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(54) A lifting device

(57) A lifting device primarily for handling luggage at airports includes a rope **(1)** having a gripping device **(10),** a winding drum **(2)** driven by a motor **(3)** so as to lift and lower the handled luggage, a control unit **(4)** for the motor **(3),** a receiver **(5)** for wirelessly receiving control commands and passing them on to the control unit **(4),** and a transmitter **(6)** used by an operator for wirelessly sending control commands to the receiver **(5).** To provide a lifting device, which can be used in cases where the luggage has to be lifted so high, that an operator would have to release his grip around the handle **(12),** the rope **(1)** has a useful minimum length that is sufficient to permit lifting the gripping device **(10)** out of vertical reach for an average man, and the transmitter is provided in a remote control **(6)** that is mechanically unattached to the other components of the lifting device. Preferably, the rope **(1)** has a useful minimum length of at least 2.2 m, and a second wireless transmitter **(13)** is provided in the gripping device **(10).** Thereby, the operator can use the one wireless transmitter that for the moment is best for him, which is ergonomically favorable.

EP 2 042 465 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a lifting device including as main components: a rope provided at one end with a gripping device for gripping an object to be lifted; a grooved winding drum, to which the other end of the rope is attached; a motor for rotating the drum to wind and unwind the rope, so as to lift and lower the object, respectively; a control unit for the motor; a receiver for wirelessly receiving control commands and passing them on to the control unit; and a transmitter used by an operator for wirelessly sending control commands to the receiver.

[0002] In the present context, the term rope is intended to include not only ropes or lines from natural and/or synthetic fibers but also wire ropes, where the wires are of metal, usually steel.

BACKGROUND ART

[0003] A lifting device of the kind referred to above is disclosed in US 6,916,015 B2, for example. Such lifting devices are used to lift luggage at air ports, for example, but the invention is not limited to only this field of application. Lifting devices for e.g. luggage at air ports are previously known and facilitate to a large extent the work in connection with the handling of luggage and are very appreciated by the personnel. The lifting device includes a handle with a hook at the bottom, which is connected to a rope. The rope may be actuated by a winding drum driven by an electric motor, which is provided at the ceiling, and through influence of the handle a user can control the hook so it is either lowered or raised. The lifting operation itself is performed by the hook, which is provided on an ergonomically shaped handle, and which is hooked in the handle of the suitcase, whereupon a pressure on an up-button that is provided on the handle activates the motor, so that the suitcase is lifted. The operator can then guide the suitcase to the desired position via a conveyer system, whereupon he gets the suitcase to be lowered by pressing a down-button on the handle. The whole operation can be performed without any heavy lifts, which results in a substantial reduction of diseases due to wear, which in its turn reduces the absence due to illness. The ergonomically shaped handle may include electric controllers that are provided inside the handle together with a wireless transmitter for the control of the electric motor via a wireless receiver and control unit.

[0004] Further, the control unit in the lifting device may have installed functions (preferably in the form of software), which ensure smooth starting motions and stop motions, respectively, so that possible detrimental jerks (which can be negative both for the lifting device and the goods) are eliminated. Such a function also implies a minimizing of possible risk of damage in connection with a handle getting loose from a suitcase, for instance. In such a situation, the rope could otherwise lash out, which may result in personal injury.

[0005] To eliminate the risk that the rope will leap off the winding drum, the rope passes through a rope guide before arriving at the winding drum. The rope guide consists of a fixed, strong element having a slot, the width of which is somewhat larger than the diameter of the rope. The edges of the slot in the rope guide are blunt, so that the rope will not be damaged.

[0006] Even though the lifting device of US 6,916,015 B2 is very appreciated by the luggage handling personnel, it cannot be used in cases where the luggage has to be lifted so high, that an operator would have to release his grip around the ergonomically shaped handle. Other improvements worth aiming at relate to the desirability of avoiding a detrimental jerk when starting the lifting of the luggage and also of starting the lifting with low speed and high torque. Further, when the motor drives a speed-reducing transmission that has an outgoing shaft, on which the winding drum is mounted, the outgoing shaft will be exposed to a high bending moment, which preferably should be reduced.

DISCLOSURE OF THE INVENTION

[0007] The main object of the present invention is to provide a lifting device, which can be used in cases where the luggage or other object has to be lifted so high, that an operator would have to release his grip around the handle.

[0008] In the lifting device referred to in the first paragraph above, this object is achieved in accordance with the present invention, in that said rope has a useful minimum length that is sufficient to permit lifting the gripping device out of vertical reach for an average man; and said transmitter is provided in a remote control that is mechanically unattached to the other components of the lifting device.

[0009] The rope preferably has a useful minimum length of at least 2.2 m.

[0010] To facilitate normal operation, the gripping device preferably includes an operating handle having a second wireless transmitter for sending control commands to the receiver. Thereby, the operator can choose to use the one wireless transmitter that for the moment is best for him. This alternative with dual controls provides increased practical and ergonomic applications of the lifting device.

[0011] As the lifting device in practice usually will be used in an environment where a plurality of identical lifting devices may be used in parallel, the wireless transmitter suitably has a limited range, so as not to interfere with the wireless transmitters of the other lifting devices.

[0012] In addition or alternatively, at least the first wireless transmitter and the receiver are paired, but if two wireless transmitters are used with one receiver, it is recommendable that all of them are paired.

[0013] The increased rope length in relation to prior art

lifting devices may cause some problems that are not encountered with short rope lengths. *E.g.* if the increased length of the rope requires a longer winding drum, it is recommendable that the winding drum has an extra support bearing to permit the winding of a rope of increased length. However, the winding drum may also have an increased diameter to accommodate the increased length of the rope.

[0014] Another recommendable solution to the problem is to arrange the grooved portion of the winding drum radially outside of and surrounding the output end of the reduction gearing. Thereby, the total assembly will be shorter, and the bending moment will be reduced.

[0015] If desired, the winding drum may be frustoconical and have said other end of the rope attached at the small diameter end of the drum. Hereby, when most of the rope is unwound from the drum, the lifting will be slower in the beginning, so it will be easier to avoid a possible detrimental jerk, simultaneously as the torque will be higher.

[0016] Another preferred way of avoiding a detrimental jerk at the start of the lifting operation is to interconnect a resilient member between said one end of the rope and said gripping device. The resilient member absorbs a possible wrench at a start of the lifting operation and preferably is a helical compression spring.

[0017] Still another preferred way of avoiding a detrimental jerk at the start of the lifting operation is to use a motor that is programmed to lift with lower speed and higher torque during an initial stage of the lifting operation.

[0018] It is also preferred that the motor is programmed to stop lifting or at least reduce the winding speed of the drum, if a maximum permissible load is reached. This reduces the risk of damaging *e.g.* the rail system for the lifting device in a case where the operator tries to lift a load of 100 kg but 50 kg is the set maximum permissible load.

