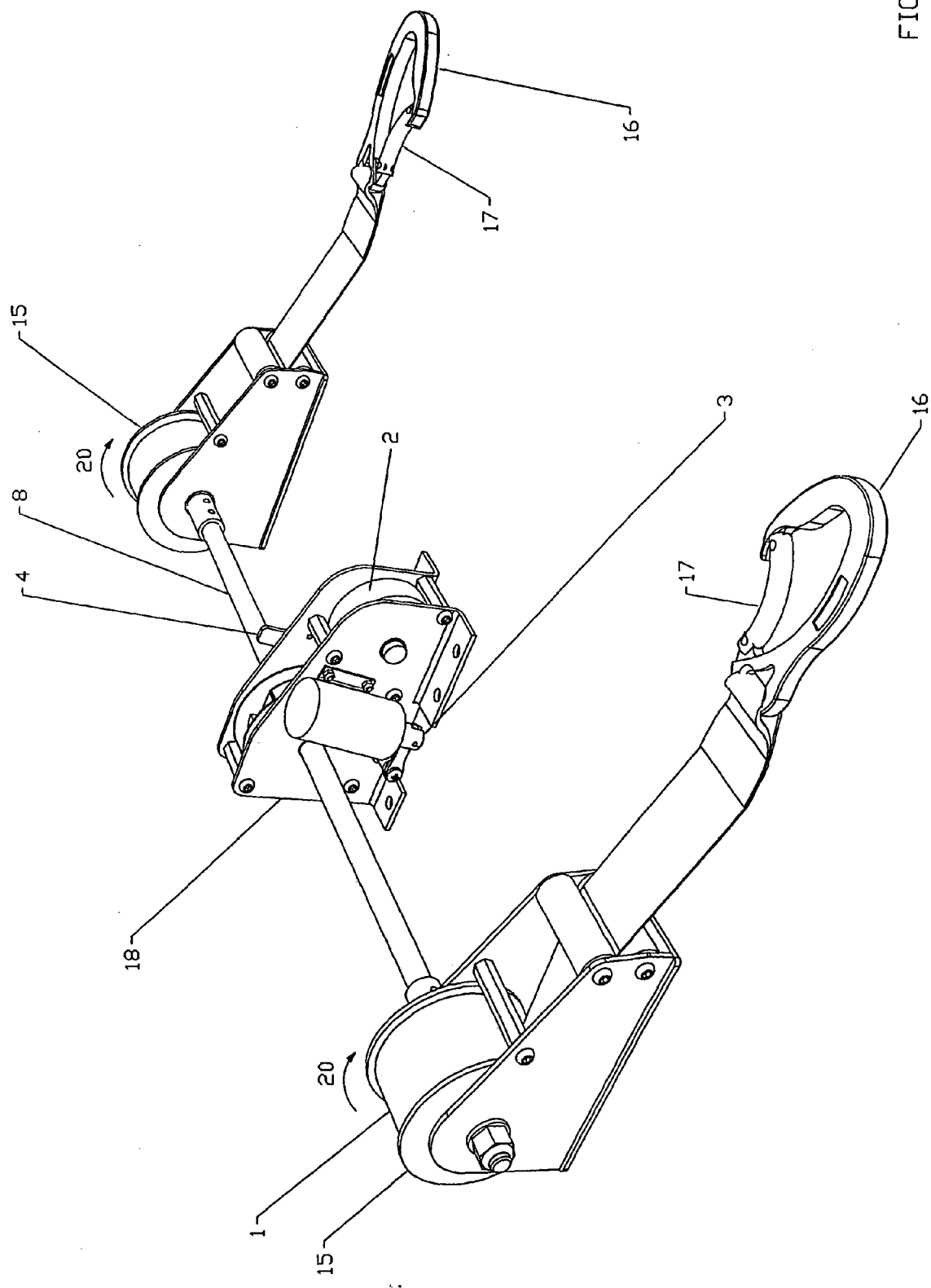


FIG 1

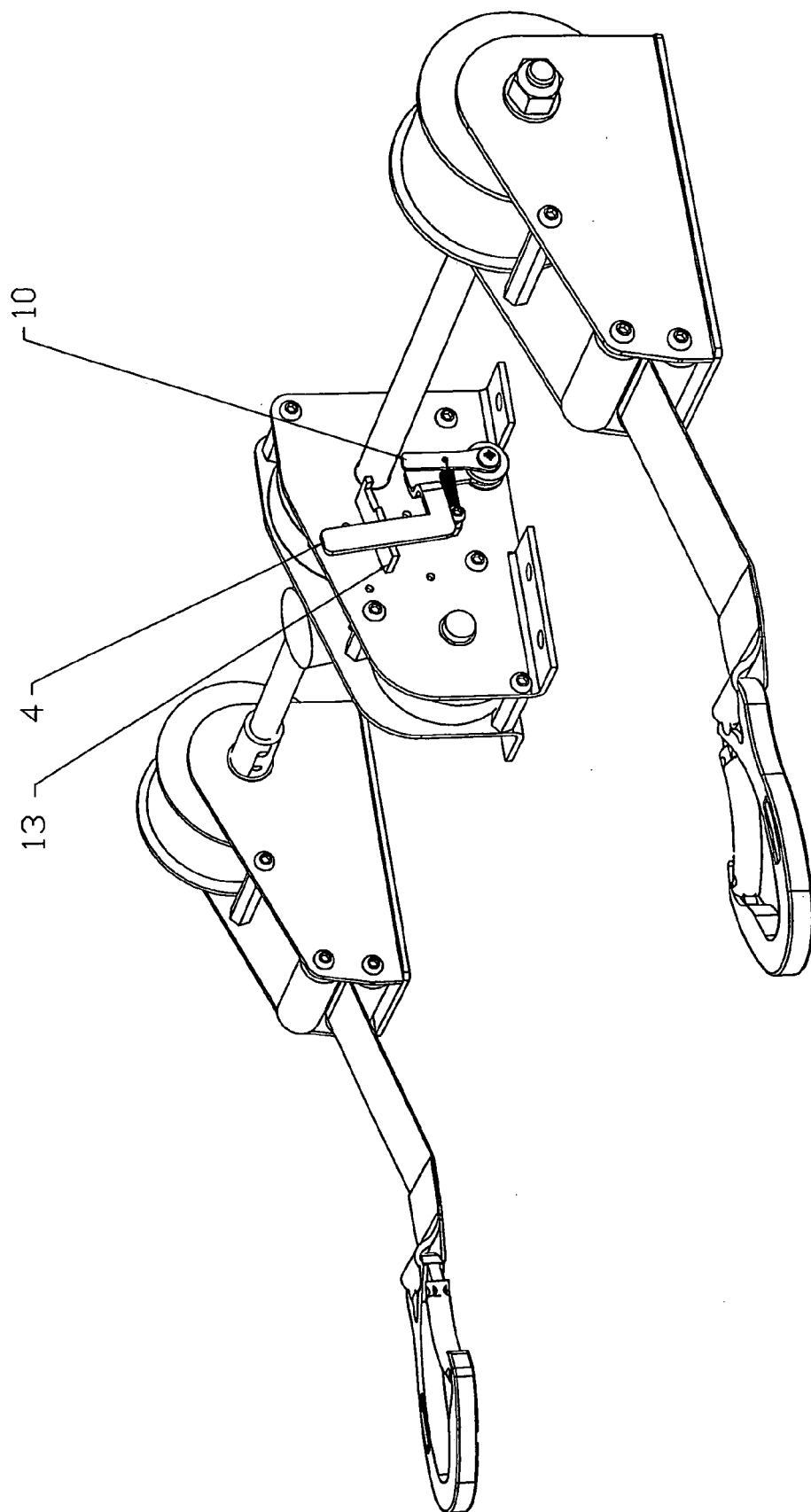


FIG 2

