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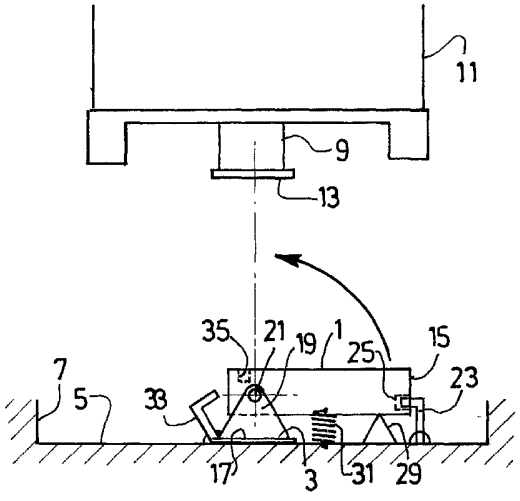
(54) **Title:** SAFETY DEVICE FOR OPERATOR PROTECTION IN LOW-HEIGHT SHAFT BOTTOM END ELEVATORS AND ELEVATOR EQUIPPED THEREWITH



(57) **Abstract:** The safety device according to the invention for operator protection in elevators with a low-height shaft bottom (5), is characterized in that it uses a brace (1) hinged on a base plate (3) secured to the bottom of the shaft (5) and arranged when folded in the horizontal position at a reduced height above the shaft bottom (5) in normal elevator operation, and a buffer element (9) secured underneath the car (11) and adapted to come into contact with a horizontal side surface of the brace (1) in its folded position, wherein said brace (1) is adapted to be moved by an appropriate lifting device (31) to a vertical lifted position in which the buffer element (9) can come into contact with an upper surface (15) of the brace (1), in a condition where the operator can work in the shaft bottom (5), wherein the length of the 15 brace added (1) to the thickness of the buffer element (9) provides for a sufficient depth between the underside of the car (11) and the shaft bottom (5) to suppress any risk for the operator to be crushed in the shaft bottom (5).

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Safety device for operator protection in low-height shaft bottom end elevators and elevator equipped therewith

This invention relates to a safety device for operator protection in elevators with a low-height shaft bottom and an elevator equipped therewith.

Some elevators are known to require a reduced height at shaft bottom, particularly when groundwater layers are located close to ground level. This low height of the shaft bottom relative to the standard height (0.8 to 1.2 m) creates a risk of the maintenance operator being crushed by the elevator car.

This invention aims at solving this problem and proposes a safety device to protect an operator in elevator shafts with a low height bottom end, characterized in that it uses a brace hinged on a base plate secured to the bottom of the shaft and arranged when folded in the horizontal position at a reduced height above the shaft bottom in normal elevator operation, and a buffer element secured underneath the car and adapted to come into contact with a horizontal side surface of the brace in its folded position, wherein said brace is adapted to be moved by an appropriate lifting device to a vertical lifted position in which the buffer element can come into contact with an upper surface of the brace, in a condition where the operator can work in the shaft bottom, wherein the length of the brace added to the thickness of the buffer element provides for a sufficient depth between the underside of the car and the shaft bottom to suppress any risk for the operator to be crushed in the shaft bottom.

This brace length added to the thickness of the buffer can add up to a standard length, i.e. 0.80m to 1.20m according to car speed.

The brace is advantageously arranged in a central position in the shaft bottom, and the opposing buffer element likewise on the car, but a position slightly off-centre is also possible, preferably in the plane of the

car guide rails so as not to produce a harmful lateral stress thereon if the car accidentally hits the brace.

The brace is advantageously tubular with a square or rectangular cross-section, said horizontal side surface facing the buffer element being one of the lateral sides of the tube.

The upper surface of the brace is flat and formed perpendicular to the lateral sides of the tube so that it can be horizontal when the brace is in its vertical lifted position.

The buffer is advantageously a block of rubber or a similar damping material with a steel plate attached or vulcanized on its lower side, said plate being cut horizontally at least in accordance with the dimensions of the rubber block and allowing shocks to be absorbed by the complete surface of the block.