[0019] The use of a long rope in the lifting device further makes it recommendable to provide a rope guide for guiding the rope during winding on the drum. The rope guide preferably includes a generally horizontal arm having two ends, a vertical rope guiding bore provided at one of the ends, and an upwardly directed member spaced therefrom in a direction toward the other end for engaging the groove on the winding drum. The arm extends generally perpendicularly to a rotary axis of the winding drum and is mounted to move along the drum on rotation of the drum, so that the bore at the end of the arm will be located straight below a point where the rope enters/leaves the drum. The rope guide reduces the risk of the rope being improperly wound on the drum, even when the baggage or other objects to be lifted are located at an oblique angle to the lifting device.

[0020] Preferably, a first stop member projects from the arm and is moveable therewith, and a micro switch is mounted to be actuated by the movement of said first stop member to stop the motor when the rope during unwinding reaches a point just ahead of where its end is attached to the winding drum.

[0021] A press roll may extend along the winding drum and be biased, *e.g.* by springs, against the drum at a position where the rope enters/leaves the drum or slightly thereabove. The press roll will assist in the proper winding of the rope on the drum.

[0022] Suitably, a second stop member is positioned in the groove and dimensioned to lift the rope locally when the rope during winding reaches the stop member, and a second micro switch is mounted to stop the motor when the rope during winding reaches the point where it is lifted by the second stop member. If desired, the press roll can be interposed between the rope in the groove and the micro switch and, thus, be used to transfer the local lifting of the rope to the second micro switch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] In the following, the invention will be described in more detail with reference to preferred embodiments and the appended drawings.

Fig. 1 is an exploded perspective view of the main components of a preferred embodiment of a lifting device in accordance with the invention.

Fig. 2 is a side view of the assembled lifting device of Fig. 1, except for the gripping device and a remote control, and with the front wall removed and partly in cross section.

Fig. 3 is a top view of the lifting device of Fig. 2.

Fig. 4 is an end view of the lifting device of Fig. 2 with the end wall removed.

Fig. 5 is a longitudinal cross sectional view of a preferred embodiment of the gripping device used for gripping the objects to be lifted.

Fig. 6 is a perspective view of the main components of a preferred embodiment of a rope guide in accordance with the invention.

Fig. 7 is a perspective view of reduction gearing, support bearing, and winding drum.

Fig. 8 is a side view of a frustoconical winding drum.

MODE(S) FOR CARRYING OUT THE INVENTION

[0024] Fig. 1 is an exploded perspective view of the main components of a preferred embodiment of a lifting device in accordance with the invention, while Fig. 2 is a side view of the assembled lifting device of Fig. 1, except for the gripping device and a remote control, and with the front wall removed and partly in cross section, Fig. 3 is

a top view of the lifting device of Fig. 2, Fig. 4 is an end view of the lifting device of Fig. 2 with the end wall removed, and Fig. 5 is a longitudinal cross sectional view of a preferred embodiment of the gripping device used for gripping the objects to be lifted.

[0025] The shown lifting device includes as main components a rope **1** provided at one end with a gripping device generally designated **10** for gripping an object to be lifted, a grooved winding drum **2,** to which the other end of the rope **1** is attached, an electric motor **3** for rotating the drum **2** to wind and unwind the rope **1,** so as to lift and lower the object, respectively, a control unit **4** for the motor **3,** a receiver **5** for wirelessly receiving control commands and passing them on to the control unit **4,** and a first transmitter **6** used by an operator for wirelessly sending control commands to the receiver **5.**

[0026] The entire lifting device is suspended in two carriages **7, 7'** of bogie type from a rail **8** mounted to the ceiling or other support structure. If desired, the rail **8** may be suspended from a rail structure and be movable in a horizontal direction to increase the useful working area of the lifting device. The carriages carry a frame structure **9,** in which the motor **3,** the control unit **4,** and the winding drum **2** are mounted enclosed in a common housing **20.** To reduce the speed of the motor **3** to a desired speed of the winding drum **2,** a reduction gearing **21,** preferably a planetary gearing, is provided. The control unit **4** is mounted on the motor **3,** the reduction gearing **21** is mounted on an outgoing shaft of the motor **3,** and the winding drum **2** is mounted on an outgoing shaft of the reduction gearing **21.** The whole assembly is mounted in a bracket **22,** which is fixed to the frame structure **9.**

[0027] The gripping device **10** includes a member, usually a hook **11,** for gripping the object to be lifted, but other types, such as suction cups and electromagnets, for example, are well known and may be used. Usually it also includes a handle **12** located at the point where the hook **11** or the like is attached to the rope, and the handle has two buttons, *viz.* an up-button for winding the rope **1** on the drum **2** so as to lift the object, and a down-button for unwinding the rope from the drum **2** so as to lower the lifted object.

[0028] Sometimes, goods have to be lifted or lowered to higher/lower levels than what is possible if the operator has to hold the handle **12** to handle and steer the gods to its intended destination. Goods, which are heavy and/or bulky or hazardous for other reasons, *e.g.* glass and chemicals, are difficult to handle for operators. Also, there is always some risk that the goods might come loose from the gripping device, fall down and hit the operator's feet, for example, and liquid containers might break and splash their contents over the operator. Further, with large goods dimensions, *e.g.* steel plates, the arm length of the operator will limit the lifting/lowering movements.

[0029] In accordance with the present invention, to provide a lifting device, which can be used in cases where the luggage or other object has to be lifted so high, that an operator would have to release his grip around the handle, the rope **1** has a useful minimum length that is sufficient to permit lifting the gripping device **10** out of vertical reach for an average man, as a rule the useful minimum length of the rope is at least 2.2 m, and said first transmitter is provided in a remote control **6** that is mechanically unattached to the other components of the lifting device. The remote control **6** is provided with an up-button and a down-button for lifting and lowering of a gripped object, and suitably it is provided with a cord or strap **6'** so that it can be hung around the wrist or neck of the operator or attached to his waist belt, for example. The use of a separate remote control **6** will permit the operator to stand at more than an arm's length from the object to be lifted and communicate with the lifting device, which increases the usefulness of the lifting device and provides a safer working environment. Further, the use of a long rope **1** and the separate remote control **6** even makes it possible for an operator to lift an object up to an upper floor or lower it down to a lower floor.

[0030] Preferably, the handle **12** of the gripping device is an operating handle having a second wireless transmitter **13** for sending control commands to the receiver **5.** Each separate lifting can be operated by means of anyone of the two wireless transmitters **6** and **13.** Thereby, the operator can use the one wireless transmitter that for the moment is best for him. From an ergonomic al point of view, the operator he can get a more varying movement pattern by using this dual control, so as to minimize the static muscle stress that may arise in the arm-muscles by intensive use of the operating handle **12** in lifting and lowering. With the dual control, the operator can change to the separate remote control **6** and use both hands to move the baggage or other goods in the rail system. This alternative with dual controls provides increased practical and ergonomic applications of the lifting device.

