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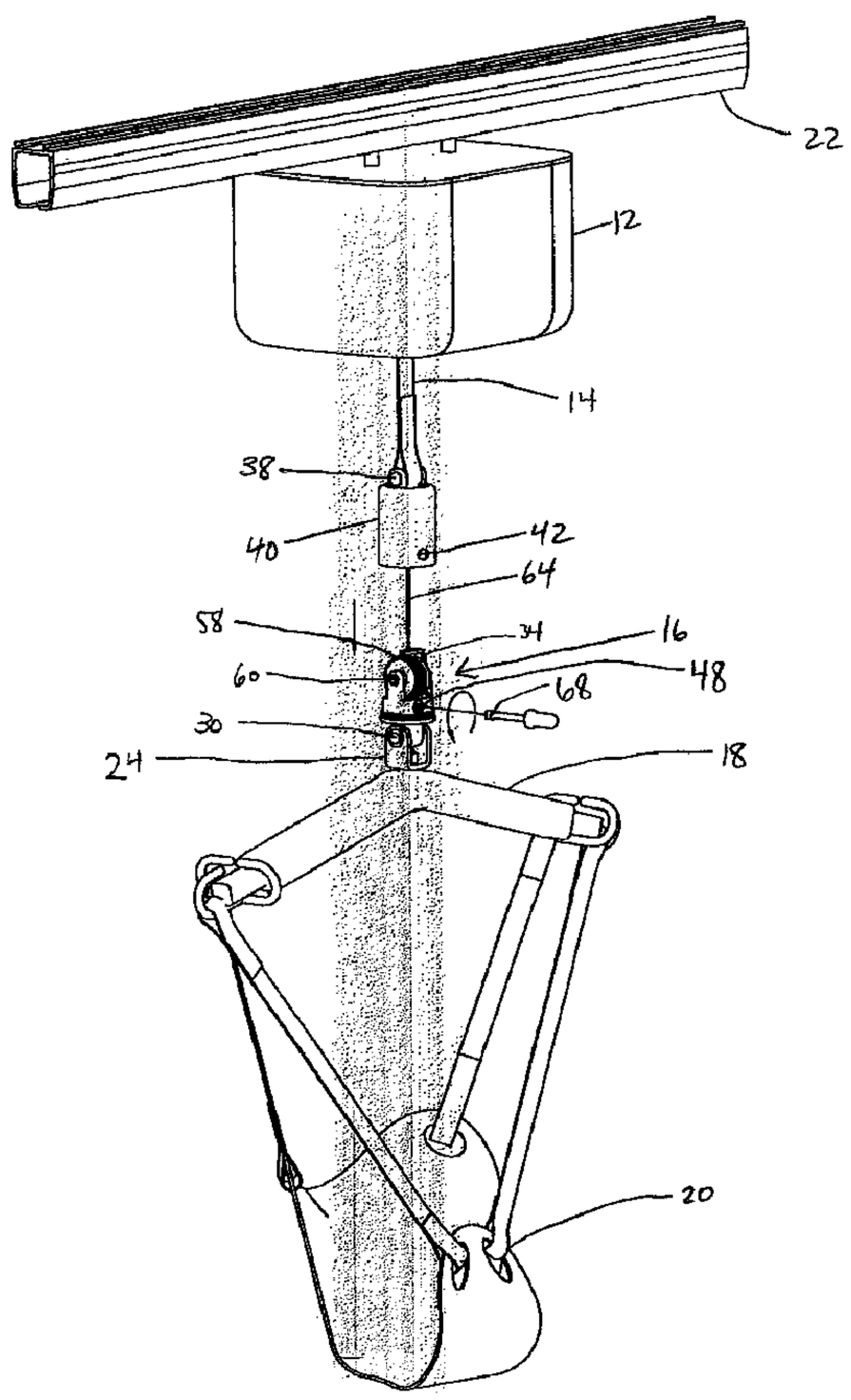

(57) Abrégé/Abstract:
In a patient-carrying device comprising a primary patient manipulation mechanism for moving a patient and a patient harness, the improvement comprises a patient lowering device positioned intermediate the harness and the primary patient manipulation

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(57) Abrégé(suite)/Abstract(continued):
mechanism, comprising (1) an extendable patient bearing means for bearing the weight of the patient and (2) an actuator, coupled to the patient bearing means for actuating the patient bearing means, whereby, if the primary mechanism malfunctions or is unavailable while the patient is being transported, the patient can be lowered to a chair, a bed or the ground by means of the patient lowering device.

ABSTRACT OF THE DISCLOSURE

In a patient-carrying device comprising a primary patient manipulation mechanism for moving a patient and a patient harness, the improvement comprises a patient lowering device positioned intermediate the harness and the primary patient manipulation mechanism, comprising (1) an extendable patient bearing means for bearing the weight of the patient and (2) an actuator, coupled to the patient bearing means for actuating the patient bearing means, whereby, if the primary mechanism malfunctions or is unavailable while the patient is being transported, the patient can be lowered to a chair, a bed or the ground by means of the patient lowering device.

Title: PATIENT LOWERING DEVICE

FIELD OF THE INVENTION

This invention relates generally to the field of mobility devices, and more particularly to patient lifting and carrying devices of the type that may be used to raise or lower a physically disabled person for the purpose of moving them.

BACKGROUND OF THE INVENTION

Personal lift or patient lift devices have been known and used in the past for the purpose of assisting with the mobility of otherwise immobilized patients. An attendant may help physically disabled patients who are elderly, or who may have suffered a traumatic injury, stroke or one form of illness or another, and who are unable to move about. However, often such patients may be too heavy to lift or the attendant may not have enough strength to help the patient move. This can be especially true for disabled patients who have reduced mobility but otherwise normal bodily functions. Getting up, going to the bathroom or having a bath, for example, can be difficult for such patients. Patient carrying devices have been used in the past, which include a strap or chain hanging down from a motor assembly, which in turn may be suspended from a movable stand, or from a rail carriage riding along an overhead track. An overhead track can be organized to extend from over a bed and into, for example, an adjoining bathroom area, to permit the patient to be raised, suspended, and then moved along the track to a position where they can be lowered into the bathtub for the purposes of a bath or onto a toilet.

Typically such patient carrying devices are provided with an electric lift motor, which provides the power to lift the patient. In operation, such a device will be used to lift the patient, transport him laterally, and lower the patient. However, a problem can arise in the event of a malfunction or power failure, namely, that the patient cannot be lowered using the motor,

and thus may be stranded above the floor in the patient harness.

Solutions to this problem have been attempted. For example, US patent number 5,038,425 issued in 1991 to Merry discloses a device for raising and lowering a patient from a bed and for moving the patient to other locations. The device includes a motor for lifting and lowering the patient via a gearing mechanism. Also included is a hand crank to actuate the gearing mechanism in the event of a power failure. Thus, if the patient is suspended in mid-air when the power fails, it is possible to lower the patient using the hand crank, even though the electric motor is unavailable because of the power failure.

This device suffers from a number of deficiencies. First, the hand crank is by necessity located adjacent to the motor's gearing mechanism, because the hand crank operates through that mechanism. Thus, in cases where the motor is mounted high off the floor, reaching the hand crank to lower the patient can be inconvenient and awkward. Second, the hand crank feature is not easily or inexpensively retrofittable onto an existing patient carrying device. Therefore, if there is a system in place which does not have the hand crank feature, it could be necessary to replace the whole system in order to obtain the benefits of the hand crank. Such a replacement would also be expensive. Third, while the hand crank can be used to lower the patient in the event of a power failure, the hand crank simply actuates the gears that would otherwise have been actuated by the motor. In the event of other types of malfunctions, such as, for example, the gear machanism seizing up, the hand crank would not be effective for lowering the patient.

