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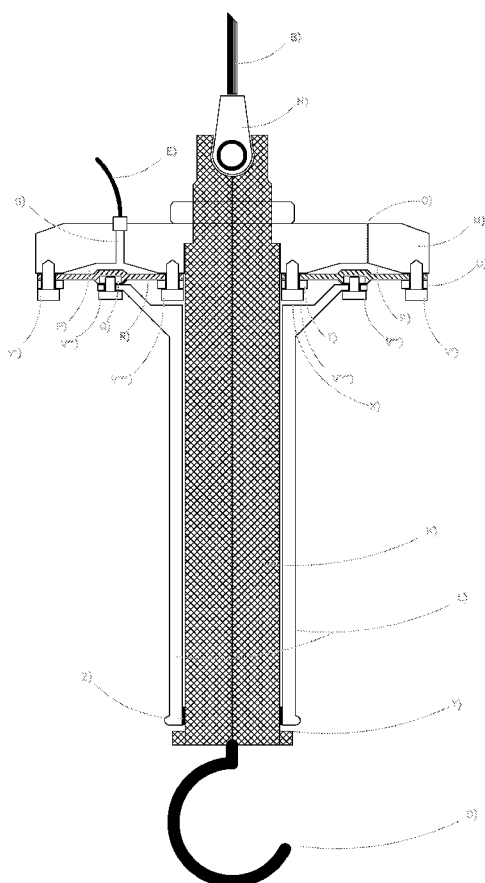
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(54) Title: HANDLE FOR CONTROLLING A LIFTING DEVICE



(57) Abstract: The object of the invention is to provide a cost-efficient technique for control handle for lifting devices, which withstand tough industrial environments with a minimum of maintenance and calibration. Said object is achieved by using a pressure sensor managing with great accuracy to measure pressures deviating from the atmospheric pressure. The sensor is connected to a cavity in the control handle, which partly consists of a resilient membrane, which is in its turn connected to the handle portion of the control handle in such a way that, when a vertical force is applied to the handle, a pressure deviation in the cavity being in proportion to the force. The pressure deviation measured by the sensor is read by a control unit, which in its turn controls the driving device performing the lifting operation itself.

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HANDLE FOR CONTROLLING A LIFTING DEVICE

The present invention relates to a new type of control handle for controlling different types of lifting devices.

5

PRIOR ART

It is already known, that by measuring the vertical force being applied on a control handle by the operator, an effective control of the lifting device can be obtained. For instance SE 453589 discloses that two piezo-electric elements are arranged to measure
10 upward and downward motions, respectively, with an outer jacket on the control handle, which jacket constitutes the handle itself. In this case, a cost efficient solution is obtained with two electric output signals, which are proportional to the force up and down, respectively, applied by the operator.

15 In US 4,917,360 a solution is shown, which is in principle constructed as SE 453 598 but where the measurement of the force is performed by a return spring always aiming at keeping the outer jacket in a "zero position", and the mechanical displacement is measured by an optic reading fork. This methodology with a mechanical system in the form of a spring for return to zero and a separate system for measurement always raises
20 great requirements for precision with both systems, as the two "zero positions" of the systems have to coincide exactly.

US 3,998,432 shows an entirely pneumatic concept, where upward and downward motions are generated by a valve, which is integrated in the handle portion. The outer
25 jacket constituting the handle will act on a slide, which determines if the integrated lifting cylinder shall be aired or de-aired. However, the concept has drawbacks, as for instance the optimization of the control characteristics only may be performed through mechanical modifications and as both said slide and lifting cylinder always have an undesired friction in the included sealings - which negatively affects the total
30 performance of the lifting device.

DISCLOSURE OF THE INVENTION

The object of the invention is to provide a cost-efficient solution as to control handle for lifting devices, which withstand tough industrial environments with a minimum of
35 maintenance and calibration. Said object is achieved by using a comparatively new type of pressure sensors which with great accuracy manages to measure pressures deviating from the atmospheric pressure in the order of +/-10 kPa. Through industrial and

medical use, this type of sensors has a relationship between price and performance, which makes them very useful in said context. The sensor is connected to a cavity in the control handle, which partly consists of a resilient membrane, which in its turn is connected to the handle portion of the control handle in such a manner that when a
5 vertical force is applied to the control handle a pressure deviation in the cavity being in proportion to the force. The pressure deviation measured by the sensor is read by a control unit, which in its turn controls the driving device performing the lifting operation itself. A number of advantages is then obtained as compared to other known techniques.