[0031] The wireless system preferably is a Bluetooth® system, and as the lifting device in practice will be used in an environment where a plurality of identical lifting devices may be used in parallel, the two wireless transmitters **6** and **13** suitably have a limited range, so as not to interfere with the wireless transmitters of the other lifting devices. In addition or alternatively, at least the first wireless transmitter **6** and the receiver **5** are paired, but if two wireless transmitters are used with one receiver, it is recommendable that all of them are paired. By pairing, they will be matched to each other, so as to exclude communication with others. If desired, it is of course possible to substitute a data transferring cable for the second wireless transmitter **13** to transfer up and down commands from the handle **13** to the control unit **4.** As shown in Fig. 2, the receiver **5** may be located within the control unit **4** and have an antenna **23** extending out of the housing **20.** Alternatively, the antenna **23** may be located on the exterior of the housing **20** or even located inside of the housing.

[0032] In the shown preferred embodiment, the grooved portion of the winding drum **2,** which here is generally cylindrical, is located radially outside of and surrounds the output end of the reduction gearing **21.** When the reduction gearing is a planetary gearing, the grooved portion of the drum **2** could also be provided on an exterior surface of a rotary, drum-shaped cover of the planetary gearing **21.** Thus, the grooved portion of the drum **2** will be located between the output shaft of the reduction gearing **21** and the bracket **22** holding the entire assembly. Thereby, the total assembly will be shorter, and the bending moment caused by the weight of the lifted load will be reduced.

[0033] Preferably, the winding drum **2** is attached to the outgoing shaft of the reduction gearing **21** by a freewheel, freehub, instant anti-reverse bearing or similar mechanism that permits the operator to easily pull out more rope by hand from the winding drum **2** after the grip on a moved object has been released. In the embodiment best shown in Fig. 2, an anti-reverse bearing **43** is mounted between two deep grove ball bearings **44** and has an inner ring that is fixed to the shaft by a key, while all three outer rings have a tight fit in the winding drum **2.** When a baggage handler has lowered an object, such as a suitcase, carried by the lifting device of the invention, onto a baggage cart, for example, he continues pushing the down-button when detaching the hook **11** from the suitcase and pulling out more rope **1** while walking to the next suitcase to be moved from a conveyer, for example. He moves faster than the lifting device, which will follow him, and he can attach the hook **11** in the handle of the next suitcase and start pushing the up-button to lift the new suitcase without the lifting device being straight above him. Consequently, he can work faster. Further, when the baggage handler pulls out rope manually while pushing the down-button, there is no risk of the pulling force in the rope **1** being so low, that the rope portion wound on the grooved drum **2** might tend to straighten so much, that parts of the rope **1** might lift from the groove and get entangled.

[0034] It is not uncommon that an object to be lifted will be exposed to a detrimental jerk at the start of the lifting operation. When handling suitcases, for example, a defective handle might get torn loose or break. This problem may be solved in the manner shown in Fig. 5 by interconnecting a resilient member **14** between said one lower end of the rope **1** and said gripping device **10,** more precisely between the end of the rope **1** and the hook **11** or other member for gripping the object to be lifted. As shown, the resilient member preferably is a helical compression spring **14.**

[0035] In the embodiment shown in Fig. 5, the rope **1** extends vertically and coaxially through the entire compression spring **14** and at its lower end it has an enlarged termination **15.** Radially between the rope **1** and the lower three quarters of the spring, there is an inner protective tube **16** having a radial flange **17,** which rests on the enlarged termination **15** and supports the lower end of the spring **14.** The hook **11** is fixed to the bottom of the handle **12,** *e.g.* by screwing and locking by means of a counter nut, and an outer protective tube **18** encloses the spring **14** within the handle **12.** The lower end of the outer tube **18** is fixed to the bottom of the handle **12,** *e.g.* by welding, and at its upper end the tube is closed by a screw member **19** that compresses the spring **14** to a desired extent and has a central bore, through which the rope **1** extends. In the embodiment of Fig. 5, the handle **12** with the hook **11** is resiliently attached to the rope **1.** If desired, this design may be inverted, so that the hook **11** is resiliently attached to the handle **12** that is fixed to the rope **1.**

[0036] At the top of the handle **12,** a chamber **24** is provided for housing the second wireless transmitter **13** as well as a battery, not shown, for powering the transmitter. In case a cable is used for transferring operating commands from the two buttons, the cable exits the handle through the chamber **24.**

[0037] Another way of avoiding a detrimental jerk at the start of the lifting operation is to program the control unit **4** to start the motor **3** at low speed and high torque and then gradually increase the speed along a ramp and reduce the torque to normal operating values. However, it is recommendable to use a handle having the jerk absorbing compression spring **14** also in this case, because an operator might pull out so much rope from the drum **2** that the rope **1** would not be taught before the ramp time has passed, and then you would have full winding speed when the lifting starts. Preferably, the control unit **4** is also programmed to make the motor **3** stop lifting or at least reduce the winding speed of the drum **2** if a maximum permissible load is reached. Thereby, damage to the lifting device or the structure from which it is suspended will be avoided.

[0038] It may occur that an operator connects the gripping device **10** to an object located where the rope will deviate considerably from an ideal vertical lifting path. Then, it is recommendable that the lifting device includes a rope guide for guiding the rope **1** during winding on the drum **2.** The main components of a preferred embodiment of a rope guide **25** in accordance with the present invention are best shown in Fig. 6, but they are shown also in Figs. 2 to 4. The rope guide **25** includes a generally horizontal arm **26** having two ends, a vertical bore **27** for guiding the rope **1** provided at one of the ends, and an upwardly directed member **28** spaced therefrom in a direction toward the other end for engaging the groove on the winding drum **2.** The arm **26** extends generally perpendicularly to a rotary axis of the winding drum **2** and is mounted to move along the drum **2** on rotation of the drum **2,** so that the bore **27** at the end of the arm **26** will be located straight below a point where the rope **1** enters/leaves the drum **2.** Both the inlet and the outlet edges of the bore **27** are rounded to reduce wear of the rope **1.** To make the arm **26** follow a path where the bore **27** always will be located vertically under the point where the rope **1** enters/leaves the groove on the drum **2,** the

arm is guided by two parallel guide members **29, 30** that also are parallel with the direction of movement of the entrance/departure point of the rope **1** in the groove upon rotation of the drum **2.** The ends of the two guide members **29, 30** are fixed in end members **31, 32** that are parallel with each other and with the arm **26.** In the shown embodiment, the guide members are round bars **29, 30** extending through corresponding bores in the arm **26.** Preferably, the rope guide **25** also includes a guide plate **33** having a rope guiding slot **34,** which is located straight below a path travelled by the rope guiding bore **27** on rotation of the drum **2.** Also the edges of the slot **34** are rounded not to cause wear of the rope **1.**

[0039] As best shown in Fig. 2, a first stop member **35** may project from the arm **26** and be movable therewith during winding and unwinding, so as to actuate a micro switch **36,** best shown in Fig.1, to stop the motor **3** when the rope **1** during unwinding reaches a point just ahead of where it is attached to the winding drum **2,** *i.e.* near one end of the groove on the drum **2.**

[0040] As best shown in Figs. 3 and 4, the rope guide **25** further includes a rotary press roll **37** extending along the grooved portion of the winding drum **2** and biased against the drum **2** at a position where the rope **1** enters/leaves the drum **2** or slightly thereabove. The rotary press roll **37** has a shaft projecting axially from each end of the roll **37,** and the biasing force is suitably provided by two helical compression springs **38, 39** acting on the ends of the shaft radially with respect to the rotational axis of the drum **2.** The biasing force of each spring **38, 39** may be set be tightening or loosening a screw **40, 41** extending axially through the spring **38, 39.** The press roll **37** assists in keeping the rope **1** in the groove also in case the rope portion located below the guiding bore **27** should form an angle with a vertical line through the bore.