SUMMARY OF THE INVENTION

Therefore, what is desired is a patient lowering device that will allow a patient that has been lifted by a patient carrying device to be lowered in the event of a power failure, and preferably, in the event that the patient carrying device malfunctions. Preferably, the patient lowering device will be positionable such that reaching and using the patient lowering device is straightforward and convenient. Also, preferably, the

patient lowering device will be installable on existing patient carrying devices.

Therefore, according to one aspect of the invention, there is provided, in a patient-carrying device comprising a primary patient manipulation mechanism for lifting, lowering or laterally moving a patient, wherein the primary patient manipulation mechanism is supportable from a mechanism support, and a patient harness coupled to the primary patient manipulation mechanism, an improvement comprising a patient lowering device positioned intermediate the harness and the primary patient manipulation mechanism, the patient lowering device comprising:

(1) an extendable patient bearing means for bearing the weight of the patient, the patient bearing means being coupled to the patient harness and to the primary patient manipulation mechanism; and

(2) an actuator, coupled to the patient bearing means for actuating the patient bearing means;

whereby, if the primary mechanism malfunctions or is unavailable while the patient is being transported, the patient can be lowered to a chair, a bed or the ground by means of the patient lowering device.

According to another aspect of the invention, there is provided a patient lowering device for lowering a patient being carried by a patient carrying device which includes a primary patient manipulation mechanism and a patient harness, the lowering device comprising:

(1) an extendable patient bearing means for bearing the weight of the patient, the patient bearing means being adapted to be coupled to the patient harness and to the primary patient manipulation mechanism, and to be positioned intermediate the harness and the mechanism; and

(2) an actuator, coupled to the patient bearing means, for actuating the patient bearing means without actuating the primary mechanism;

whereby, if the primary mechanism malfunctions or is unavailable while the patient is being transported, the patient can be lowered to a chair, a bed or the ground by means of the patient lowering device.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described, by way of example only, with reference to the drawings which depict a preferred embodiment of the invention, and in which:

Figure 1 is a perspective view of a patient-carrying device including a patient lowering device;

Figure 2 is a perspective view of the patient-carrying device when the patient lowering device is being prepared for use;

Figure 3 is a perspective view of the patient-carrying device showing the patient lowering device in operation;

Figure 4 is a perspective view of the patient lowering device with the cover on;

Figure 5 is a perspective view of the patient lowering device without the cover;

Figure 6 is a perspective view of an inner portion of the patient lowering device shown without the cover and housing; and

Figure 7 is a cross-sectional view of the patient lowering device along line 7-7 of Figure 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figures 1-3 show a patient-carrying device comprising a primary patient manipulation mechanism 12, typically including a motor and gearing system (details not shown), an extendible primary weight bearing element in the form of a lift strap 14, a patient lowering device 16, and a patient holder in the form of a carry bar 18, a patient harness 20 and a swivel element 24. The patient carrying device is mounted on a support in the form of a track 22. Typically, the track 22 will be mounted on some kind of chassis or frame (not shown) which could include the ceiling or a cross-bar positioned under the ceiling.

In typical operation, the patient-carrying device is used to lift, lower or laterally transport a patient (not shown). To lift the patient, the patient is placed in the harness 20. Then, by use of a controller (not shown), the motor is activated so as to cause the lift strap 14 to be raised by the motor

12 to which the lift strap 14 is coupled.

The lift strap 14 is coupled to the patient-lowering device 16, which is in turn coupled via the swivel element 24 and the carry-bar 18 to the patient harness 20. As the lift strap 14 is raised by the motor 12, the harness 20 is raised, thus lifting the patient.

To transport the patient laterally, the controller is used to activate the motor so as to move the patient carrying device along the track 22. The result is that the patient is held in the harness and transported laterally.

Similarly, to lower the patient in normal operation, the controller is activated in order to extend the lift strap 14. The patient harness 20 is lowered, thus lowering the patient.

It will be appreciated that the strap 14 acts as an extendible primary weight bearing element. When the motor is used to lower the patient, the strap 14, bearing the weight of the patient, is extended from the mechanism 12. The strap 14 is also movable upward. Thus, when the patient is lifted, the strap 14 bearing the patient's weight, is moved upward, preferably by being retracted into the mechanism 12 by the motor 12.

In the event that it is impossible, inconvenient or not preferred to lower the patient by means of the primary patient manipulation mechanism 12 (for example, if the motor is broken or otherwise malfunctioning, or if there is a power failure), the patient lowering device 16 provides an alternative for lowering the patient.

The patient lowering device 16 includes a base 26, which includes a base coupler in the form of a base bore 28. The base bore 28 is sized and shaped to receive a base shaft 30 which carries the swivel element 24. Thus, the base 26, and in particular the base coupler included therein, permits the patient lowering device 16 to be coupled at its bottom via the swivel element 24 and the carry-bar 18 to the harness 20.

The patient lowering device 16 further includes a top portion 32 and a housing 34. The top portion 32 includes a top coupler which comprises, in the preferred embodiment, a pair of top bores 36 for

receiving a top shaft 38. The top shaft 38 acts as an attachment point for the lift strap 14 which is looped around the shaft 38 and fastened. Thus, when the lift strap 14 is attached to the top portion 32, the patient lowering device is coupled to the primary patient manipulation mechanism 12, and positioned intermediate the patient harness 20 and the mechanism 12.

The patient lowering device 16 further includes a cover 40, which includes an actuator access in the form of a cover bore 42, and a tamper-resistant cap 44. The cover 40 is attached to the patient lowering device 16 by means of cover threading 46 positioned on the housing 34 adjacent the base 26. The cover threading 46 cooperates with inner threading (not shown) positioned on the inner bottom portion of the cover 40. Thus, the cover 40 can be attached to the patient lowering device 16 by screwing it onto the cover threading 46 and removed by unscrewing it.

The patient lowering device 16 further comprises an actuator, for actuating the device 16, which in the preferred embodiment takes the form of a head 48 attached to a worm shaft 50 housed within the housing 34. The worm shaft 50 is rotatably mounted within a bearing 52 carried by the housing 34. The worm shaft 50 has a threaded surface comprising spiral threading 55.

The patient lowering device 16 further comprises a first driven element in the form of gear 56 having teeth 58. The gear 56 is positioned such that the teeth 58 are engaged by the threading 55. The gear 56 is mounted on the housing shaft 60, which is carried by the housing 34. Because of the engagement between the teeth 58 and the threading 55, when the shaft 50 is rotated, the threading 55 acts on the teeth 58, pushing on the teeth 58 and driving the gear 56, causing it to rotate about the shaft 60.

Also mounted on the shaft 60 is a patient-bearing-means-carrier, sized, shaped and positioned to extendibly carry a patient bearing means and preferably in the form of a spindle 62. Wound around and carried by the spindle 62 is an extendible patient bearing means, for bearing the weight of the patient, in the form of the cable 64. Thus, before actuation, the spindle 62 extendibly carries the cable 64 in an unextended state

(that is, carries the cable 64 in a manner that permits the cable 64 to be extended). At one end, the cable 64 is attached to the spindle 62. At its other end, the cable 64 is attached to the underside of the top portion 32.

As can be seen from the above description, in the preferred embodiment, the housing 34 carries, directly or indirectly, the head 48, the bearing 52, the shaft 50, the gear 56, the shaft 60, the spindle 62 and the cable 64.

In the preferred embodiment, the patient lowering device will include an infection control seal 66 positioned between the top portion 32 and the cover 40. Preferably, the infection control seal 66 will be in the form of silicone caulking. The purpose of the infection control seal is to prevent microbes which may be present under the cover 40 from migrating, or being passed, out from under the cover 40, particularly through the place where the cover 40 meets the top portion 32. As the patient lowering device will often be in used in hospitals where patients who are susceptible to disease are present, it is preferred to include an infection control seal that will inhibit the migration of microbes from inside the cover 40 to outside it.

It will be appreciated that, though the use of silicone caulking as the infection control seal is preferred because it is effective and relatively easy to apply, other seals may be used. For example, a removable or breakable plastic film over the cover 40 may be used. What is important for the infection control seal is that it be effective in inhibiting the migration of microbes from under the cover 40 while the cover 40 is covering the patient lowering device 16.