- 10 1. Very little dead zone. The lowest measurable force is very small, as the design as such allows a very low friction in the movable portion.
2. Easy to scale the force/signal ratio by varying the effective region of the membrane.
3. Easy to vary the rigidity of the control handle. By altering the volume of the cavity,
15 the stroke length for a certain force may be varied, which may be an important parameter when the performance of the entire lifting equipment shall be optimized.
4. No "zero calibration". By allowing the cavity to leak somewhat, the system itself will tare the weight of the movable gripping portion. Of course, the leakage has to be very small and will at the same time compensate pressure deviations deriving from variations in the environmental temperature.
- 20 5. Simple protection against outrage. A measurement region in the order of ± 1 N is desirable for this type of lifting devices. In an industrial environment, it shall, however, be taken into consideration that the handle portion will be subject to forces in the order of 1000N. Normally, the type of pressure sensor which is used here for the force measurement stands a nominal pressure region $\times 2$ without
25 permanent damages. Thus, this presents a simple possibility to introduce a mechanical limitation of the end position, which without great requirements as to accuracy stops the motion of the handle somewhere between 100 and 200 % of the determined motion region.

30 There are certain applications where the possibility entirely to avoid an electric connection between the control handle and the control unit is especially advantageous. One example is when there exists extreme electric environments, such as the presence of static electricity, where an electric control handle may be affected in an undesirable way. An additional example is the food industry, where the control handle regularly is
35 subject to severe stresses in the form of high pressure washing, hot water, etc. Yet another example is explosive environments, where the use of electronic components always is a problem. In all these examples, it is clearly more difficult and more

expensive to manage sensitive electronic components in the control handle and multipolar connection cabling between the control handle function satisfactorily than an control handle according to the invention with a helical hose between control handle and control means.

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Quite irrespective of the application, the multipolar cabling between control handle and the control unit with associated contact means in both ends (which is the predominating solution) is a very common reason for shutdowns with said types of lifting devices. A helical hose is thus as such an advantage, as it is more insensitive, robust and cheaper.

10

In many applications, it is desirable to allow the gripping device and the control handle rotate freely in relation to the driving unit, for instance when the operation sequence implies that the operator is moving around in the same direction, turn after turn. The situation described above with a multipolar cabling between the control unit and the control handle may thus only be used if a multipolar swivel means (or current collector) is mounted on the cabling somewhere between the control handle and the driving unit. Said solution is both expensive and a clear drawback as to reliability. The device of the invention only needs a pneumatic swivel to obtain a freely rotating control handle, which is less expensive as well as more reliable.

20

Other advantages of the invention will be apparent of the following description of embodiments.

DESCRIPTION OF DRAWINGS

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The description of embodiments is made with reference to the drawings, in which:

Fig. 1 shows the parts of a conventional lifting device,

Fig. 2 show a cross section of a circular design of the control handle according to the invention,

Fig. 3 shows how the control handle is affected by the upward force applied by the operator,

30

Fig. 4 shows how the control handle is affected by the downward force applied by the operator,

DESCRIPTION OF EMBODIMENTS

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In Fig. 1, a typical lifting device with its essential parts is shown. A driving unit (A) is arranged to lift the control handle (C) and the gripping device (D) by means of a wire (B). The driving unit (A) may for instance be an electric motor with a wire drum or a

pneumatic cylinder with the purpose to supply the lifting force. The driving unit (A) is controlled by a control unit (H), which via the connection (E) and the pressure sensor (F) is provided with information about operator forces influencing the control handle (C).