[0041] Further, a second stop member, not shown, may be positioned in the groove near its other end and dimensioned to lift the rope **1** locally when the rope **1** during winding reaches the second stop member. The lifting of the rope **1** by the second stop member will also lift one end of the press roll **37** against the biasing force from the compression springs **38, 39.** Then, a second micro switch, not shown, may be mounted to stop the motor **3** when the rope **1** during winding reaches the point where it is lifted by the second stop member as disclosed in US-B2 6,916,015, herewith incorporated by reference. These two micro switches prevent the unintentional winding or unwinding of too much rope **1.**

[0042] If desired, the winding drum **2** may have an extra support bearing to permit the winding of a rope **1** of increased length. In the embodiment shown in Fig. 7, the support bearing **45** is located at the outgoing shaft of the reduction gearing **21.**

[0043] A mechanical solution of acquiring lower lifting speed in the beginning of a lifting operation is shown in Fig. 8. Here, the winding drum **42** is frustoconical, and the rope **1** is attached at the small diameter end of the drum. Hereby, when most of the rope **1** is unwound from the drum **42,** the lifting will be slower in the beginning, so it will be easier to avoid a possible detrimental jerk, simultaneously as the torque will be higher. Of course, the teachings above relating to a cylindrical winding drum, and its cooperation with other components of the lifting device, can be applied also when a frustoconical winding drum is used, even though in some case may they may have to be slightly modified by measures that are obvious to a skilled art worker.

INDUSTRIAL APPLICABILITY

[0044] The main field of application of the invention is for baggage handling at airports, where passenger baggage, for example, weighing 5-80 kg has to be transferred between conveyers and baggage carts.

Claims

1. A lifting device including as main components:

- a rope (**1**) provided at one end with a gripping device (**10**) for gripping an object to be lifted;
- a grooved winding drum (**2, 42**), to which the other end of the rope (**1**) is attached;
- a motor (**3**) for rotating the drum (**2**, **42**) to wind and unwind the rope (**1**), so as to lift and lower the object, respectively;
- a control unit (**4**) for the motor (**3**);
- a receiver (**5**) for wirelessly receiving control commands and passing them on to the control unit (**4**); and
- a first transmitter (**6**) used by an operator for wirelessly sending control commands to the receiver (**5**);

wherein

- said rope (**1**) has a useful minimum length that is sufficient to permit lifting the gripping device (**10**) out of vertical reach for an average man; and
- said first transmitter (**6**) is provided in a remote control that is mechanically unattached to the other components of the lifting device.

2. A lifting device as claimed in claim 1, **wherein** said rope (**1**) has a useful minimum length of at least 2.2 m.

3. A lifting device as claimed in claim 1 or 2, **wherein** said gripping device (**10**) includes an operating handle (**12**) having a second wireless transmitter (**13**) for sending control commands to the receiver (**5**).

4. A lifting device as claimed in claim 3, **wherein** said first and second wireless transmitters (**6**, **13**) have a

limited range, not to interfere with possible other transmitters.

5. A lifting device as claimed in any one of claims 1-4, **wherein** at least said first wireless transmitter (**6**) and said receiver (5) are paired.

6. A lifting device as claimed in any one of claims 1-5, **wherein** said winding drum (**2**, **42**) has an extra support bearing to permit the winding of a rope (**1**) of increased length.

7. A lifting device as claimed in any one of claims 1-5, **wherein** the grooved portion of said winding drum (**2**, **42**) is located radially outside of and surrounds the output end of the reduction gearing (**21**).

8. A lifting device as claimed in any one of claims 1-7, **wherein** said winding drum (**42**) is frustoconical, and said other end of the rope (**1**) is attached at the small diameter end of the drum (**42**).

9. A lifting device as claimed in any one of claims 1-8, **wherein** the winding drum (**2**) is attached to an outgoing shaft of the reduction gearing (**21**) by a a freewheel, freehub, instant anti-reverse bearing or similar mechanism (**43**).

10. A lifting device as claimed in any one of claims 1-9, **further comprising** a resilient member (**14**) for avoiding a detrimental jerk at a start of the lifting operation, said resilient member (**14**) being interconnected between said one end of the rope (**1**) and said gripping device (**10**)**.**

11. A lifting device as claimed in claim 10, **wherein** said resilient member is a helical compression spring (**14**).

12. A lifting device as claimed in any one of claims 1-11, **wherein** said control unit (**4**) is programmed to make the motor (**3**) lift with lower speed and higher torque during an initial stage of the lifting operation.

13. A lifting device as claimed in any one of claims 1-12, **wherein** said control unit (**4**) is programmed to make the motor (**3**) stop lifting or at least reduce the winding speed of the drum (**2**, **42**) if a maximum permissible load is reached.

14. A lifting device as claimed in any one of claims 1-13, **further comprising** a rope guide (**25**) for guiding said rope (**1**) during winding on said drum (**2**).

