



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.05.2011 Bulletin 2011/18

(51) Int Cl.:
E05D 13/00 (2006.01)

(21) Application number: **10188522.6**

(22) Date of filing: **22.10.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Champion Door OY**
85500 Nivala (FI)

(72) Inventor: **Hosio, Pekka**
FI-85500, Nivala (FI)

(74) Representative: **Vanhala, Jorma Kalevi**
Berggren Oy Ab
Kirkkokatu 9
90100 Oulu (FI)

(30) Priority: **27.10.2009 FI 20096100**

(54) **Safety catch for vertically movable door and vertically movable door**

(57) The vertically movable door has a flexible door plate, a hoist mechanism for lifting and lowering the door plate and a lower beam, which is attached with suspension members, such as hoist lines (34), to the hoist mechanism. In the edges of the door plate there are side rails guiding the vertical movement of the door plate. The vertically movable door has a safety catch, which has a protruding locking cam (56), which attaches to the side rail. The safety catch prevents the uncontrolled falling of the vertically movable door due for example to the breaking of the suspension member. The safety catch comprises a catch plate (30), wherein said locking cam is formed, a turning axis (32) for attaching the catch plate in a ro-

tating manner to the lower beam of the vertically movable door and attaching members for attaching the hoist line to the catch plate. The catch plate is arranged to rotate into a locking position, where the locking cam is pushed up, when the tension force of the suspension member attached thereto falls below a predetermined value. Correspondingly the catch plate is arranged to remain in a standby position, where the locking cam is not protruding, when the tension force of the suspension member attached thereto exceeds the predetermined value. The locking cam is arranged to protrude from the vertical edge of the door plate in the direction of the tangent of the door plate. The side rails comprise a catch rail (60), which has locking holes (70) for receiving the locking cam.

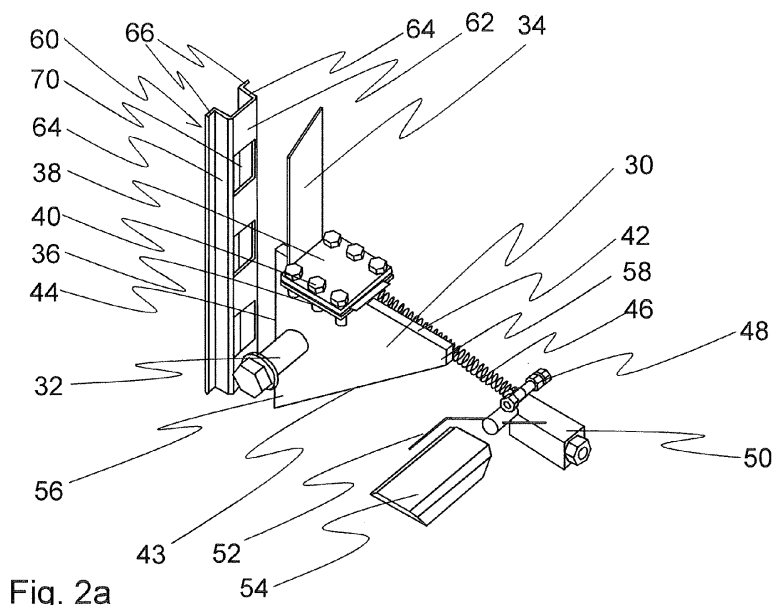


Fig. 2a

Description

[0001] The invention relates to a safety catch for a vertically movable door, which safety catch has a protruding locking cam. The invention also relates to a vertically movable door, which has a door plate, a hoist mechanism for lifting and lowering the door plate, a lower beam, which is attached with suspension members, such as hoist lines, to the hoist mechanism, side rails guiding the vertical movement of the door plate on both vertical edges of the door plate, and a safety catch, which has a protruding locking cam, which attaches to the side rail.