5

Fig. 2 shows a cross section of a circular control handle according to the invention. The wire (B) emanating from the driving unit is with a shackle (N) connected to the through shaft (K) and further to the gripping device (D). Thus, the lifting force passes straight through the control handle via the shaft (K). A movable outer jacket is provided around said shaft (K), which jacket forms the handle (L) suspending in its lower portion in a slide bearing (Z) and in its upper portion in a resilient membrane (R) by means of screws (V'') and a washer (Q). The membrane (R) is formed as a plate with a centre hole where the outer and inner edges of the plate are fixed to the cover (O) by washers (T), (U) and screws (V'), (V'''), which forms a cavity (P) between the membrane (R) and the cover (O). The cavity (P) will change its volume when the handle portion (L) and hence the membrane (R) is pressed up or down. Said change of volume results in a change of pressure in the cavity, which pressure is measured in the pressure sensor (F) via the connection conduit (S) and the connection hose (E). In the cavity there is another opening to the environment, namely a very small opening (O), the purpose of which is very slowly to leak atmospheric pressure into the cavity. It should be understood that said opening to the inclusion (P, S, E) also may be arranged in another way and further anywhere in connection with the pressure sensor or the hose (E). By leaking atmospheric pressure in this way into the inclusion, the effects of for instance material stresses in the membrane and the dead weight of the handle portion (L) will be "tared" away automatically. The limitation valid for the opening (O) is that it must not leak so rapidly that it injuriously affects normal raising or lowering motions. If the handle portion (L) would be subject to upward or downward forces exceeding the measurement region the end position limitations (X) and (Y) will stop the motion before any permanent damage is established on the membrane or the pressure sensor.

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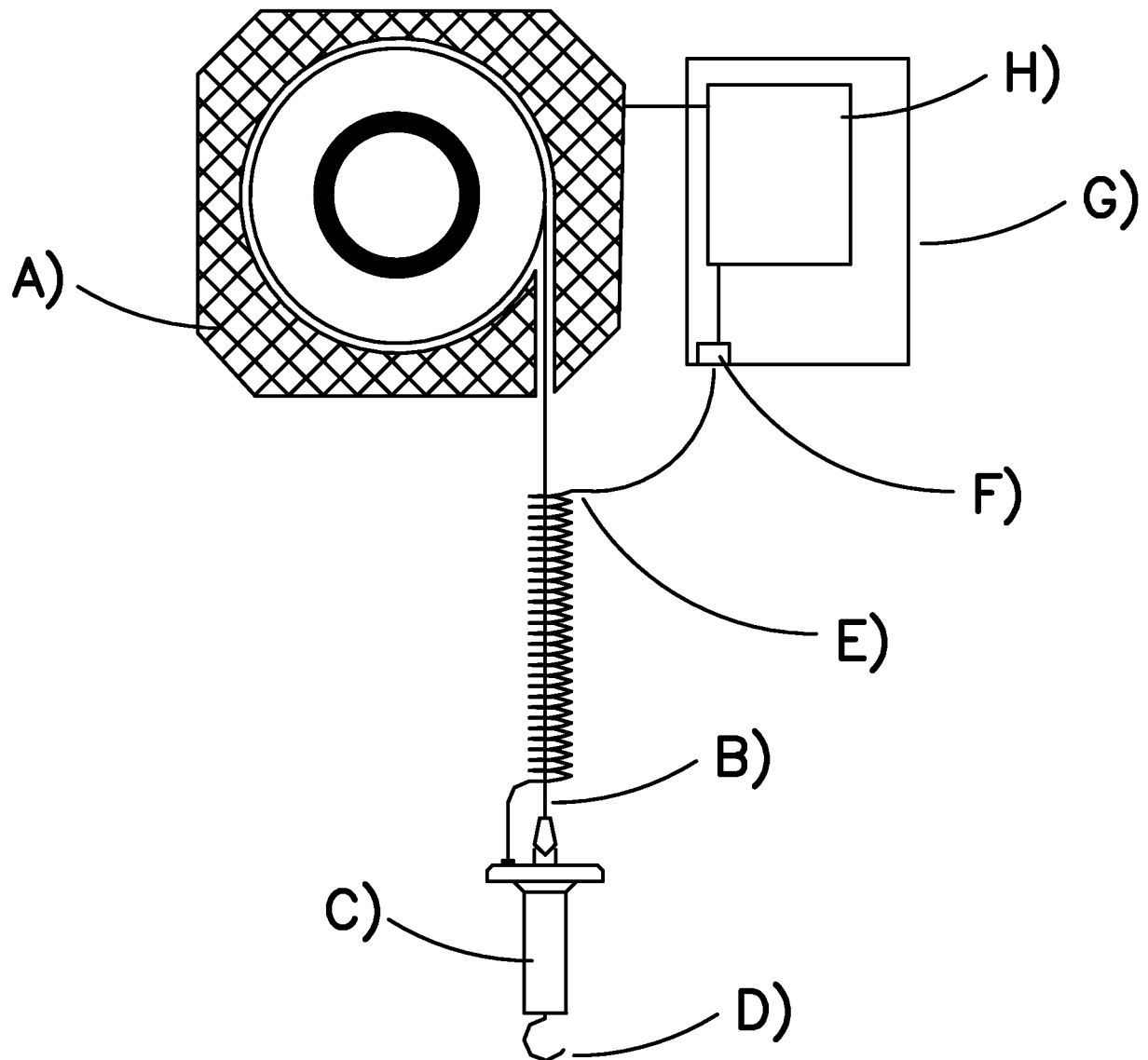
Fig. 3 shows the handle portion (L) in its uppermost position at the end position limitation (X). The cavity (P') has then its very smallest volume and the pressure detected by the pressure sensor is the very highest.