It can now be appreciated how the patient lowering device 16 is preferably operated. First, the tamper-resistant cap 44, which is typically positioned within the cover bore 42 in an interference fit, is removed from the cover bore 42. This can preferably be accomplished either by using a plier to grip the tamper-resistant cap 44 and remove it from the cover bore 42, or simply by a person applying pressure with his thumb to pop the tamper-resistant cap 44 out. It will be appreciated that the tamper-resistant cap 44 can be placed in the cover bore 42 by other methods

than an interference fit, for example, by screwing it in. In such a case, the tamper-resistant cap 44 would be removed by unscrewing it. What is important is that the cover 40 and cap 44 impede access to the head 48, thus providing resistance to tampering.

Once the tamper-resistant cap 44 is removed, the cover bore 42 provides access to the head 48. Preferably, the head 48 is a six-sided (hexagonal) head which is sized and shaped to receive a hexagonal actuating tool 68 which can be used to turn the head 48.

Preferably, the head 48 is first turned one or two turns in a non-actuating direction. This has the effect of causing the shaft 50 to rotate, which causes the the gear 56 to rotate, which in turn causes the spindle 62 to wind the cable 64 more tightly. This draws the top portion 32 downward relative to the cover 40, thus breaking the infection control seal 66. Also, this action removes any slack that may be present in the cable 64, such that, when the lowering process begins, there is less likely to be a sudden release of the cable 64 which would cause a sudden and unpleasant drop for the patient.

Then, the cover 40 is unscrewed from the base 26 and raised so as to remove the cover 40 from the lowering device 16. The tool 68 is then used to rotate the head 48 in the actuating direction. When the head 48 is rotated, the threading 55 exerts a force on the teeth 58 causing the gear 56 to rotate in a actuating direction. The spindle 62, which is also carried by the shaft 60 and is attached to the gear 56, is rotated so as to unwind and thus extend the cable 64, which acts as the patient bearing means. As the head 48 is rotated more, the cable 64 extends further and further, thus lowering the patient. It will be appreciated that the cable 64 is attached to the top portion 32, which is itself attached to the lift strap 14. Thus, as the cable 64 is extended, it lowers the patient downward from the top portion 32 until the patient is lowered sufficiently to be placed in a wheelchair, bed or other convenient location.

It will be appreciated that the patient lowering device 16 of the preferred embodiment is self-locking. This is because the teeth 58 are engaged with the threading 55 on the shaft 50. The threading 55 runs in

a direction transverse to the direction of movement of the teeth 58. As a result, when the shaft 50 is not being rotated, the threading 55 holds the teeth 58 in place, and the threads 55 act as a lock on the gear 56, and therefore on the spindle 62 and the cable 64. When the shaft 50 is rotated, the threading 55 exerts a force on the teeth 58 causing the gear 56 to rotate about the shaft 60. It will be appreciated that the invention comprehends the lowering device 16 having self-locking features other than the threads 55 and teeth 58 of the preferred configuration described above. For example, the self-locking feature could comprise a friction brake or friction lock which prevents the cable 64 from unwinding, but is released when the device is actuated. What is important for the self-locking features is that they lock the patient-bearing means unless the patient bearing means are being actuated.

In the preferred embodiment, the patient lowering device further includes a backup lock in case the self-locking features of the emergency lowering device 16 fail for some reason. The backup lock includes a locking arm 70, a biasing spring 72 and a stop 74. The locking arm 70 is pivotally mounted to the spindle 62 by a screw 76. When the patient lowering device16 is not being actuated, or when it is being actuated so as to cause the spindle 62 to rotate at a moderate speed as a result of the actuation, the biasing spring 72, which is attached to the spindle 62 and the locking arm 70, biases the locking arm 70 to a position which permits the rotation of the spindle. However, in the event that the self-locking features of the patient lowering device 16 fail, and the spindle begins to rotate at a high rate of speed, the centrifugal force associated with the rotating of the spindle 62 will cause the locking arm 70 to pivot outward and catch on the stop 74 which is mounted to the housing. The stop 74 is positioned to catch the arm 70 when it pivots outward. The limiter 75, mounted on the side of the spindle 62, prevents the arm 70 from pivoting so far that the arm 70 rotates past the stop 74 and allows the spindle 62 to continue rotating. Thus, when the spindle 62 is rotating quickly enough to cause the arm 70 to pivot outward, the limiter 75 and the stop 74 combine cause the arm 70 to catch the stop 74 and lock the spindle. The

biasing spring 72 is adapted such that its biasing force is small enough to be overridden by the centrifugal force when the rotation is sufficiently fast such that backup locking is warranted, but large enough to bias the arm 70 to an unlocked position otherwise.

Once the patient has been lowered using the patient lowering device, the cable 64 can be rewound around the spindle 62 using the head 48 and the tool 68. A new infection control seal 66 can be applied to the cover 40, and the cover can be screwed on to the base 26 so as to position the bore 42 over the head 48, such that access to the head 48 is available through the bore 42. Then, the tamper-resistant cap 44 can be replaced in the cover bore 40, and the patient lowering device is thus ready for use once again if needed.

Preferably, the cable 64 will be a steel cable, and most preferably a stainless steel cable, most preferably covered by a plastic sheathing. Thus, the cable 64 is preferably composed at least in part of stainless steel to provide both strength and resistance to corrosion, while still providing sufficient flexibility for winding.

It will be appreciated that, though the preferred extendable patient bearing means is the cable 64 described above, the extendable patient bearing means need not be a cable. Rather, the invention comprehends the extendable patient bearing means being any element which can be extended to lower the patient, and can bear the weight of the patient. Thus, for example, the patient bearing means could comprise a strap that is extended by being unwound from around a spindle. Alternatively, the extendable patient bearing means could be a series of rods that can be controllably extended telescopically relative to one another to lower the patient. As another example, the patient bearing means could be a series of bars that are connected end to end and are folded until the patient lowering device 16 is actuated, at which time they unfold, thus extending and lowering the patient while bearing the weight of the patient.

It will also be appreciated that, though the preferred actuator is the head 48 attached to the worm shaft 50 as described above, the actuator need not take this preferred form. Rather, the invention comprehends any

actuator which functions to cause the extendable patient bearing means to extend, thus lowering the patient. For example, the patient lowering device 16 could include a friction brake which, when the lowering device 16 is not in use, prevents the spindle 62 from unwinding the cable 64. The actuator, in such a case, could be in the form of a brake release which, when actuated, gradually lowers the frictional force braking the spindle until it slowly starts to unwind the cable. What is important is that the actuator functions to cause the extendable patient bearing means to extend and lower the patient.

It will be appreciated that the invention comprehends means to resisting tampering other than the preferred form of cover and tamper-resistant cap described above. For example, the cover could be made tamper resistant by providing a key lock that must be opened in order to remove the cover and access the actuator.

It will further be appreciated that, because the lowering device 16 is preferably positioned apart from the primary mechanism 12, and thus intermediate the primary mechanism 12 and the harness 20, the lowering device is more conveniently located and easier to reach. The lowering device 16 is preferably located adjacent the patient just above the harness 20 and the bar 18; it is preferably not located adjacent the primary mechanism 12, and therefore not within the same casing as the primary mechanism 12. In such a case, the lowering device 16 is not located out of reach near the ceiling, but rather is located near the patient to allow for easy operation.

Also, the lowering device is preferably couplable as described above to the lift strap 14 and the harness 20. Thus, if a traditional patient carrying device is in use, which includes a lift strap and harness, it is usually possible to conveniently and cheaply retrofit the lowering device 16 into the patient carrying device. Doing so would simply involve detaching the strap from the harness, attaching the strap to the shaft 38, and attaching the harness to the base 26. It will be appreciated that, even in embodiments other than the one described herein, it is preferred that the patient lowering device have top and bottom couplers sized, shaped

and positioned to facilitate retrofitting of the device 16 to an existing patient carrying device.