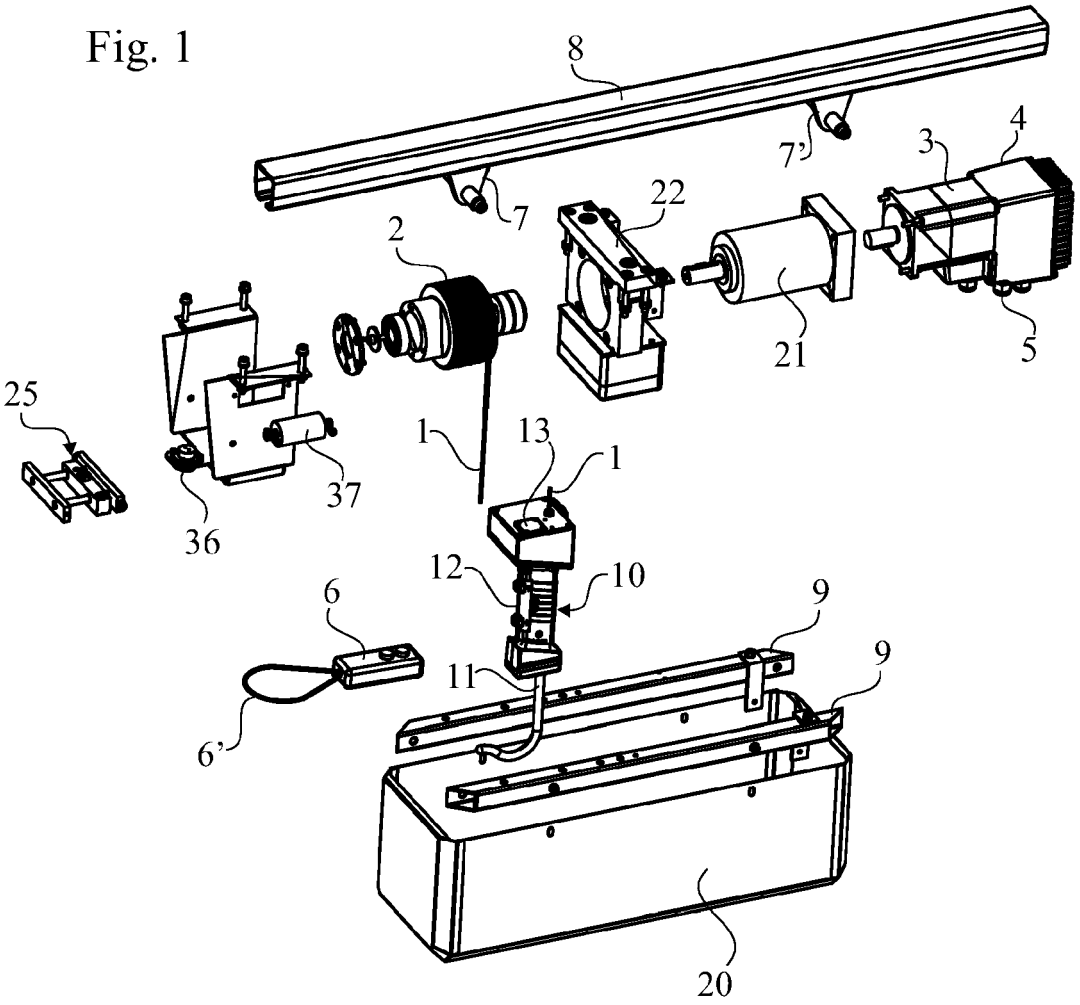
15. A lifting device as claimed in claim 14, **wherein** said rope guide (**25**) includes a generally horizontal arm (**26**) having two ends, a vertical bore (**27**) for guiding the rope (**1**) provided at one of the ends, and an upwardly directed member (**28**) spaced therefrom in a direction toward the other end for engaging the groove on the winding drum (**2**, **42**), said arm (**26**) extending generally perpendicularly to a rotary axis of the winding drum (**2**, **42**) and being mounted to move along the drum (**2**, **42**) on rotation of the drum (**2, 42**), so that the bore (**27**) at the end of the arm (**26**) will be located straight below a point where the rope (**1**) enters/leaves the drum (**2**, **42**).

16. A lifting device as claimed in claim 15, **further comprising** a first stop member (**35**) projecting from the arm (**26**) and movable therewith during winding and unwinding, and a first micro switch (**36**) mounted to be actuated by the movement of said first stop member (**35**) to stop the motor (**3**) when the rope (**1**) during unwinding reaches a point just ahead of where its end is attached to the winding drum (**2**).

17. A lifting device as claimed in any one of claims 1-16, **further comprising** a press roll (**37**) extending along the winding drum (**2**, **42**) and biased against the drum (**2**, **42**) at a position where the rope (**1**) enters/leaves the drum (**2**, **42**) or slightly thereabove.

18. A lifting device as claimed in any one of claims 1-17, **further comprising** a second stop member positioned in the groove and dimensioned to lift the rope (**1**) locally when the rope (**1**) during winding reaches the second stop member, and a second micro switch mounted to stop the motor (**3**) when the rope (**1**) during winding reaches the point where it is lifted by the second stop member.