[0002] Vertically movable doors of fabric are generally used as partitions in manufacturing spaces and rooms, and as doors of passages in halls and facilities. Vertically movable doors of fabric with two fabrics have an inner and an outer fabric, between which there are transverse horizontal reinforcements. In the upper edge of the vertically movable door there is an upper casing, wherein the hoist mechanism of the door and the motor belonging thereto are placed. In the lower edge of the vertically movable door there is a lower beam, which is connected to the hoist mechanism with at least two hoist lines or wires travelling between the inner and outer fabric. In the vertical edges of the vertically movable door there are edge rails, which guide the linear movement of the horizontal reinforcements and the lower beam. The vertically movable door is opened by lifting the lower beam upwards with the aid of the hoist mechanism, whereby the horizontal reinforcements are gathered on the lower beam and the inner and outer fabrics are folded on different sides of the lower beam. The vertically movable door is correspondingly closed by lowering the lower beam suspended on the hoist lines or wires against the lower edge of the opening. Vertically movable doors of fabric are typically large. The width and height of a vertically movable door functioning for example as a partition in an industrial hall or as the door of an aircraft hangar can be several meters.

[0003] In order to ensure the operational safety of vertically movable doors of fabric they must be equipped with safety catches, which prevent uncontrolled falling of the door due for example to the breaking of the hoist lines or wires, the lower beam getting stuck or some other damage to the hoist mechanism. A vertically movable door is known from publication US 4368770, both surfaces of the door plate of which door are manufactured from fabric or a flexible material. Between the surfaces there are transverse beams, which reinforce the door plate. The lowest transverse beam is attached with wires to the hoist mechanism at the top of the door. In the vertical edges of the doors there are U-shaped guide rails, which guide the ends of the transverse beams to move in the direction of the guide rails. In the junction between the lowest transverse beam and the hoist wire there is a safety catch, which comprises a casing, wherein there is a latching mechanism. The ends of the latches protrude from the casing against flanges on the guide rails, when

the load of the hoist wire falls below a predetermined threshold value.

[0004] In this solution the safety catch locks onto the guide rail by means of friction between the ends of the latches and the flanges of the guide rail. A locking occurring only by means of friction is unreliable and may lead to the locking failing, which results in the falling of the vertically movable door. The latching mechanism of the safety catch further comprises several hinge joints and axes passing through holes, which easily get stuck for example due to fouling. The complicated structure of the safety catch, which comprises several moving parts, diminishes its operational reliability.

[0005] The object of the invention is to provide a safety catch, which prevents the falling of a vertically movable door, and a vertically movable door, with which disadvantages and flaws relating to the prior art can be significantly reduced.

[0006] The objects of the invention are obtained with a safety catch and a vertically movable door, which are characterized in what is presented in the independent claims. Some advantageous embodiments of the invention are presented in the dependent claims.

[0007] The safety catch of the vertically movable door according to the invention has a protruding locking cam, which in a malfunction of the hoist mechanism locks onto the side rail of the vertically movable door and prevents the uncontrolled falling of the vertically movable door. The safety catch comprises a catch plate, wherein said locking cam is formed, a turning axis for attaching the catch plate in a rotating manner to the vertically movable door and attaching members for attaching the suspension members of the vertically movable door, such as the hoist line, to the catch plate. The suspension member is thus attached to the vertically movable door by means of the catch plate.

[0008] In an advantageous embodiment of the safety catch the catch plate is arranged to rotate into a locking position, where the locking cam is pushed up, when the tension force of the suspension member, such as the hoist line, attached thereto falls below a predetermined value. The catch plate is advantageously arranged to remain in a standby position, where the locking cam is not protruding, when the tension force of the suspension member, such as the hoist line, attached thereto exceeds the predetermined value.

[0009] In a second advantageous embodiment of the safety catch the center of gravity of the catch plate is at a distance from the vertical line passing through the turning axis when the safety catch is in its operational position. The eccentric position of the center of gravity of the catch plate in relation to the turning axis makes the catch plate turn automatically into the locking position when the tension force of the suspension member decreases. The safety catch advantageously further comprises an actuating member, such as a spring or an actuator functioning with the aid of an external power source, for rotating the catch plate around the turning axis.