Furthermore, it will be appreciated that the preferred lowering device 16 operates separately and independently from the gearing and other mechanical components contained in the primary mechanism 12. Thus, if the primary mechanism's gearing seizes up or malfunctions, the user of the device 16 is not dependent on the malfunctioning gearing. Rather, the preferred lowering device 16 has its own actuator, extendible patient-bearing means and gearing mechanism for lowering the patient.

While the foregoing embodiments of the present invention have been set forth in considerable detail for the purpose of making a complete disclosure of the invention, it will be apparent to those skilled in art that various modifications can be made to the device without departing from the broad scope of the invention as defined in the attached claims. Some of these variations are discussed above and others will be apparent to those skilled in the art. For example, the back-up-lock described above can be a lock other than the centrifugal lock described above. What is considered important in the present invention is to provide a patient lowering device that allows the patient to be lowered when the patient carrying device is not available.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. In a patient-carrying device comprising a primary patient manipulation mechanism for lifting, lowering or laterally moving a patient, wherein the primary patient manipulation mechanism is supportable from a mechanism support, and a patient harness coupled to the primary patient manipulation mechanism, the improvement comprising a patient lowering device positioned intermediate the harness and the primary patient manipulation mechanism, the patient lowering device comprising:

(1) an extendable patient bearing means for bearing the weight of the patient, the patient bearing means being coupled to the patient harness and to the primary patient manipulation mechanism; and

(2) an actuator, coupled to the patient bearing means for actuating the patient bearing means;

whereby, if the primary mechanism malfunctions or is unavailable while the patient is being transported, the patient can be lowered to a chair, a bed or the ground by means of the patient lowering device.

2. The patient-carrying device of claim 1, wherein the patient lowering device includes self-locking features to lock the patient-bearing means when the patient bearing means is not being actuated and to permit extension of the patient bearing means when the patient bearing means is actuated.

3. The patient-carrying device of claim 2, wherein the patient lowering device further comprises a backup lock adapted to lock the patient bearing means when the patient bearing means is not being actuated and to permit extension of the patient bearing means when the patient bearing means is actuated.

4. The patient-carrying device of claim 1, wherein the extendable

patient-bearing means comprises a cable.

5. The patient-carrying device of claim 4, wherein the patient lowering device further comprises a spindle, attached to the cable, for holding the cable in an unextended state, the spindle being coupled to the actuator such that, when the actuator is actuated, the spindle rotates and extends the wire.

6. The patient-carrying device of claim 4 or claim 5, wherein the cable is composed at least in part of steel.

7. The patient-carrying device of claim 2, wherein the extendible patient bearing means comprises a cable.

8. The patient carrying device of claim 7, wherein the patient lowering device further comprises a spindle, attached to the cable, for holding the cable in an unextended state, the spindle being coupled to the actuator such that, when the actuator is actuated, the spindle rotates and extends the wire, the spindle further being operatively coupled to the self-locking features.

9. The patient-carrying device of claim 7 or claim 8, wherein the patient lowering device further comprises a backup lock adapted to lock the patient bearing means when the patient bearing means is not being actuated and to permit extension of the patient bearing means when the patient bearing means is actuated.

10. The patient-carrying device of claim 1, wherein the patient-lowering device further comprises a cover removably positionable to cover the actuator, and to cover the extendible patient bearing means, when the patient bearing means is unextended.

11. The patient-carrying device of claim 10, wherein the cover comprises a cover body, an actuator access positionable to provide

access to the actuator, and a tamper-resistant cap, the tamper-resistant cap being positionable so as to discourage tampering with said actuator, and being removable so as to provide access to the actuator.

12. The patient-carrying device of claim 1, the patient-lowering device further comprising a cover positioned to cover the actuator, and the extendible patient bearing means, when the patient bearing means is unextended, the patient lowering device further including an infection control seal, the infection control seal being positioned adjacent the cover so as to inhibit the migration of microbes from inside the cover to outside the cover.

13. The patient-carrying device of claim 1, wherein the actuator comprises a head sized and shaped to receive an actuating tool.

14. The patient-carrying device of claim 13, wherein the patient-lowering device further comprises a worm shaft, and wherein the head is attached to the worm shaft, and wherein the worm shaft is operatively coupled to the patient bearing means such that when the shaft rotates in an actuating direction, the patient bearing means is extended.

15. The patient-carrying device of claim 14, wherein the patient lowering device further comprises a gear, wherein the worm shaft is operatively engaged with the gear such that when the shaft is rotated the gear turns, the gear being coupled to the patient bearing means such that when the gear turns in an actuating direction, the patient bearing means is extended.

16. The patient-carrying device of claim 15, further comprising a spindle, the patient bearing means comprising a cable windable on said spindle, the spindle being attached to the gear such that, when the gear is rotated, the spindle rotates to wind or unwind the cable.

17. The patient-carrying device of claim 15, wherein the worm shaft comprises spiral threading thereon, the gear including teeth, the gear being positioned such that the teeth engage the threading and such that, when the shaft is rotated, the threading applies force to the teeth and rotates the gear.

18. The patient-carrying device of claim 2, wherein the patient-lowering device further comprises a worm shaft attached to the actuator, and a gear including teeth and being operatively coupled to the patient bearing means and operatively engaged with the shaft, the shaft including spiral threading and the gear being positioned such that the teeth engage the threading, wherein the patient bearing means is locked by the threading holding the teeth unless the shaft is rotated.

19. The patient-carrying device of claim 18, wherein the self-locking features comprise the threading.

20. The patient-carrying device of claim 1, the patient lowering device further comprising a housing carrying the actuator and the patient-bearing means.

21. The patient-carrying device of claim 8, the patient lowering device further comprising a housing carrying the actuator, the patient bearing means and the spindle.

22. The patient-carrying device of claim 14, the patient lowering device further comprising a housing carrying the head, the worm shaft and the patient bearing means.

23. The patient-carrying device of claim 15, the patient lowering device further comprising a housing carrying the head, the shaft, the gear and the patient bearing means.

24. The patient-carrying device of claim 3, wherein the patient lowering

device further comprises a housing carrying the actuator, the patient bearing means and the backup lock.

25. The patient carrying device of claim 1, the patient lowering device further comprising a coupler coupling the patient bearing means to the primary mechanism.

26. A patient lowering device for lowering a patient being carried by a patient carrying device which includes a primary patient manipulation mechanism and a patient harness, the lowering device comprising:

(1) an extendable patient bearing means for bearing the weight of the patient, the patient bearing means being adapted to be coupled to the patient harness and to the primary patient manipulation mechanism, and to be positioned intermediate the harness and the mechanism; and

(2) an actuator, coupled to the patient bearing means, for actuating the patient bearing means without actuating the primary mechanism;

whereby, if the primary mechanism malfunctions or is unavailable while the patient is being transported, the patient can be lowered to a chair, a bed or the ground by means of the patient lowering device.

27. The patient lowering device of claim 26, wherein the patient lowering device self-locking features for locking the patient bearing means when the patient bearing means is not being actuated and to permit extension of the patient bearing means when the patient bearing means is actuated.

28. The patient lowering device of claim 27, wherein the patient lowering device further comprises a backup lock adapted to lock the patient bearing means when the patient bearing means is not being actuated and to permit extension of the patient bearing means when the patient bearing means is actuated.

29. The patient lowering device of claim 26, wherein the extendable patient-bearing means comprises a cable.

30. The patient lowering device of claim 29, wherein the patient lowering device further comprises a spindle, attached to the cable, for holding the cable in an unextended state, the spindle being coupled to the actuator such that, when the actuator is actuated, the spindle rotates and extends the wire.