Fig. 1



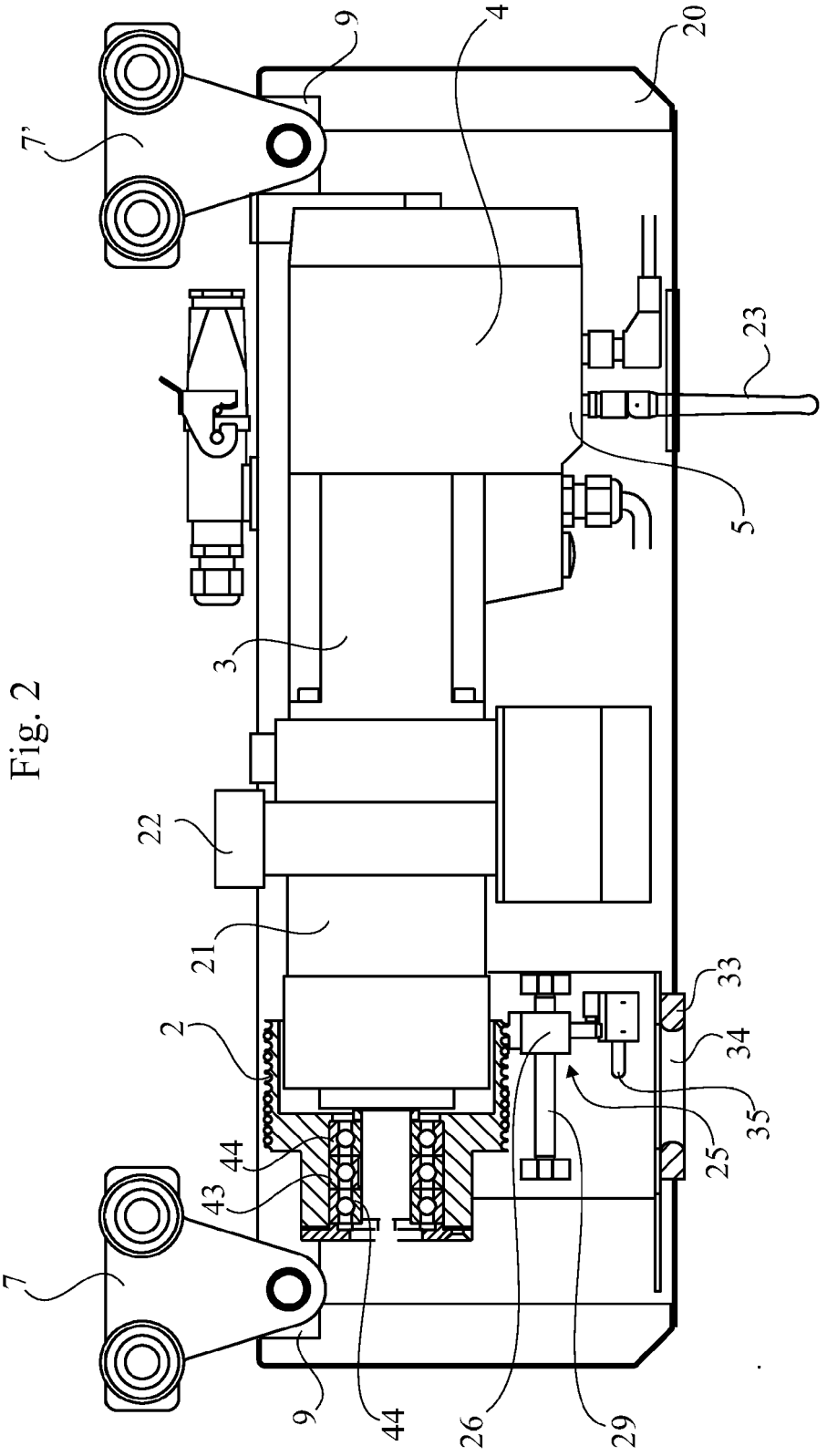


Fig. 2

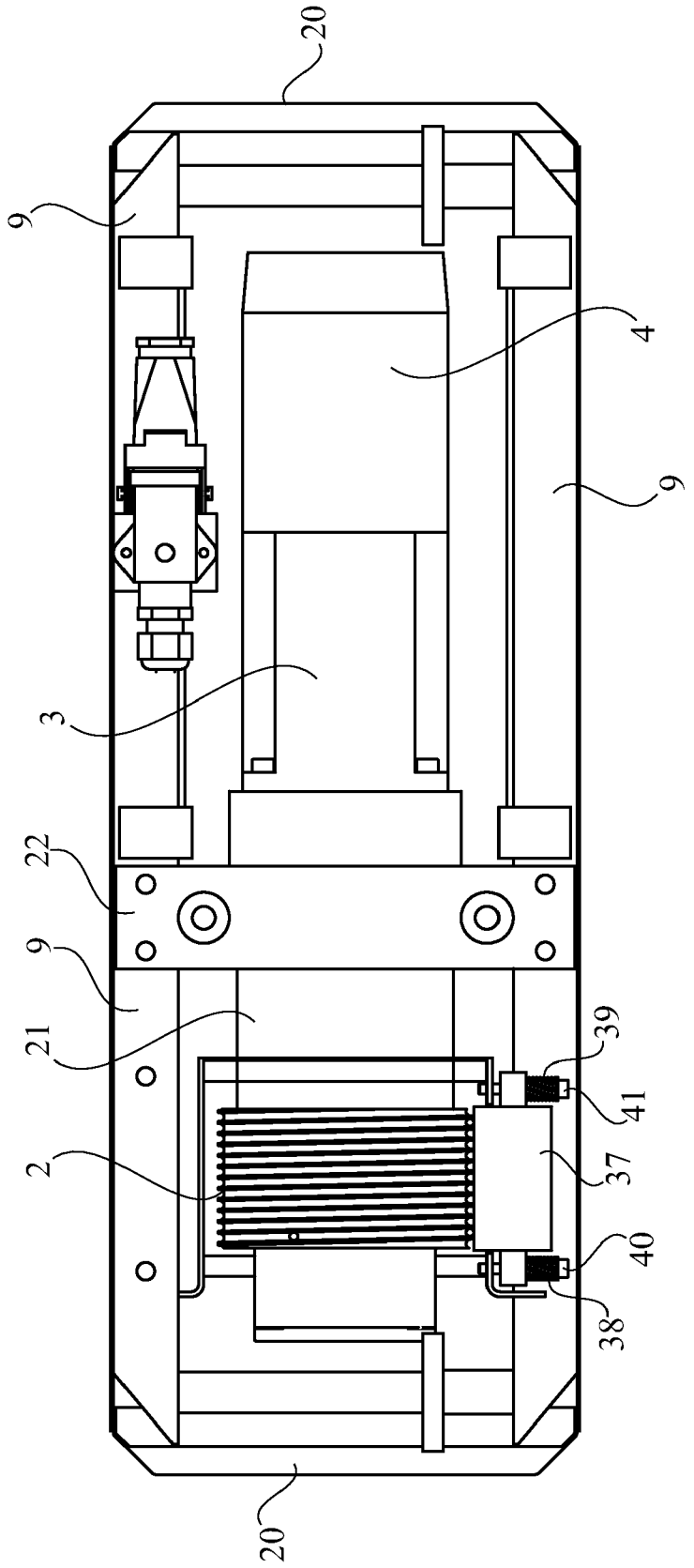


Fig. 3

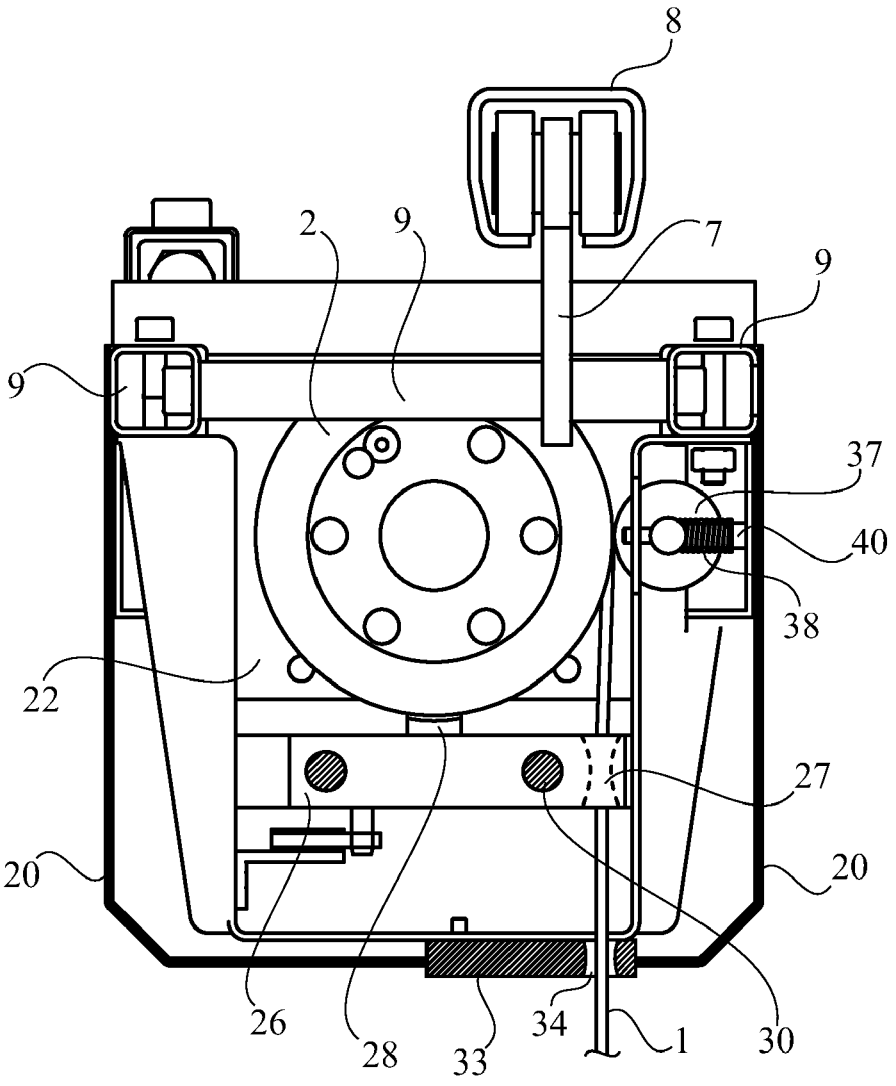


Fig. 4

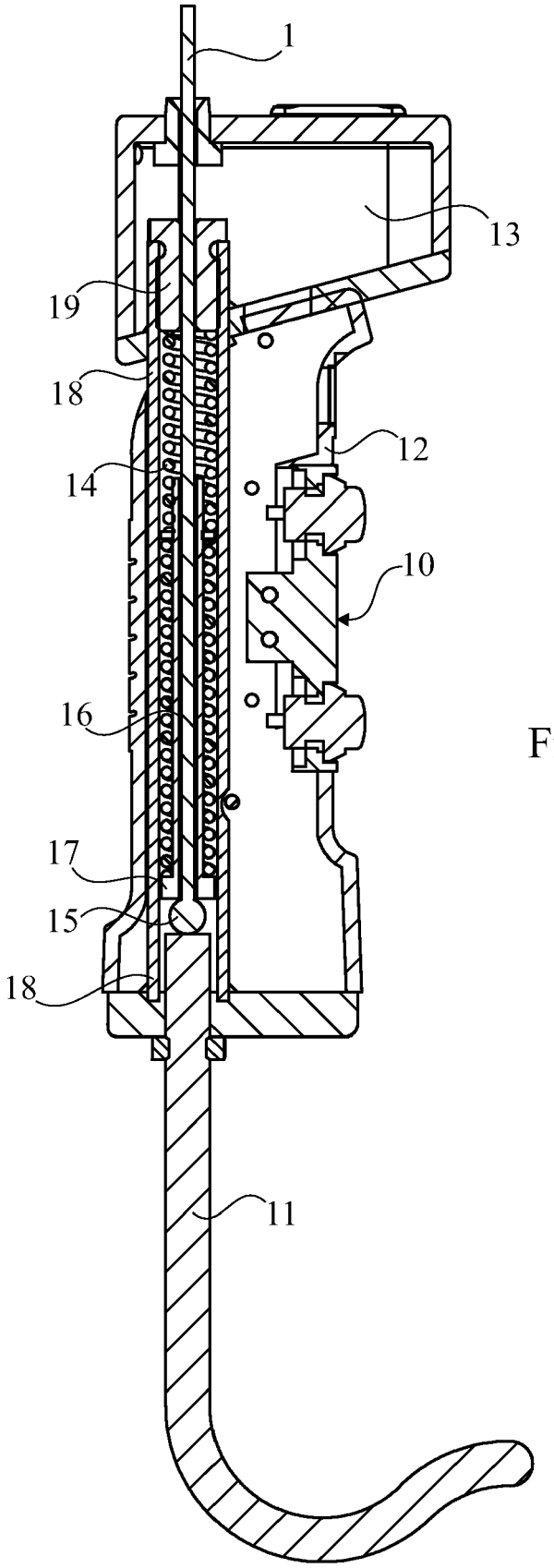