35 Fig. 4 shows the handle portion (L) in its lowest position at the end position limitation (Y). The cavity (P'') has then its very largest volume and the pressure detected by the pressure sensor is the very lowest.

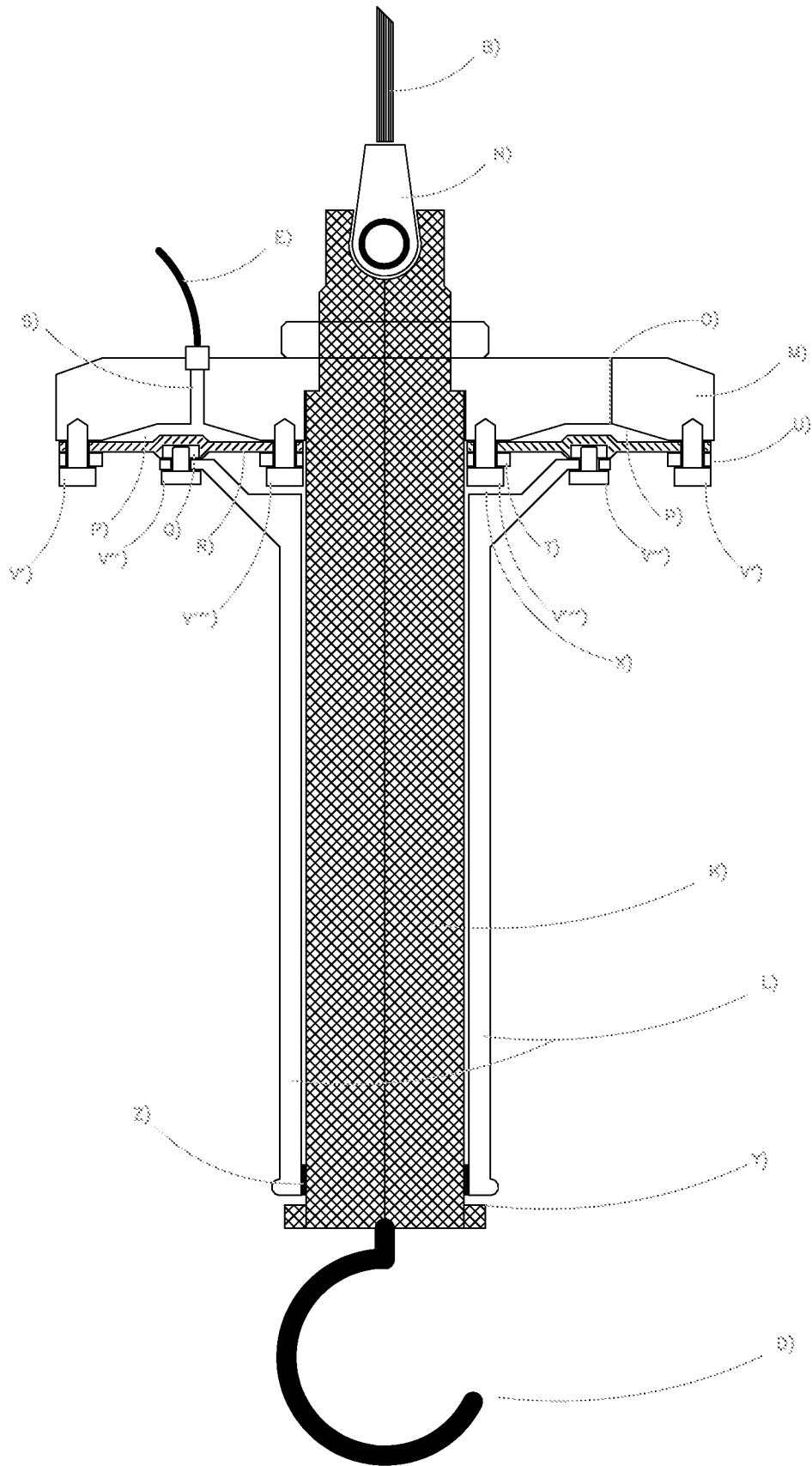
- The gripping device (D), here illustrated as a simple hook, may in many cases be a more complicated mechanism with sensors and activators of different kinds. Therefore, it is an obvious advantage if the membrane (R) and the cavity (P) are designed so that a
- 5 through hole in the centre of the control handle may be used for leading cabling and/or hoses for pneumatic therethrough. The advantage is that the handle may be gripped from any side without being disturbed by said cabling and/or hoses, which otherwise must be brought over the outside of the handle.
- 10 The invention is not limited to the above description but may be varied within the scope of the subsequent claims. Thus, it should for instance be realized that the pressure sensor (F) may also be mounted directly at the cavity (P), and the connection to the control unit (H) may be performed by cabling instead of a hose. Also
- 15 embodiments, where the cavity is arranged on one side of the shaft (L) and hence offers the possibility that the membrane is designed without any centre hole, fall within the scope of the device according to the invention. Nor is it necessary that the cross section of the control handle is circular, as is indicated in the examples above.