31. The patient lowering device of claim 29 or claim 30, wherein the cable is composed at least in part of steel.

32. The patient lowering device of claim 27, wherein the extendible patient bearing means comprises a cable.

33. The patient lowering device of claim 32, wherein the patient lowering device further comprises a spindle, attached to the cable, for holding the cable in an unextended state, the spindle being coupled to the actuator such that, when the actuator is actuated, the spindle rotates and extends the wire, the spindle further being operatively coupled to the self-locking features.

34. The patient lowering device of claim 7 or claim 8, wherein the patient lowering device further comprises a backup lock adapted to lock the patient bearing means when the patient bearing means is not being actuated and to permit extension of the patient bearing means when the patient bearing means is actuated.

35. The patient lowering device of claim 26, wherein the patient-lowering device further comprises a cover removably positionable to cover the actuator and to cover the extendible patient bearing means when the patient bearing means is unextended.

36. The patient lowering device of claim 35, wherein the cover comprises a cover body, an actuator access positionable to provide access to the actuator, and a tamper-resistant cap, the tamper-resistant cap being positionable so as to discourage tampering with said actuator, and being removable so as to provide access to the actuator.

37. The patient lowering device of claim 26, the patient-lowering device further comprising a cover positioned to cover the actuator and the extendible patient bearing means when the patient bearing means is unextended, the patient lowering device further including an infection control seal, the infection control seal being positioned adjacent the cover so as to inhibit the migration of microbes from inside the cover to outside the cover.

38. The patient lowering device of claim 26, wherein the actuator comprises a head sized and shaped to receive an actuating tool.

39. The patient lowering device of claim 38, wherein the patient-lowering device further comprises a worm shaft, and wherein the head is attached to the worm shaft, and wherein the worm shaft is operatively coupled to the patient bearing means such that when the shaft rotates in an actuating direction, the patient-bearing means is extended.

40. The patient lowering device of claim 39, wherein the patient lowering device further comprises a gear, wherein the worm shaft is operatively engaged with the gear such that when the shaft is rotated the gear turns, the gear being coupled to the patient bearing means such that when the gear turns in an actuating direction, the patient bearing means is extended.

41. The patient lowering device of claim 40 further comprising a spindle, the patient bearing means comprising a cable windable on said spindle, the spindle being attached to the gear such that, when the gear is

rotated, the spindle rotates to wind or unwind the cable.

42. The patient lowering device of claim 40, wherein the worm shaft comprises spiral threading thereon, the gear including teeth, the gear being positioned such that the teeth engage the threading and such that, when the shaft is rotated, the threading applies force to the teeth and rotates the gear.

43. The patient lowering device of claim 27, wherein the patient-lowering device further comprises a worm shaft attached to the actuator, and a gear including teeth and being operatively coupled to the patient bearing means and operatively engaged with the shaft, the shaft including spiral threading and the gear being positioned such that the teeth engage the threading, wherein the patient bearing means is locked by the threading holding the teeth unless the shaft is rotated.

44. The patient lowering device of claim 43, wherein the self-locking features comprise the threading.

45. The patient lowering device of claim 26, the patient lowering device further comprising a housing carrying the actuator and the patient-bearing means.

46. The patient lowering device of claim 33, the patient lowering device further comprising a housing carrying the actuator, the patient bearing means and the spindle.

47. The patient lowering device of claim 39, the patient lowering device further comprising a housing carrying the head, the worm shaft and the patient bearing means.

48. The patient lowering device of claim 40, the patient lowering device further comprising a housing carrying the head, the shaft, the gear and

the patient bearing means.

49. The patient lowering device of claim 28, wherein the patient lowering device further comprises a housing carrying the actuator, the patient bearing means and the backup lock.

50. The patient lowering device of claim 26, the patient lowering device further comprising a coupler coupling the patient bearing means to the primary mechanism.