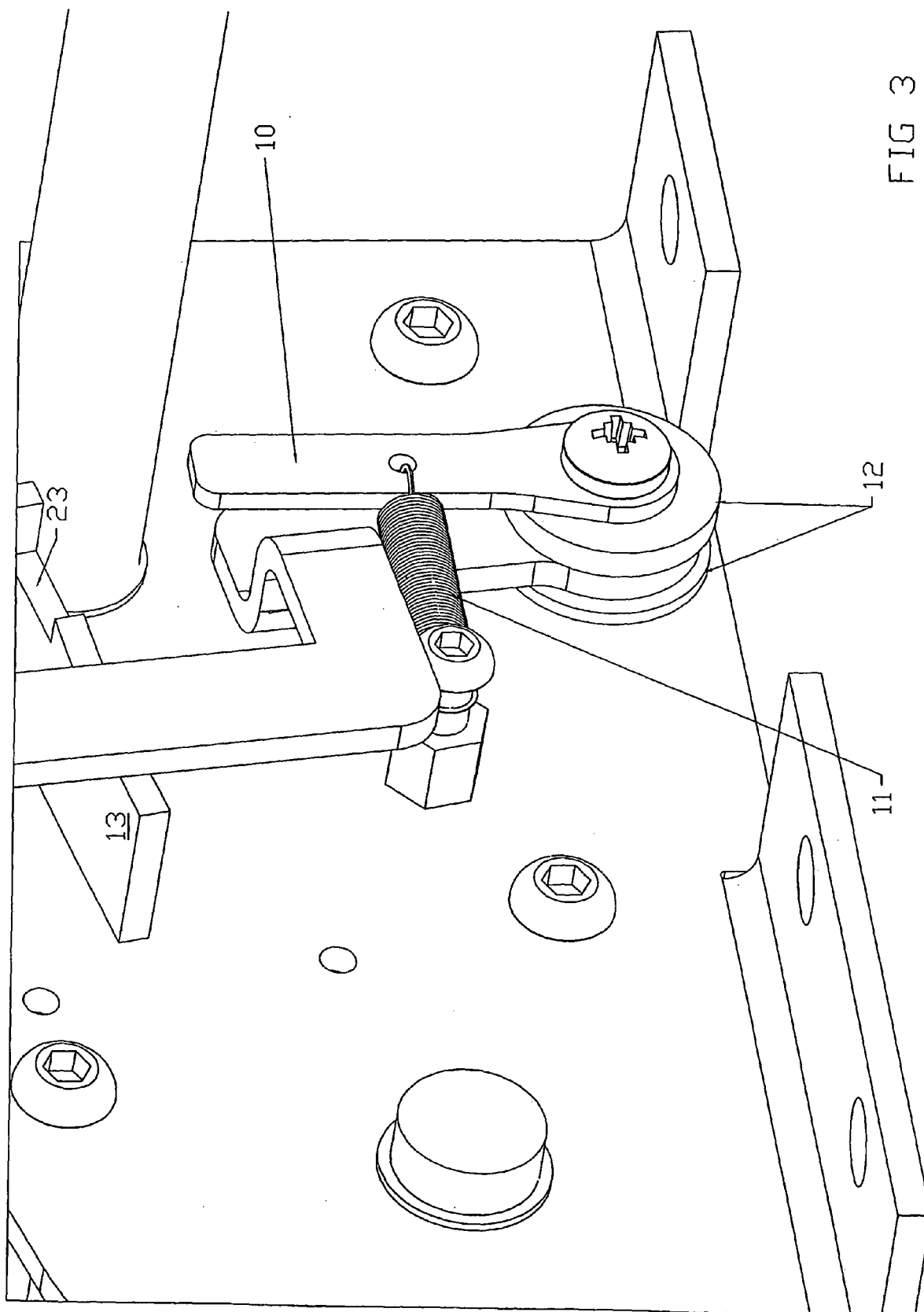


FIG 3

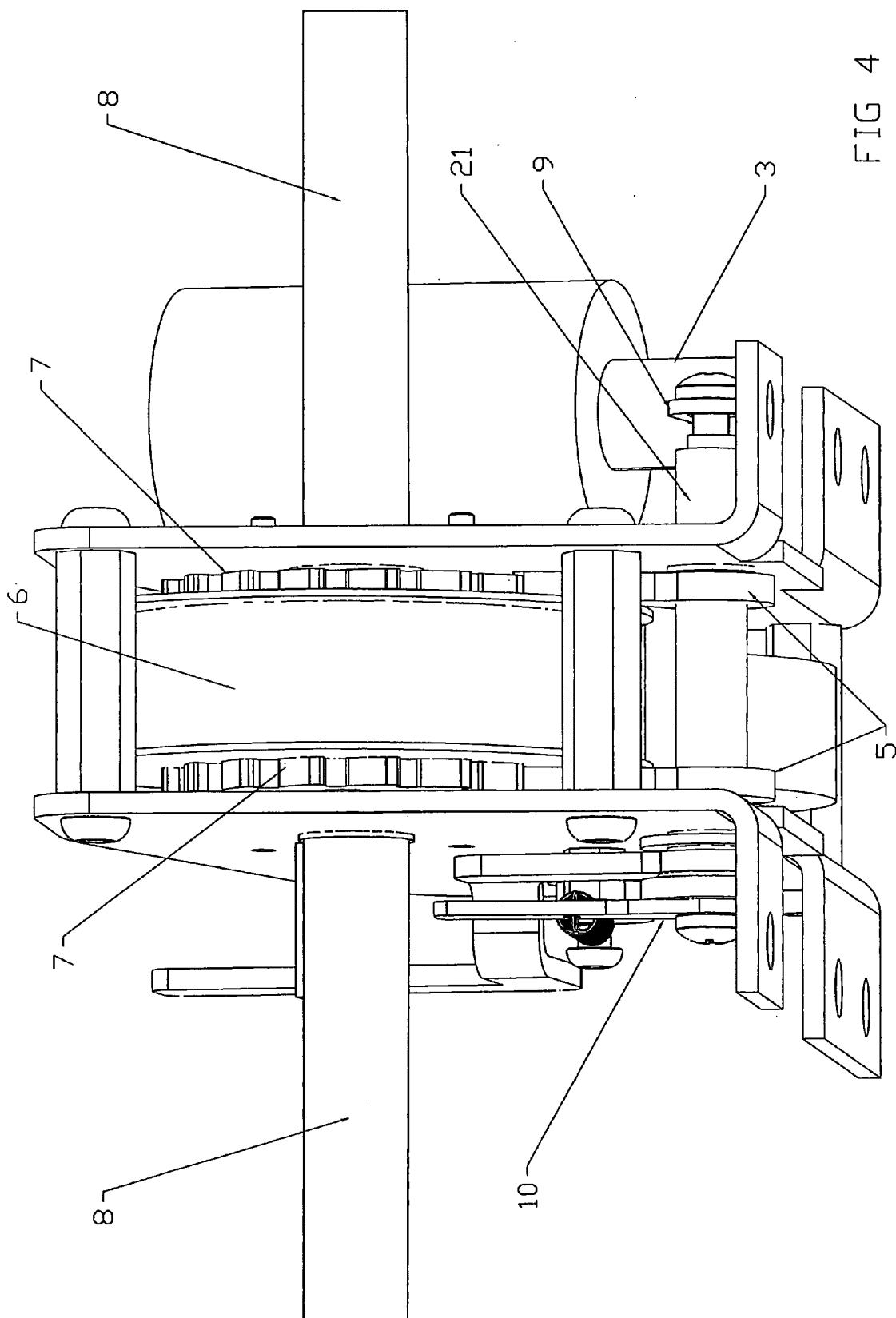


FIG 4

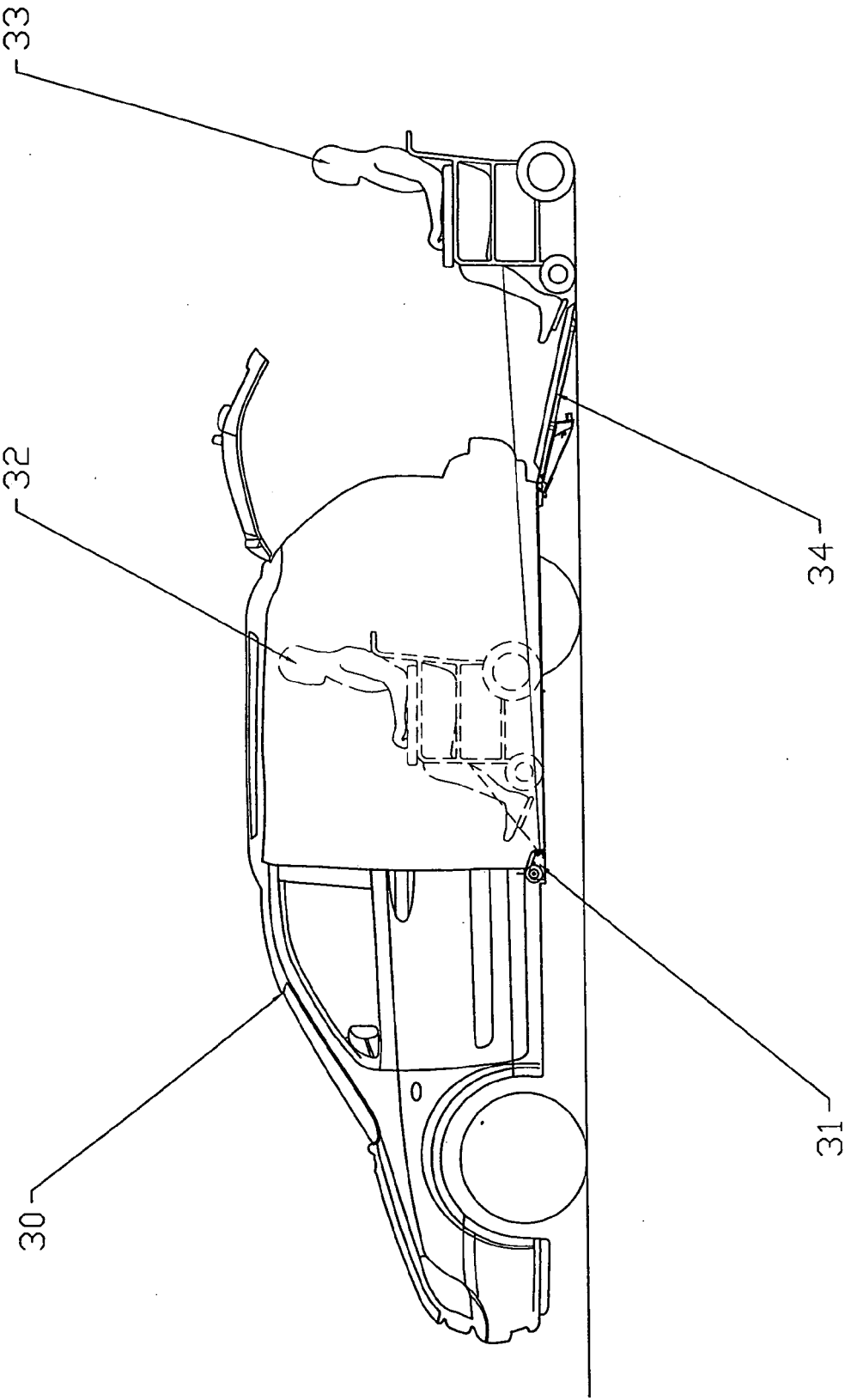