CLAIMS

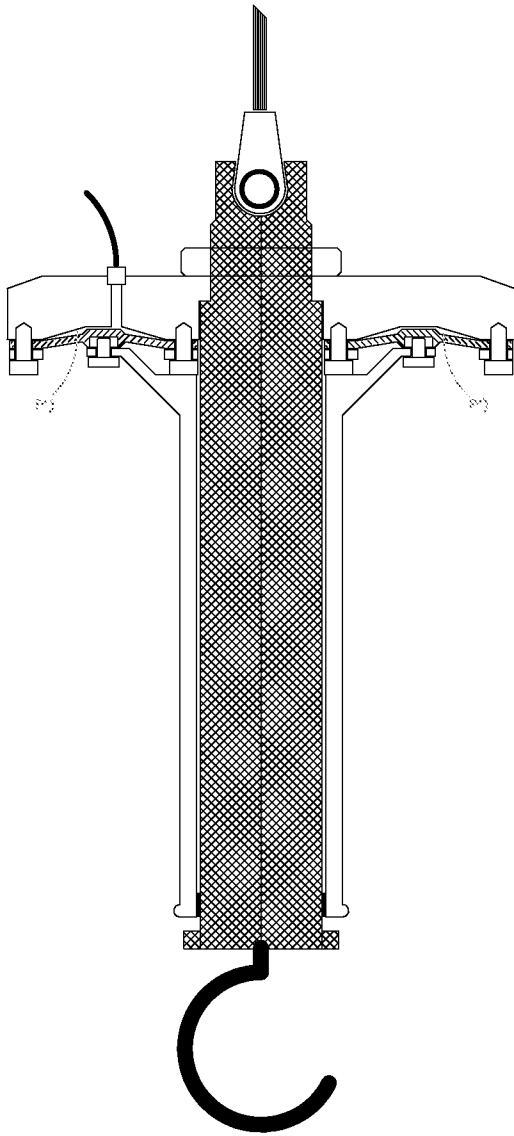
1. A device for measuring the operator's forces applied to a control device (C) for operating a lifting device, which measuring device comprises a movable handle portion (L), which the operator may manipulate, and a control unit (H) which via a driving unit (A) performs the vertical operation, c h a r a c t e r i z e d in that the movable handle portion (L) is mechanically connected to a membrane (R) enclosing a cavity (P) in the control device, which cavity is connected to a pressure sensor (F), the signal from the pressure sensor being used by said control unit (H) for adjusting the vertical motion of the lifting device.
2. A device for measuring forces applied by an operator according to claim 1, c h a r a c t e r i z e d in that the cavity (P) is connected to the surrounding atmosphere through a small leakage (O).
3. A device for measuring forces applied by an operator according to claim 1, c h a r a c t e r i z e d in that the cavity (P) is connected to the pressure sensor (F) being provided adjacent to the control unit (H) through a hose (E).
4. A device for measuring forces applied by an operator according to claims 1 and 3, c h a r a c t e r i z e d in that the hose (E) is provided with a swivel in such a way that the control handle (C) is freely rotatable in relation to the lifting device (A).
5. A device for measuring forces applied by an operator according to claim 1, c h a r a c t e r i z e d in that the region within which the handle portion (L) may move, along the through shaft (K), is limited by mechanical end positions (X, Y).