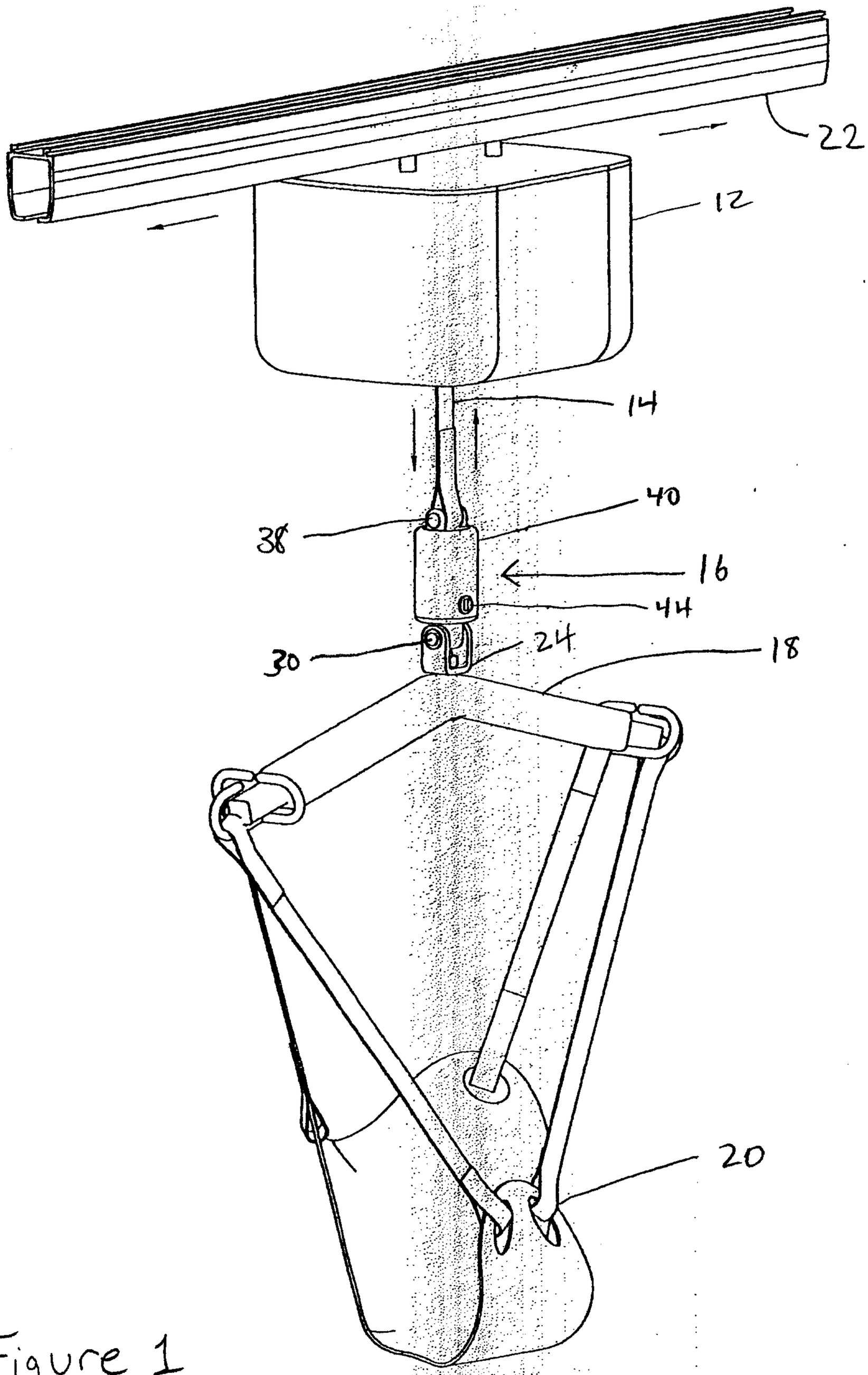


Figure 1

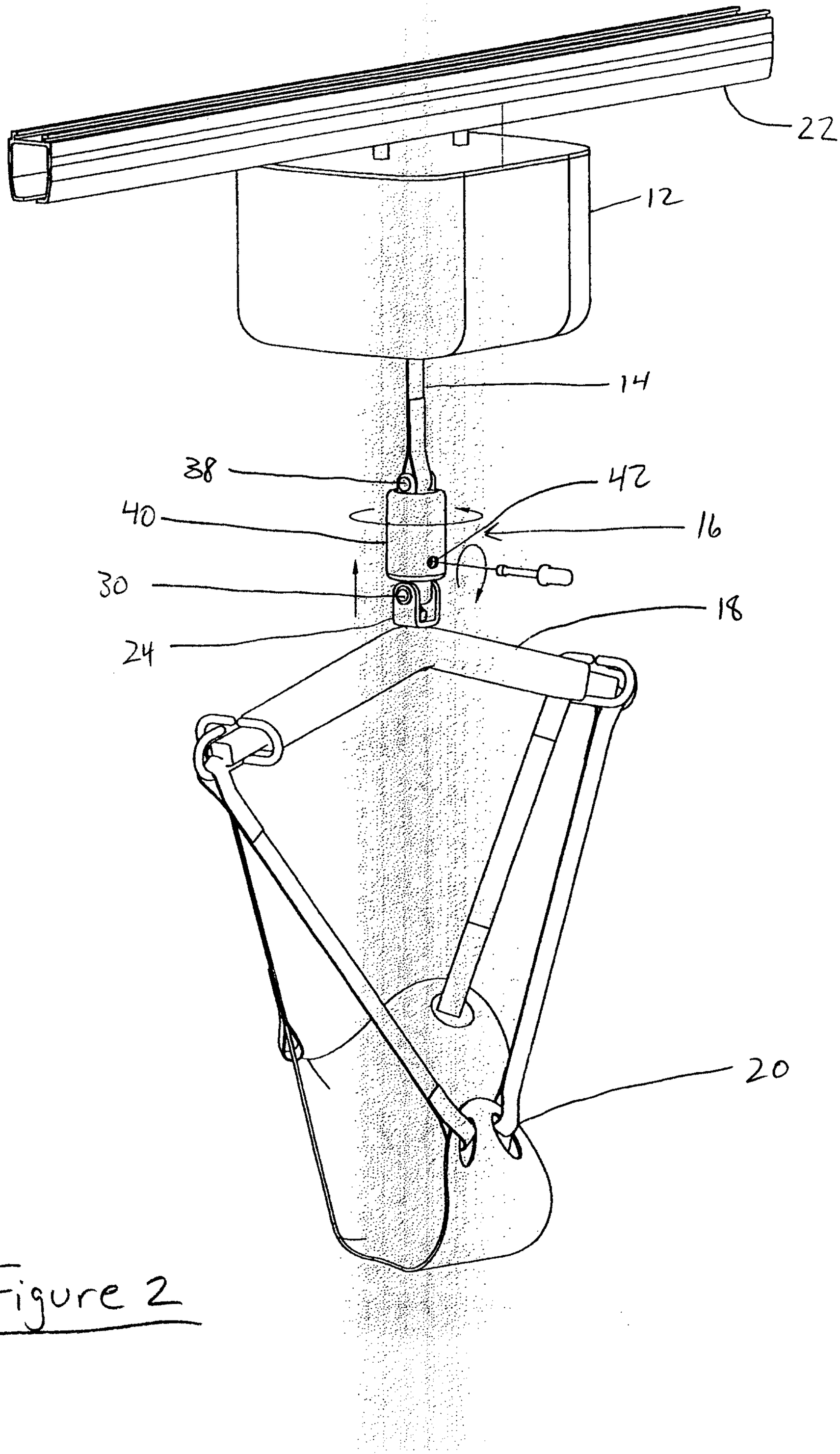


Figure 2

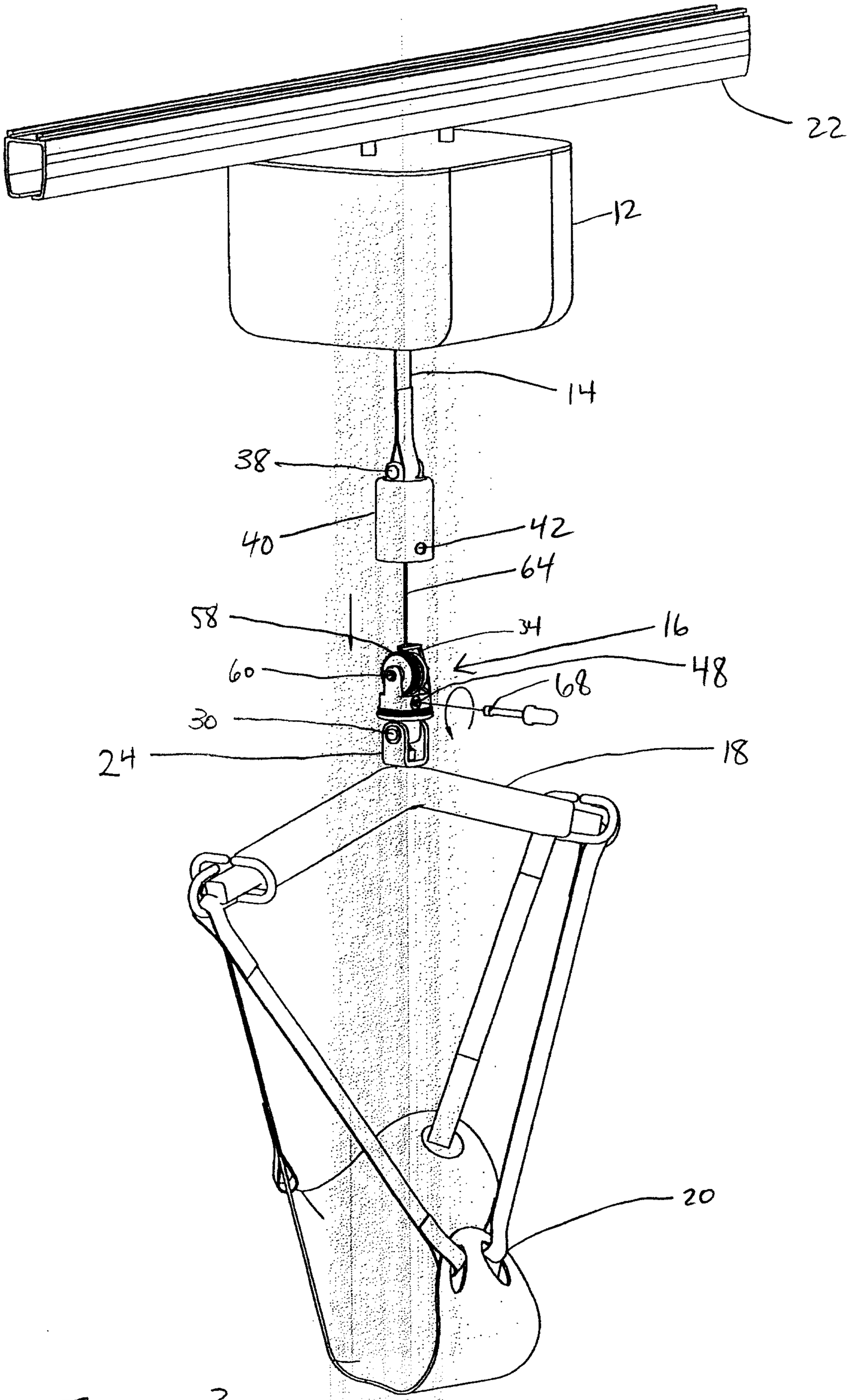


Figure 3

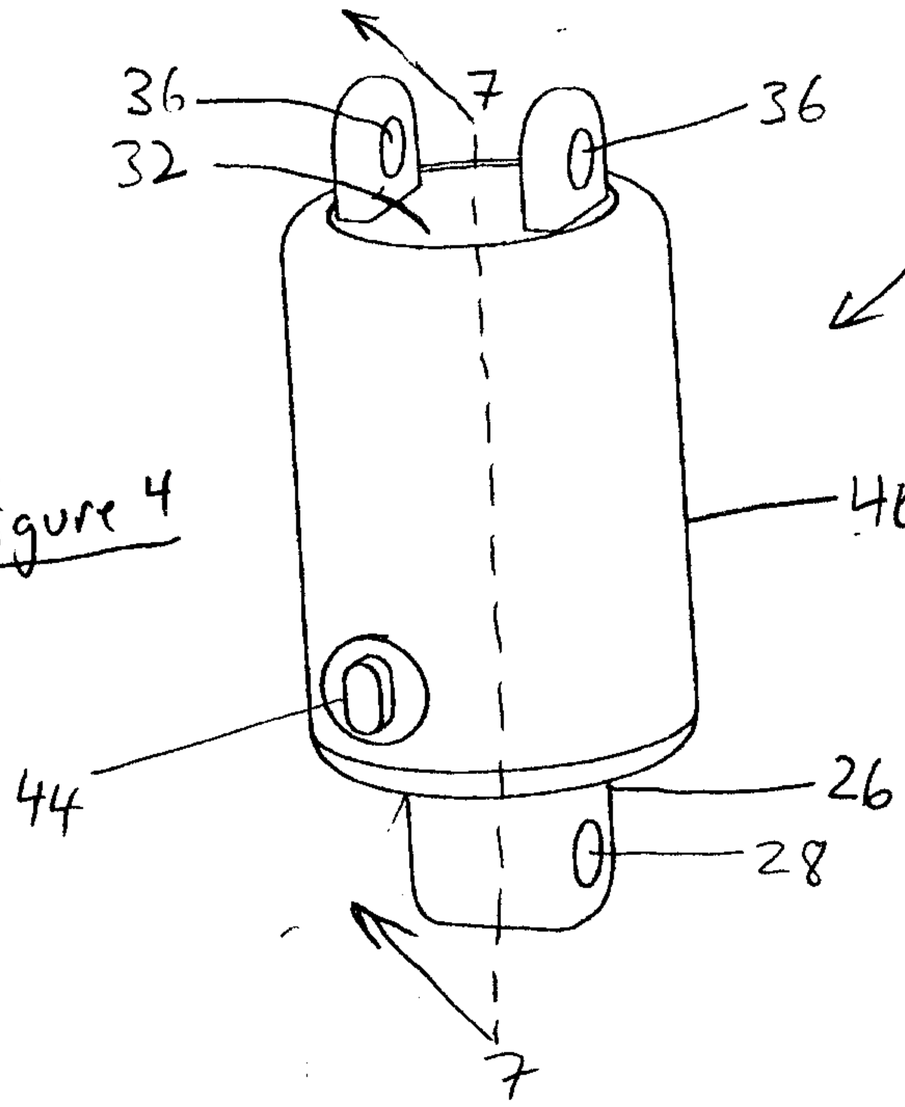