Said brace lifting device can be a helical or spiral spring element pushing the brace to return it to the vertical lifted position, wherein the horizontal folded position in service and the vertical maintenance position of the brace are locked by a respective appropriate locking element.

Said brace lifting device can also comprise an hydraulic cylinder or an electric motor device rotating the brace into its horizontal and vertical useful positions.

The lifting device can be remote controlled by the operator, e.g. as soon as the lowest landing door opens, to access the shaft bottom using the operator's safety key, and/or by a direct command from the operator, e.g. a pressure plate in the shaft bottom detecting the operator's presence through his weight and releasing the lock retaining the horizontal position of the brace.

In addition, a safety switch is provided to control the folded service position of the brace and is mounted in series on the command safety chain of the elevator. This switch is locked in the folded service position of the brace and open in the opposite case to stop any displacement of the elevator.

The invention also relates to an elevator fitted with a safety device to protect the operator in the shaft bottom as defined above.

The invention is illustrated hereafter with a preferred exemplary embodiment described in reference with the appended drawings, in which:

- Figure 1 is a schematic elevation view of the safety device according to the invention in the normal operating position of the elevator,

- Figure 2 shows the device with the brace in the lifted maintenance position,

- Figures 3 and 4 show the contact areas on the brace in its folded service position and its lifted maintenance position, respectively, and

- Figures 5 and 6 show actuating devices for the safety device according to the invention.

Referring to the drawings, and more particularly to Figure 1, the safety device for an elevator shaft bottom end to protect the maintenance operator according to this invention mainly comprises a brace 1 pivotally mounted on a base plate 3 secured to the bottom 5 of the elevator shaft 7 and a buffer element 9 secured underneath the elevator car 11 opposite the brace 1.

The buffer element 9 is a cylindrical rubber bloc, the lower surface whereof is secured to a steel plate 13. The cross-section of the horizontal steel plate 13 has a diameter of about 30cm.

The buffer element 9 is approximately 20cm thick.

The brace 1 is made of a rigid metal tube with a square cross-section. Its length is of approximately 90cm and the length of each side of the square is about 20cm. The side 15 of the right end is closed to form a face perpendicular to the lateral sides.

The base plate 3 is made of a flat bar iron 17 secured to the floor and provided with two outstanding vertical wings 19 arranged on either side of the tube 1. The tube 1 is hinged on the wings 19 by means of a horizontal axle 21 mounted on the supper end of the wings.

The base plate 3 is secured in a central position in the shaft bottom 5.

In normal operation, when the maintenance operator must not access the shaft bottom, the brace 1 is tilted horizontally and held locked in that position by a locking element 23 hooked into a complementary recess 25 in the end surface 15 of the tube.

In this condition, in the event of an accidental uncontrolled fall of the elevator car 11, the latter would fall on the lying horizontal side of the tube 1 and the buffer element 9 would come into contact with the area delimited by a chain dotted line 27 thereon (Figure 3), therefore substantially on the base thereof, which rises about 25cm high from the shaft bottom.

A detector switch 29 secured to the floor opposite the tube 1 detects the tilted position of the brace. This switch is mounted in series with the elevator control chain. Since it is closed when the brace is in the tilted position and open otherwise, it allows the elevator car to move only in this condition.

A helical spring 31 secured to the floor or to the plate 3 and to the tube 1 and compressed when the tube 1 is in the horizontal position allows pushing the latter into the vertical position by simple elastic return (Figure 2), wherein the tube is held in the vertical position by a second locking element 33, which engages another complementary recess 35 of the tube as described above. In this position, as shown in Figure 2, the height from the bottom end of the shaft to the elevator car in case of accidental uncontrolled fall thereof is of about 110cm, which is sufficient to prevent a maintenance operator 37 from being crushed by the car. Therefore, this vertical position of the brace 1 allows a maintenance operator 37 to access the shaft bottom. The contact area 39 of the buffer element on the brace is materialized on Figure 4 by a chain dotted line on the upper surface of the brace, and the contact is applied vertical to the base plate 3 in an area of high resistance,

wherein the shock is absorbed by the deformation of the material of the buffer element 9 being squeezed on the lower steel plate 13.