[0010] The vertically movable door according to the invention has a flexible door plate, a hoist mechanism for lifting and lowering the door plate, a lower beam, which is attached to the hoist mechanism with suspension members, such as hoist lines, and side rails guiding the vertical movement of the door plate on both vertical edges of the door plate. The vertically movable door is advantageously a vertically movable door of fabric made with two fabrics, which folds upwards. The vertically movable door has a safety catch, which has a protruding locking cam, which attaches to the side rail. The safety catch prevents the uncontrolled falling of the vertically movable door due for example to the breaking of the suspension member. The safety catch comprises a catch plate, wherein said locking cam is formed, a turning axis for attaching the catch plate in a rotating manner to the lower beam of the vertically movable door and attaching members for attaching the suspension member of the vertically movable door, such as the hoist line, to the catch plate.

[0011] In an advantageous embodiment of the vertically movable door the catch plate is arranged to rotate into a locking position, where the locking cam is pushed up, when the tension force of the suspension member, such as the hoist line, attached thereto falls below a predetermined value. The catch plate is advantageously arranged to remain in a standby position, where the locking cam is not protruding, when the tension force of the suspension member, such as the hoist line, attached thereto exceeds the predetermined value.

[0012] In a second advantageous embodiment of the vertically movable door said locking cam is arranged to protrude from the vertical edge of the vertically movable door in the direction of the tangent of the door plate. The side rails advantageously comprise a catch rail, which has locking holes for receiving the locking cam.

[0013] It is an advantage of the safety catch according to the invention that it is structurally simple and contains very few moving parts. A simple device is inexpensive to manufacture and functionally reliable.

[0014] It is a further advantage of the invention that the locking obtained by means of it is very reliable.

[0015] In the following, the invention will be described in detail. In the description, reference is made to the appended drawings, in which

Figure 1 shows as an example a vertically movable door according to the invention seen from the front,

Figure 2a shows as an example a safety catch according to the invention in a standby state,

Figure 2b shows the safety catch shown in Figure 2a in a locking state, and

Figure 3 shows as an example one end of the lower beam of a vertically movable door according to the invention.

[0016] Figure 1 shows as an example a vertically movable door according to the invention seen from the front. The vertically movable door shown in Figure 1 is a so-called vertically movable door of fabric with two fabrics, which folds upwards, which has a rectangular flexible door plate 10. The door plate comprises two substantially parallel surface fabrics at a distance from each other, a first surface fabric 12 and a second surface fabric 14, and a number of horizontal reinforcements 16 between the first and second surface fabrics. The horizontal reinforcements are beam-like parts preferably of aluminum, which are situated in a horizontal position at a distance from each other. The surface fabrics are polyester web reinforced PVC fabric or some other sufficiently durable fabric material suited for the purpose. The surface fabrics are advantageously protected from fire, mould and UV light. In the lower edge of the door plate there is a case-like lower beam 18 and in the upper edge of the door plate there is an upper casing 20, wherein the hoist mechanism of the door plate is placed. The hoist mechanism includes an axis substantially as long as the width of the door plate, in both ends of which there is a roll for the hoist line or hoist wire (the axis and the rolls are not shown in the figure) and a motor 22 for rotating the axis. The operation of the hoist mechanism is controlled from a control center 24, which is placed beside the vertically movable door on the wall of the space. In the vertical edges of the vertically movable door there are side rails 26a, 26b, which guide the ends of the lower beam and the horizontal reinforcements to move in the direction of the side rails.

[0017] Figures 2a and 2b show as an example the safety catch of a vertically movable door according to the invention seen diagonally from above. Figure 2a shows the safety catch in the standby state and Figure 2b shows the same safety catch in the locking state. When the safety catch is in the standby state it does not prevent the vertically movable door from moving in any way, but in the locking state it prevents the door from descending downwards. The safety catches are placed in the ends of the lower beam 18 of the vertically movable door, so that each vertically movable door has two safety catches, of which the first locks onto the first side rail of the vertically movable door and the second onto the second side rail of the vertically movable door. Figures 2a and 2b show a catch rail 60 belonging to the first side rail of the vertically movable door and a safety catch in the first end of the lower beam. In order to better bring out the structure of the safety catch, the lower beam is not shown in the figure.