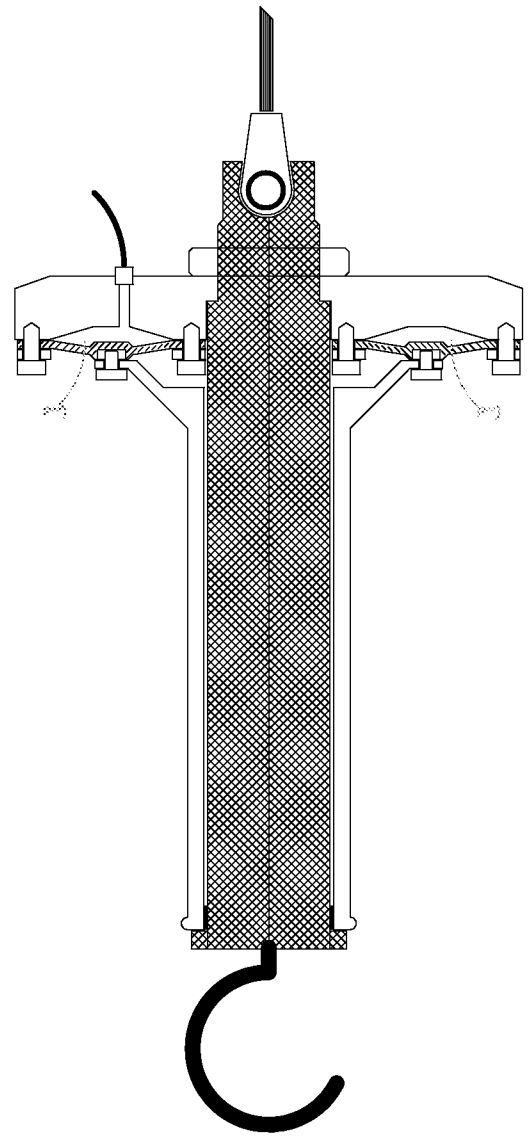
Figur 1.



Figur 2



Figur 3



Figur 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2006/050323

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B66C, B66D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9843911 A1 (KAZEROONI), 8 October 1998 (08.10.1998), page 18, line 7 - line 26, abstract --	1-5
A	US 5772184 A (ZAGUROLI, JR), 30 June 1998 (30.06.1998), column 1, line 60 - column 2, line 18 --	1-5
A	US 3921959 A (ULBING), 25 November 1975 (25.11.1975), column 1, line 22 - line 68 --	1-5
A	SE 364692 B (J E FÄGERSKIÖLD), 4 March 1974 (04.03.1974), see the whole document --	1-5

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

25/11/2006

International application No.
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US	5772184	A	30/06/1998	NONE		

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SE	364692	B	04/03/1974	NONE		