The command to lift the brace 1 in order to protect a maintenance operator 37 accessing the shaft bottom 5 is an important characteristic of the invention. It is described below according to two complementary variations, which can be installed alone or together to complement each other.

According to a first variation (Figure 5) that protects the direct access of the operator to the bottom shaft, a first access plate 41 is mounted on the shaft bottom 5. This plate covers substantially one half of the bottom surface and is fitted with a pressure detection to detect the weight of at least one foot of the operator to order the release of the element locking the horizontal position 23 of the brace using an appropriate device, so that the spring 31 can instantaneously lift the brace into its vertical position, in which the second lock 33 engages the brace to lock it in its vertical position. The operator is then protected.

The reset to normal operation follows a reverse brace tilting process as the spring 31 is compressed and the element locking the horizontal position 23 is locked again.

The second variation (Figure 6) enables the operator to remotely control the displacement of the brace 1 upwards. It consists in laying a cable 43 to control the element locking the horizontal position 23 between the latter and the lock 45 of the landing door 47 at the lowest floor giving access to the shaft bottom. The opening of the safety lock 45 of this door using a classic triangular key 49 automatically causes the release of the lock 23 and the vertical lift of the brace 1, through said cable 23, so that the operator can safely access the bottom shaft.

This order can also be produced electrically by a contact detecting the use of the unlocking key.

CLAIMS

1. Safety device for operator (37) protection in elevators with a low-height shaft bottom (5), characterized in that it uses a brace (1) hinged on a base plate (3) secured to the bottom of the shaft (5) and arranged when folded in the horizontal position at a reduced height above the shaft bottom (5) in normal elevator operation, and a buffer element (9) secured underneath the car (11) and adapted to come into contact with a horizontal side surface of the brace (1) in its folded position, wherein said brace (1) is adapted to be moved by an appropriate lifting device (31) to a vertical lifted position in which the buffer element (9) can come into contact with an upper surface (15) of the brace (1), in a condition where the operator (37) can work in the shaft bottom (5), wherein the length of the brace added (1) to the thickness of the buffer element (9) provides for a sufficient depth between the underside of the car (11) and the shaft bottom (5) to suppress any risk for the operator (37) to be crushed in the shaft bottom (5).

2. Safety device as per claim 1, characterized in that the length of the brace (1) added to the thickness of the buffer element (9) has a standard length, i.e. 0.80m to 1.20m according to the speed of the car (11).

3. Safety device as per claim 1 or 2, characterized in that the brace (1) is arranged in a central position in the shaft bottom (5), and the opposing buffer element (9) likewise on the car (11).

4. Safety device as per claim 1 or 2, characterized in that the brace (1) is arranged in a slightly off-centre position relative to the shaft bottom (5), and the opposing buffer element (9) likewise on the car (11).

5. Safety device as per claim 4, characterized in that the brace (1) and the buffer element (9) are arranged in the plane of the car (11) guide rails.

6. Safety device as per any one of the preceding claims, characterized in that the brace (1) is advantageously tubular with a square or rectangular cross-section, said horizontal side surface facing the buffer element (9) being one of the lateral sides of the tube (1).

7. Safety device as per any one of the preceding claims, characterized in that the upper surface (15) of the brace (1) is flat and formed perpendicular to its lateral sides so that it can be horizontal when the brace (1) is in its vertical lifted position.

8. Safety device as per any one of the preceding claims, characterized in that the base plate (3) is made of a flat bar iron (17) secured to the floor and provided with two outstanding vertical wings (19) arranged on either side of the tube (1), wherein the tube (1) is hinged on the wings (19) by means of a horizontal axle (21) mounted on the upper end of the wings (19).