[0018] The safety catch according to the invention comprises a triangular catch plate 30, through which the turning axis 32 passes. The turning axis is at its ends supported on the side walls of the case-like lower beam, which are not shown in the figure. The attachment of the turning axis is arranged so that it can rotate around its longitudinal axis. A lower attaching plate 36 is attached to the first edge 42 of the catch plate and an upper at-

taching plate 38 is attached with bolts 40 to the lower attaching plate. The end of the hoist line 34 is pressed between the upper and lower attaching plate. The attaching point of the hoist line is placed so that the hoist line settles on the same vertical line as the turning axis in the standby state. The first edge 42 of the catch plate is thus in a substantially horizontal position and the second edge 44 of the catch plate is in a substantially vertical position. The third edge 43 of the catch plate makes up a sharp angle with the first edge and the second edge. In the junction between the second edge 44 and the third edge 43 there is a sharp locking cam 56 and in the junction between the first edge 42 and the third edge there is a blunt stop cam 58. The material of the catch plate is metal, such as steel or aluminum.

[0019] On the side of the catch plate there is a spring 46, which is attached at its first end to the catch plate below the lower attaching plate 36 and at its second end to the attaching pin 48 in the side wall of the lower beam. The safety catch further includes a micro switch 50, which is connected with conductors to the control center 24 (the conductors are not shown in the figures). The micro switch has a control lever 52, the pressing of which sends a halt command for the motor to the control center. Correspondingly releasing the control lever returns the motor to its normal operational state. Inside the lower beam there is further a plate-like stop 54, which sets an upper limit to the turning angle of the catch plate.

[0020] The safety catch cooperates with the catch rail 60 in the side rails. The catch rail is a U profile, which has a web 62 and two flanges 64 attached to the edges of the web. In the free edges of the flanges there are further sides 66, which turn in a right angle from the plane of the flanges. The sides can have attaching holes for attaching to the side rails. The web has a number of penetrating locking holes 70 for receiving the locking cam 56 of the catch plate 30. The locking holes have a square shape and their width is substantially equal to the width of the web. There are locking holes at a distance from each other over the entire length of the catch rail. The distance between two adjacent locking holes is essentially equal to the height of the locking hole in the direction of the catch rail. The catch rail can be a separate part to be attached to the side rail, as in Figures 2a and 2b, or it can be formed as a fixed part of the side rail.

[0021] The safety catch according to the invention functions in the following manner: In a normal use situation of the vertically movable door the safety catch is in the standby state according to Figure 2a. The lower beam 18 of the vertically movable door is supported at its both ends with hoist lines to a hoist mechanism, whereby a load is directed onto the hoist lines. The magnitude of the load depends on the own weight of the lower beam and on the weight of the horizontal reinforcements and folded surface fabrics on top of it. The load generates tension force on the hoist lines. The tension force of the hoist line holds the catch plate 30 in the position according to Figure 2a, where the second edge 44 is in a sub-

stantially vertical position. The tip of the locking cam 56 thus points straight downwards.

[0022] If the tension force of the hoist line decreases for some reason, it can no longer maintain the position of the catch plate. The decrease in tension force can for example be caused by breaking of the hoist line, the end of the lower beam getting stuck in the side rail or a sudden damage to the hoist mechanism. The catch plate thus turns around its turning axis 32 into the locking position shown in Figure 2b. Simultaneously the locking cam 56 rotates out from the end surface of the lower beam and is pushed into the locking hole 70 in the catch rail. The stop cam 58 of the catch plate settles against the stop 54, which stops the rotating movement of the catch plate. In the locking position the locking cam settling in the locking hole of the catch rail thus prevents the lower beam from descending downwards, i.e. the end of the lower beam locks onto the catch rail. Simultaneously the stop cam 58 of the catch plate presses the control lever 52 of the micro switch 50 downwards, which stops the motor of the vertically movable door.

[0023] The turning of the catch plate occurs due to the traction force of the spring 46 and due to the own gravitational force of the catch plate. Turning due to gravitational force occurs because the center of gravity of the catch plate is situated at a distance from the vertical line passing through the turning axis 32. The shape and size of the catch plate can be dimensioned so that the gravitational force directed thereto is on its own sufficient to turn the catch plate into the locking position. To assist the gravitational turning or instead of it, some other mechanism can be used, such as the spring 46 shown in the figures. Some kind of actuator can also be used in the turning of the catch plate, which actuator is activated when the tension force of the hoist line falls below a predetermined threshold value. The actuator can for example function with pressurized air or electricity.