Figure 4

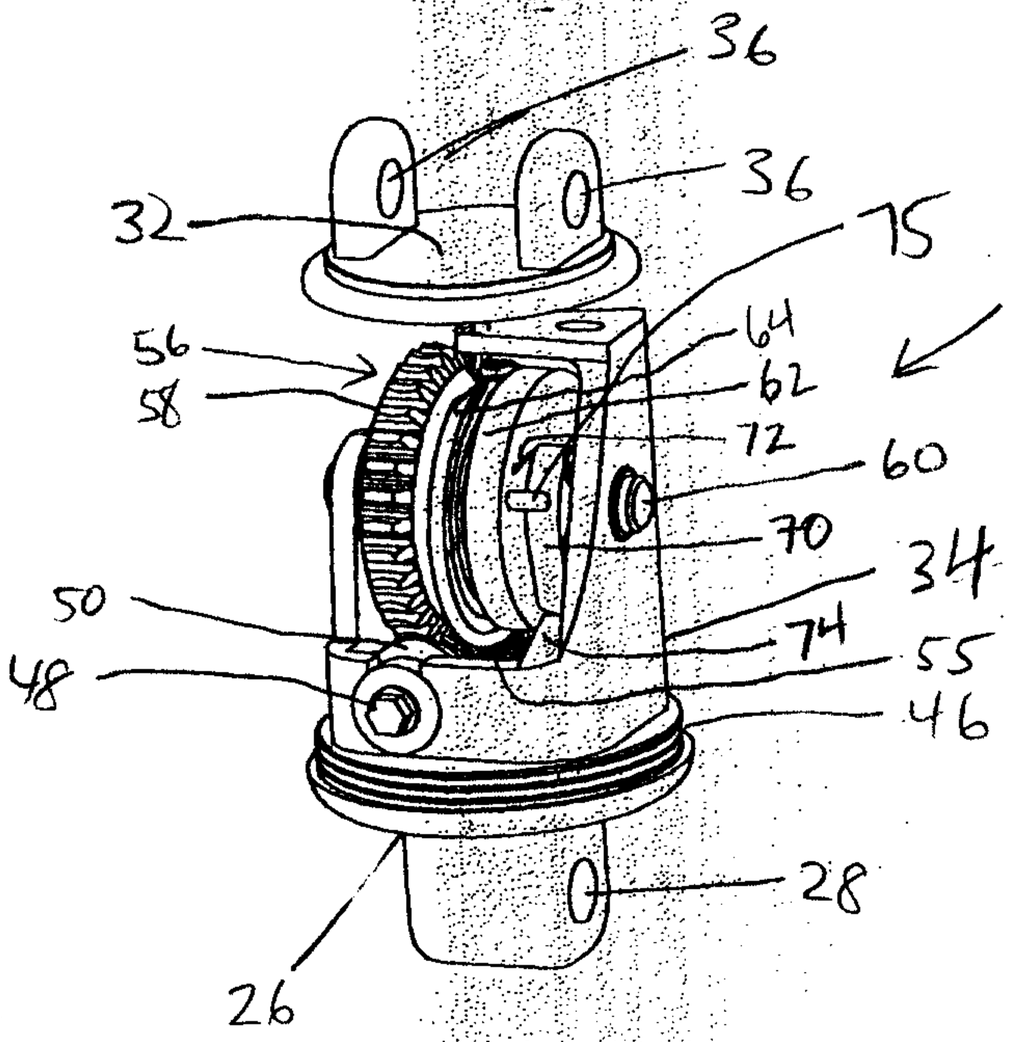


Figure 5

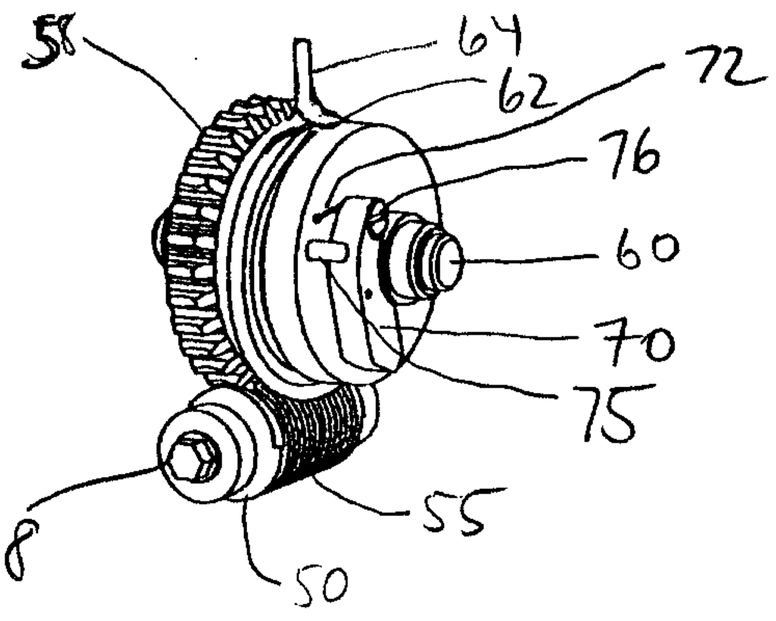


Figure 6

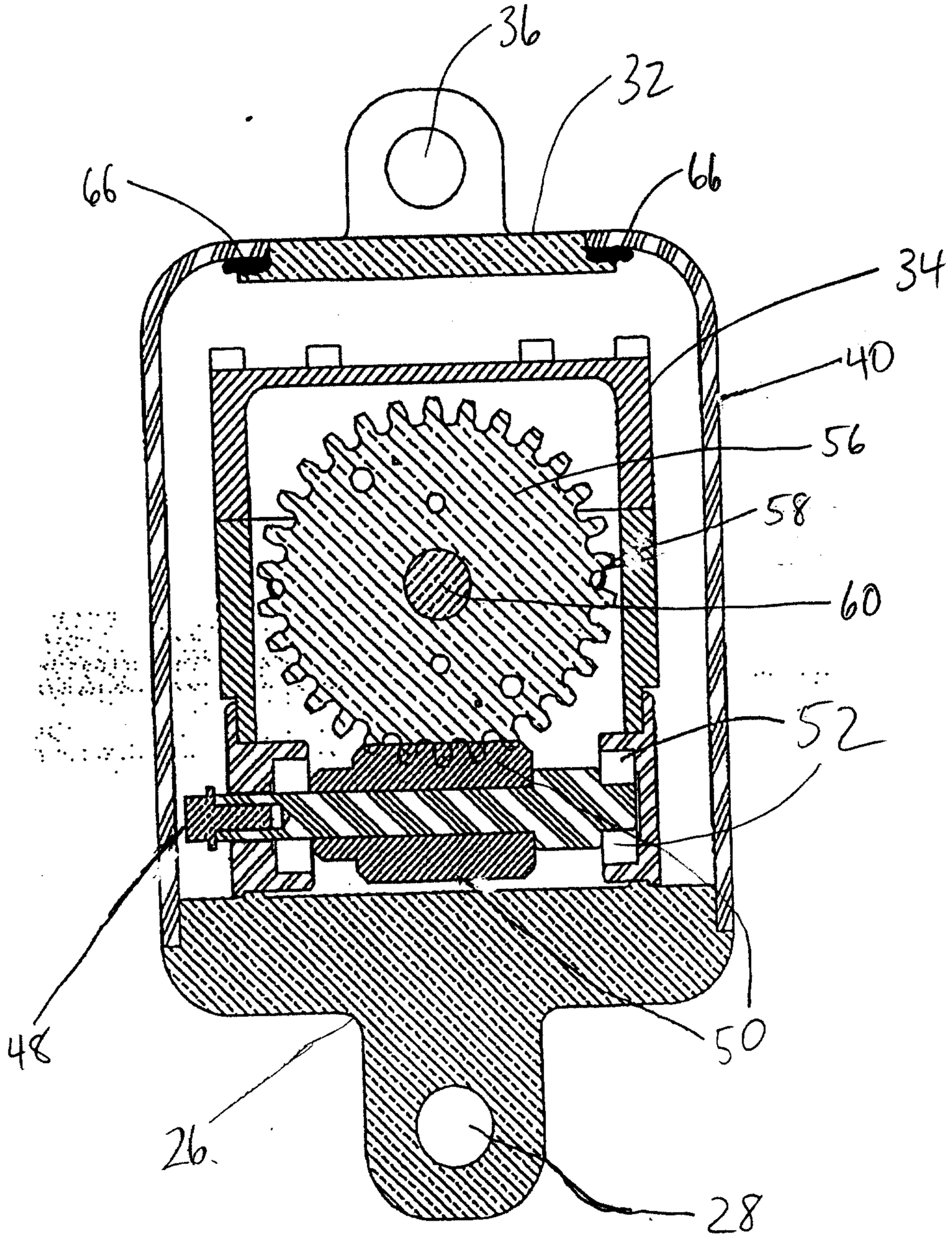


Figure 7

CANADA

PATENT APPLICATION