9. Safety device as per any one of the preceding claims, characterized in that the buffer element (9) is a block of rubber or a similar damping material with a steel plate (13) attached or vulcanized on its lower side, said plate (13) being cut horizontally at least in accordance with the dimensions of the rubber block and allowing an accidental shock of the car (11) to be absorbed by the complete surface of the block.

10. Safety device as per any one of the preceding claims, characterized in that said brace (1) lifting device is a helical (31) or spiral spring element pushing the brace (1) to return it to the vertical lifted position, wherein the horizontal folded position in service and the vertical maintenance position of the brace (1) are locked by a respective appropriate locking element (23, 33).

11. Safety device as per any one of claims 1 to 9, characterized in that said brace (1) lifting device comprises a hydraulic cylinder or electric motor device rotating the brace (1) into its horizontal and vertical useful positions.

12. Safety device as per any one of the preceding claims, characterized in that the lifting device is remote controlled by the operator (37), e.g. as soon as the lowest landing door (47) opens, to access the shaft bottom (5) using the operator's safety key (49) to release the lock (23) by means of a cable (43) connected thereto and to the door lock (45), and/or by a direct command from the operator (37), e.g. a pressure plate (41) in the shaft bottom (5) detecting the operator's presence through his weight bearing on at least one foot to release the lock (23).

13. Safety device as per any one of the preceding claims, characterized in that it includes a safety switch (29) to control the folded service position of the brace (1) that is mounted in series on the command safety chain of the elevator, wherein this switch (29) is closed when the brace (1) is in the folded operating position and open otherwise to stop any displacement of the elevator.

14. Elevator equipped with a safety device for operator protection in the shaft bottom as per any one of the preceding claims.