[0024] The turning of the catch plate thus occurs when the tension force of the hoist line falls below a predetermined threshold value. This threshold value is determined based on the own weight of the catch plate and the location of the center of gravity, on the spring force of the spring 46 and/or on the force component directed onto the catch plate by the actuator which turns the catch plate. In practice the own weight of the lower beam of the vertically movable door always generates a tension force, which is larger than the afore-mentioned threshold value, i.e. it is sufficient to hold the safety catch in the standby position. Falling below the threshold value of the tension force in practice occurs mainly in situations, where the hoist line breaks or the lower beam of the descending vertically movable door gets stuck in the side rail, wherein the own weight of the lower beam does not load the hoist line unraveling from the roll of the hoist mechanism.

[0025] Figure 3 shows as an example one end of the lower beam of a vertically movable door according to the invention partially slit open. The lower beam is a tube-

like elongated part, the cross-section of which has a rectangular shape, which part is connected at both ends to the side rails of the vertically movable door. Figure 3 shows a part of the side rail 26a of the first edge of the vertically movable door. The side rails are metal profiles, the cross-section of which resembles a letter C, which have two flanges, a first flange 92 and a second flange 94 and a web 90. In the free edges of the flanges there are edges pointing toward each other. The end parts of the lower beam are shaped so that they have a first side 82 extending to the side of the first flange 92 of the side rail, a second side 84 extending to the side of the second flange of the side rail, and an inner part 86 resembling a letter T, which extends into the gap limited by the first flange, the second flange and the web. The above-described design of the end part of the lower beam makes possible the movement of the lower beam up- and downwards in the direction of the longitudinal axis of the side rail, but prevents the end of the lower beam from diverging from the side rail in the longitudinal direction of the lower beam or in the transverse direction of the side rail. The safety catch according to the invention is placed inside the end part of the lower beam so that in the standby state only the ends of the turning axis 32 extending outside the walls of the lower beam can be seen. There is a hole 88 in the wall of the lower beam, through which the hoist line 34 attached to the catch plate passes. The catch rail 60 is placed inside the side rail 26a against the surface of the web 90.

[0026] Some advantageous embodiments of the safety catch and vertically movable door according to the invention have been described above. The invention is especially well suited for use in flexible vertically movable doors of fabric, but it can also be used in other vertically movable door structures, such as vertically movable doors constructed of stiff lamellae. The invention is not limited to the solutions described above, but the inventive idea can be applied in numerous ways within the scope of the claims.

Claims

1. A safety catch of a vertically movable door, which safety catch has a protruding locking cam (56), **characterized in that** it comprises a catch plate (30), wherein said locking cam is formed, a turning axis (32) for attaching the catch plate in a rotating manner to the vertically movable door and attaching members (36, 38, 40) for attaching a suspension member of the vertically movable door, such as a hoist line (34), to the catch plate.
2. The safety catch according to claim 1, **characterized in that** the catch plate (30) is arranged to rotate into a locking position, where the locking cam (56) is pushed up, when the tension force of the suspension member, such as the hoist line (34), attached

thereto falls below a predetermined value.