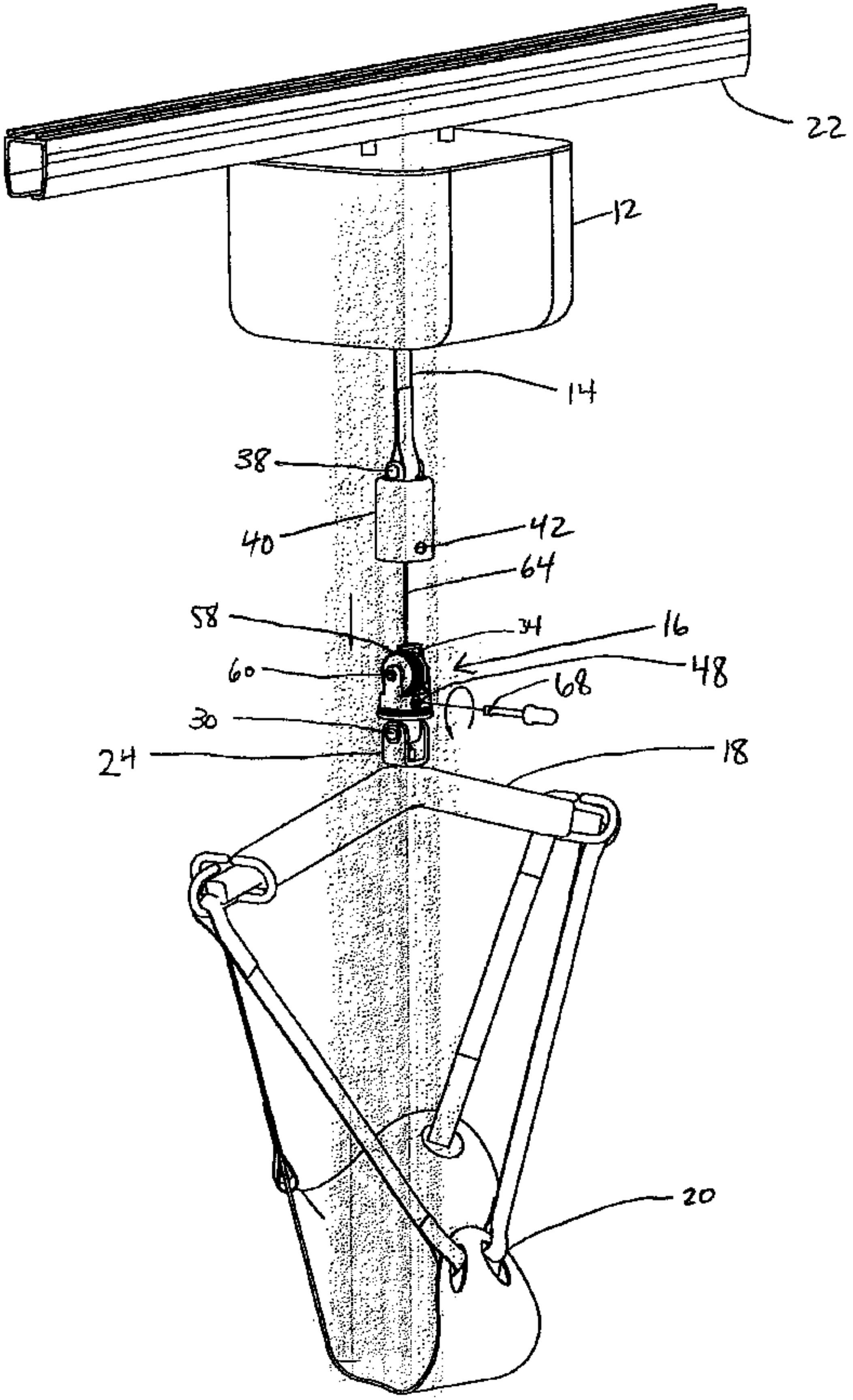
PIASETZKI & NENNIGER

File No.: WGS002

Title: **PATIENT LOWERING DEVICE**

Inventor(s): **MARK CHEPURNY**

MICHAEL F. WILSON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