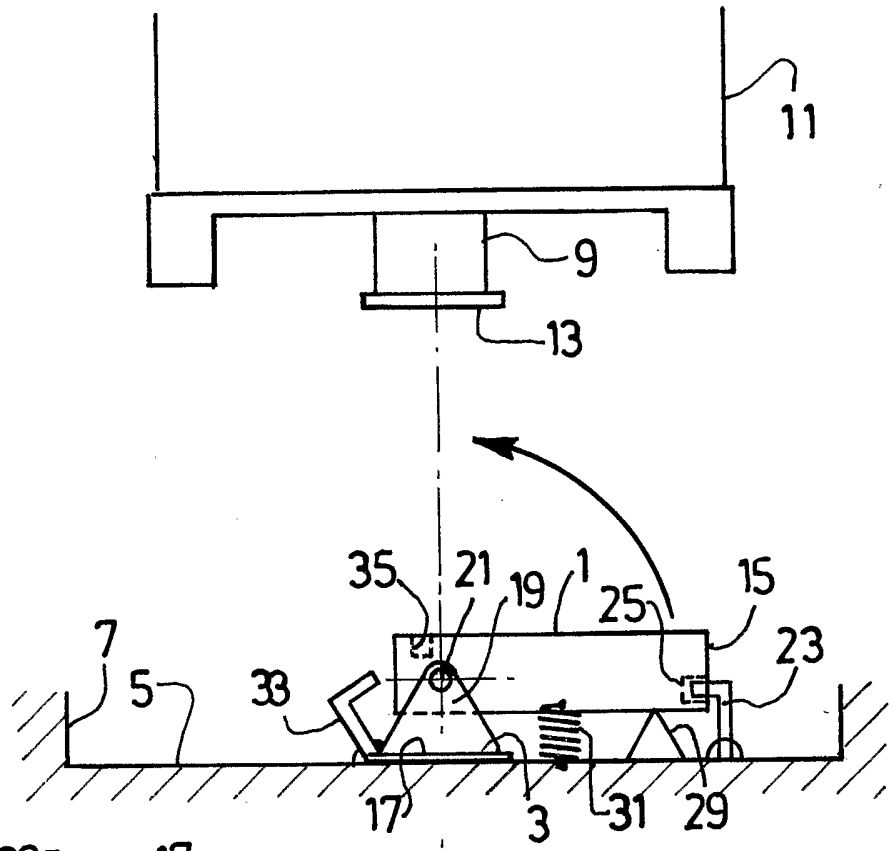

FIG.1

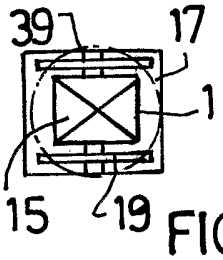

FIG.4

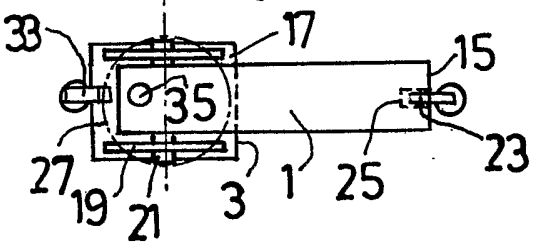

FIG.3

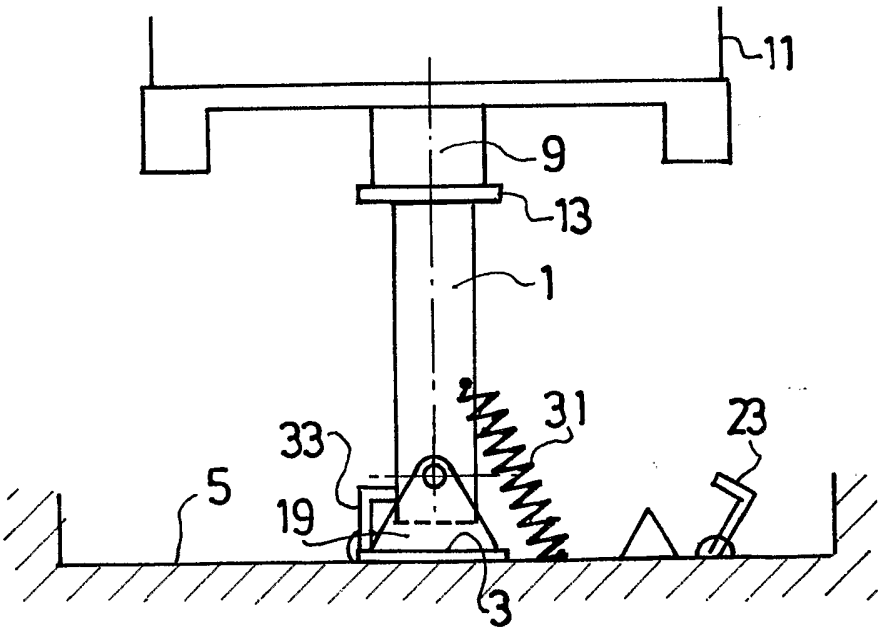

FIG.2

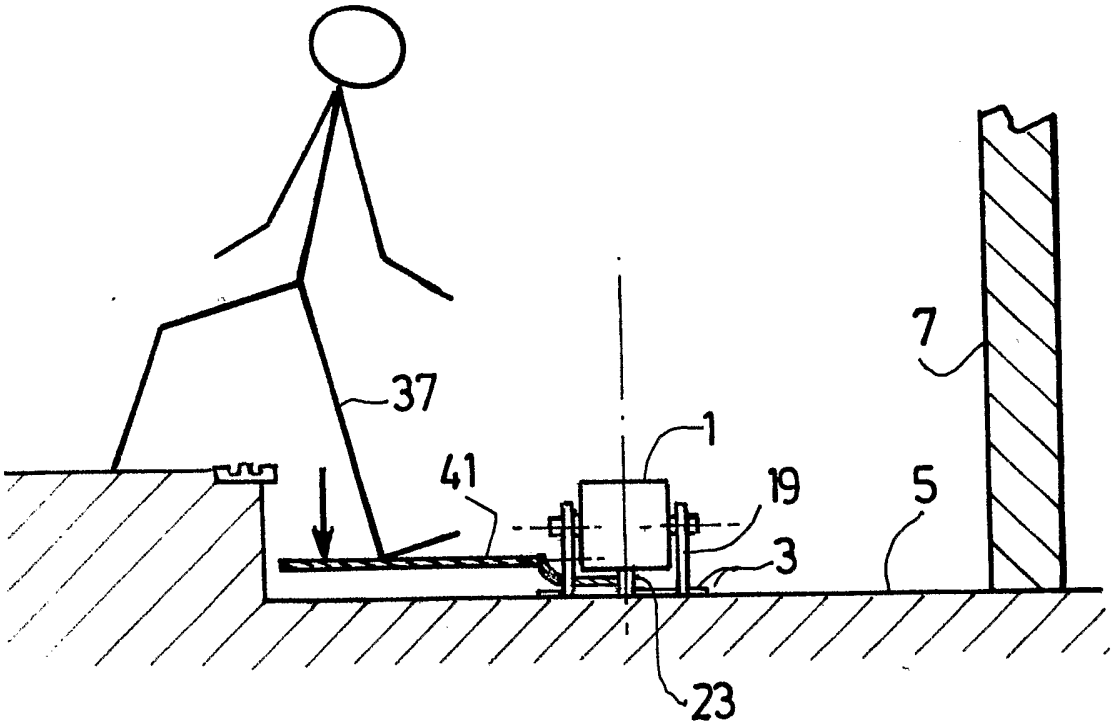

FIG.5

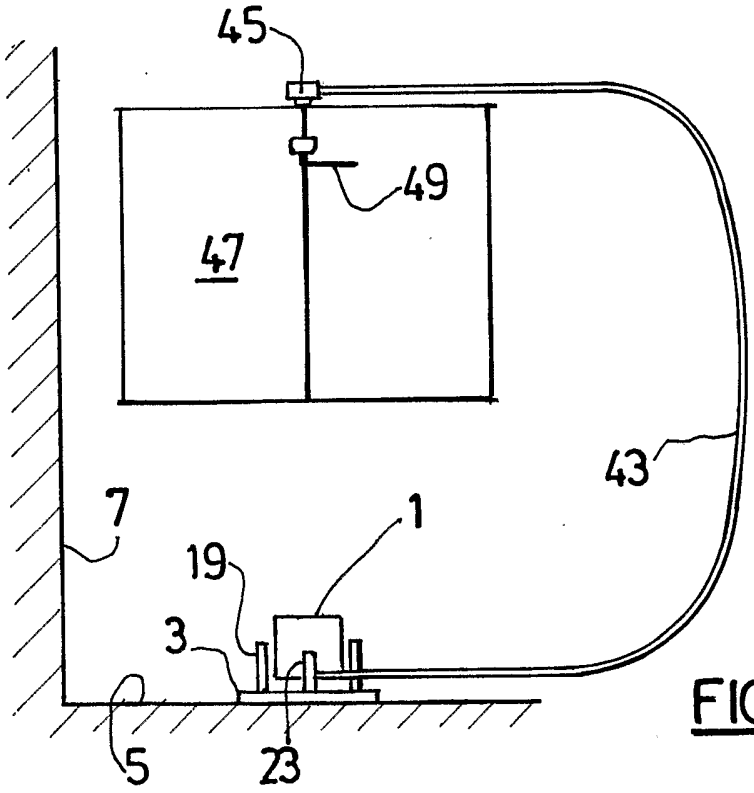

FIG.6

INTERNATIONAL SEARCH REPORT

IB2004/001560

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B66B5/00

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 7 B66B

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

Electronic data base consulted during the international search (name of data base and, where practical, 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 99/47447 A (KONE CORP ; SYRMAN TIMO (FI); HAEGG JORI (FI); KETOVIITA SEPPO (FI)) 23 September 1999 (1999-09-23) page 6, line 23 - page 7, line 20	1-14
A	US 5 806 633 A (MACUGA HENRY J) 15 September 1998 (1998-09-15) column 3, line 60 - column 6, line 38	1-14
A	CH 667 638 A (INVENTIO AG) 31 October 1988 (1988-10-31) abstract	1-14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 January 2005	21/01/2005

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

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