Fig. 5

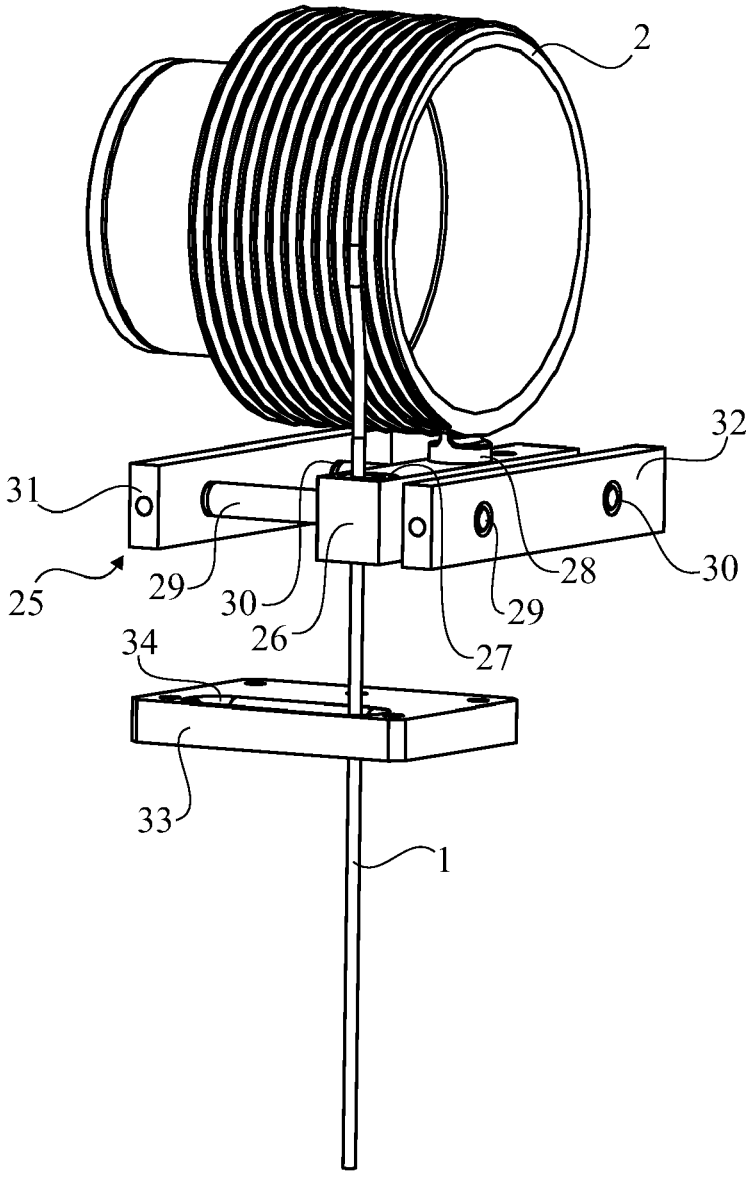


Fig. 6

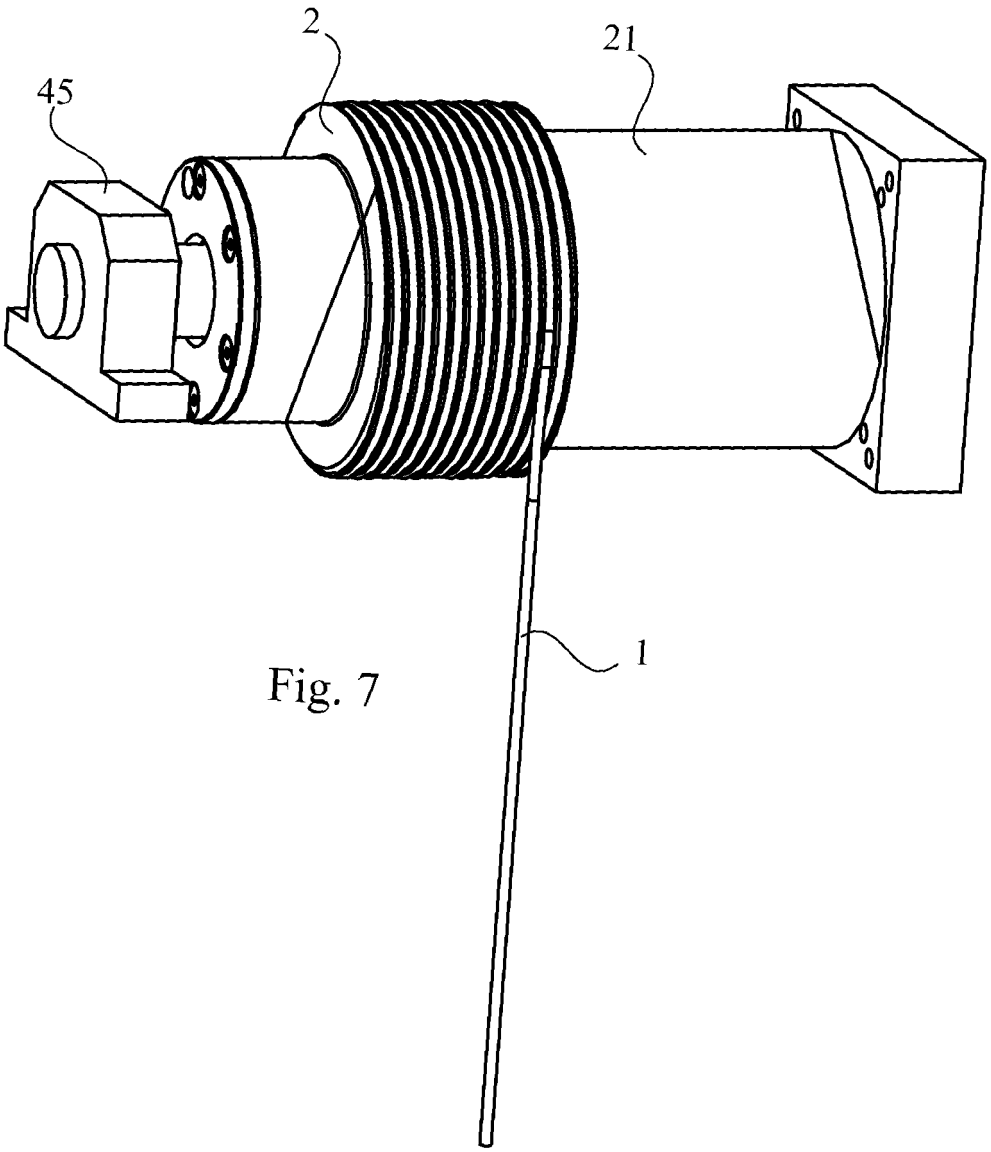


Fig. 7

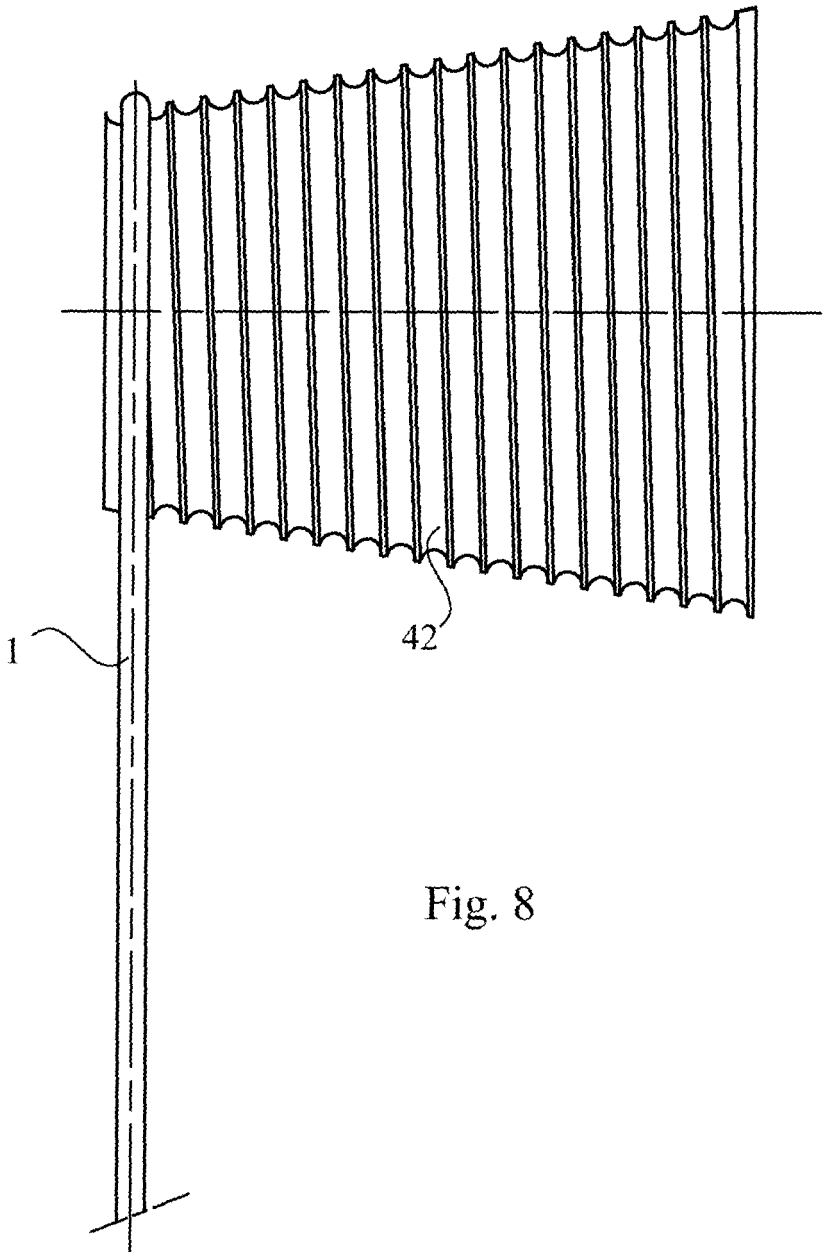


Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 07 11 7147

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B66D
B66C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 February 2008	Verheul, Omiros

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