FIG 5

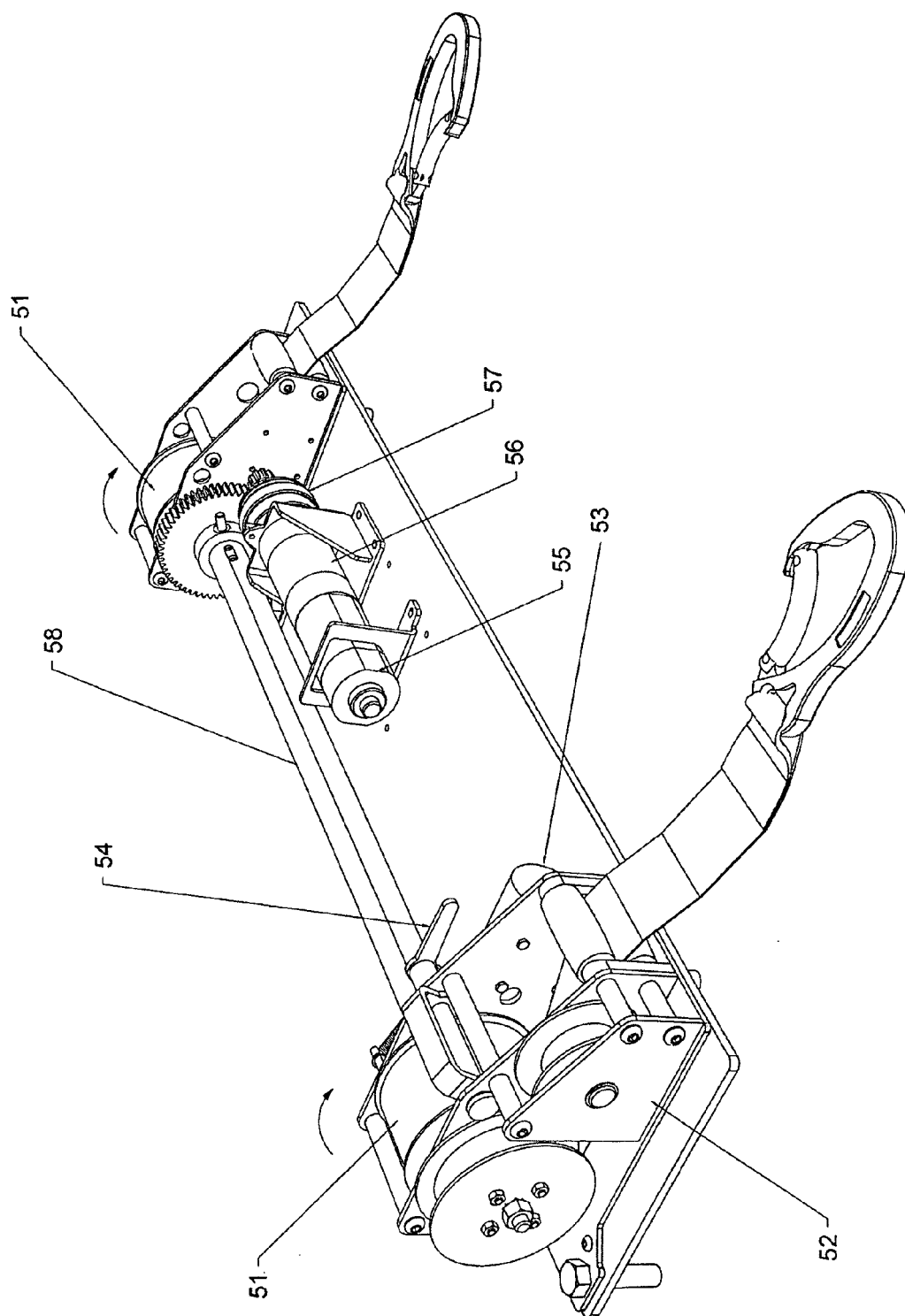
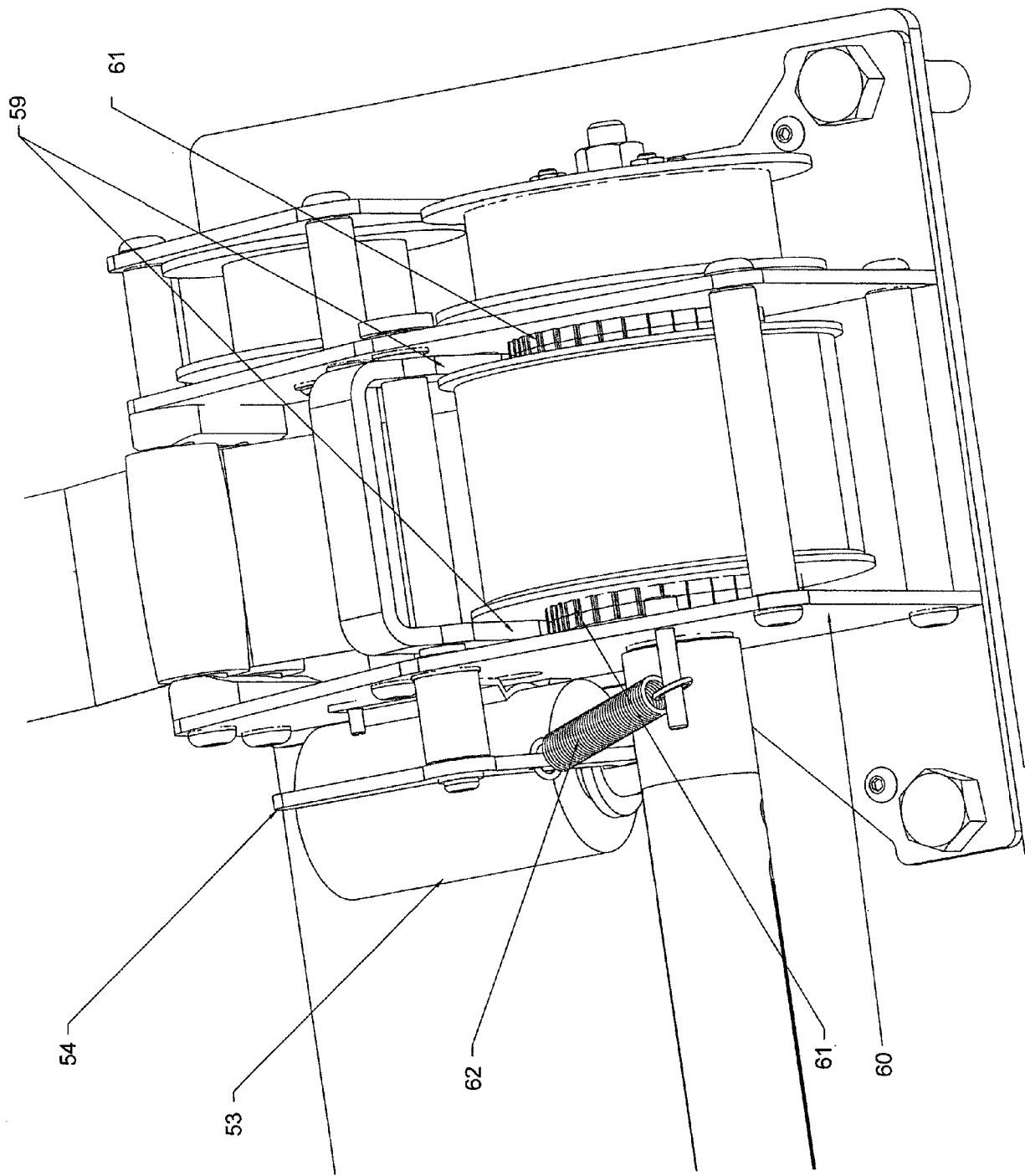


FIG 6

FIG 7





EUROPEAN SEARCH REPORT

Application Number
EP 08 25 2462

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 October 2008	Examiner Petzold, Jan
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
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 25 2462

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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21-10-2008

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