3. The safety catch according to claim 1 or 2, **characterized in that** the catch plate (30) is arranged to remain in a standby position, where the locking cam (56) is not protruding, when the tension force of the suspension member, such as the hoist line (34), attached thereto exceeds a predetermined value.
4. The safety catch according to any of the claims 1-3, **characterized in that** when the safety catch is in the operational position the center of gravity of the catch plate (30) is at a distance from the vertical line passing through the turning axis (32).
5. The safety catch according to any of the claims 1-4, **characterized in that** it further comprises an actuating member, such as a spring (46) or an actuator, for rotating the catch plate (30) around the turning axis.
6. The safety catch according to any of the claims 1-5, **characterized in that** the catch plate (30) has a stop cam (58), which limits its rotation.
7. A vertically movable door, which has a door plate (10), a hoist mechanism (22) for lifting and lowering the door plate, a lower beam (18), which is attached with suspension members, such as hoist lines (34), to the hoist mechanism, side rails (26a, 26b) guiding the vertical movement of the door plate on both vertical edges of the door plate and a safety catch, which has a protruding locking cam (56), which attaches to the side rail, **characterized in that** said safety catch comprises a catch plate (30), wherein said locking cam is formed, a turning axis (32) for attaching the catch plate in a rotating manner to the lower beam (18) of the vertically movable door and attaching members (36, 38, 40) for attaching the suspension members of the vertically movable door, such as the hoist line (34), to the catch plate.
8. The vertically movable door according to claim 7, **characterized in that** the catch plate (30) is arranged to rotate into a locking position, where the locking cam (56) is pushed up, when the tension force of the suspension member, such as the hoist line (34), attached thereto falls below a predetermined value.
9. The vertically movable door according to claim 7 or 8, **characterized in that** the catch plate (30) is arranged to remain in a standby position, where the locking cam (56) is not protruding, when the tension force of the suspension member, such as the hoist line (34), attached thereto exceeds a predetermined value.

10. The vertically movable door according to any of the claims 7-9, **characterized in that** said locking cam (56) is arranged to protrude from the vertical edge of the vertically movable door in the direction of the tangent of the door plate (10). 5
11. The vertically movable door according to any of the claims 7-10, **characterized in that** said side rails (26a, 26b) comprise a catch rail (60), which has locking holes (70) for receiving the locking cam (56). 10
12. The vertically movable door according to any of the claims 7-11, **characterized in that** it is a vertically movable door of fabric with two fabrics, which folds upwards. 15

20

25

30

35

40

45

50

55

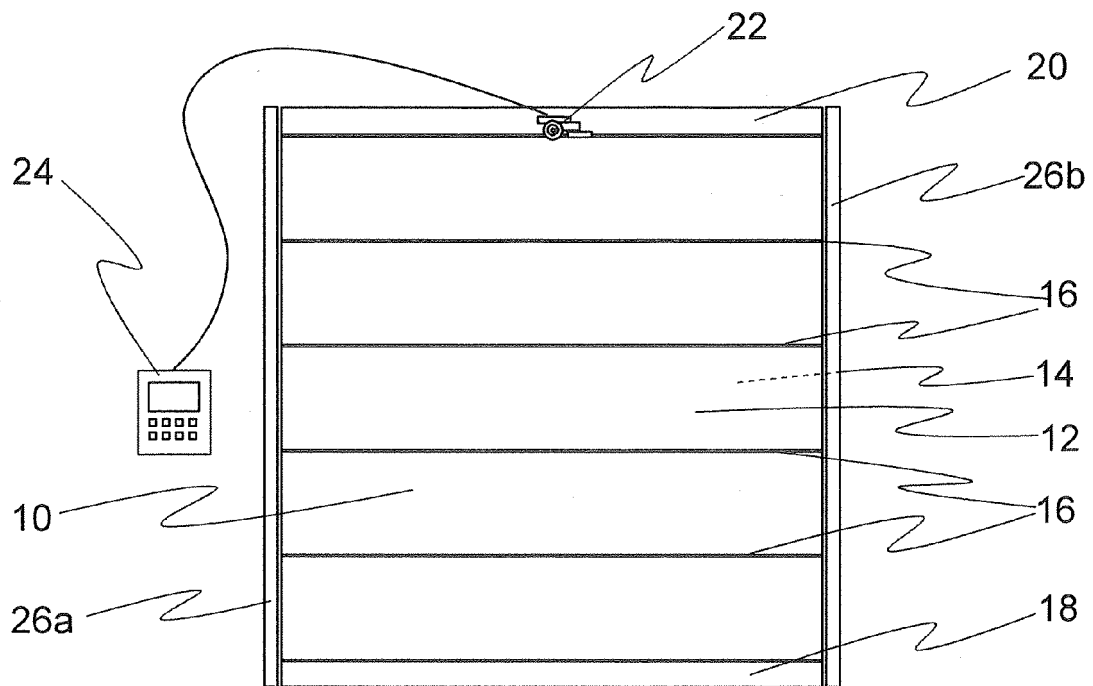


Fig. 1

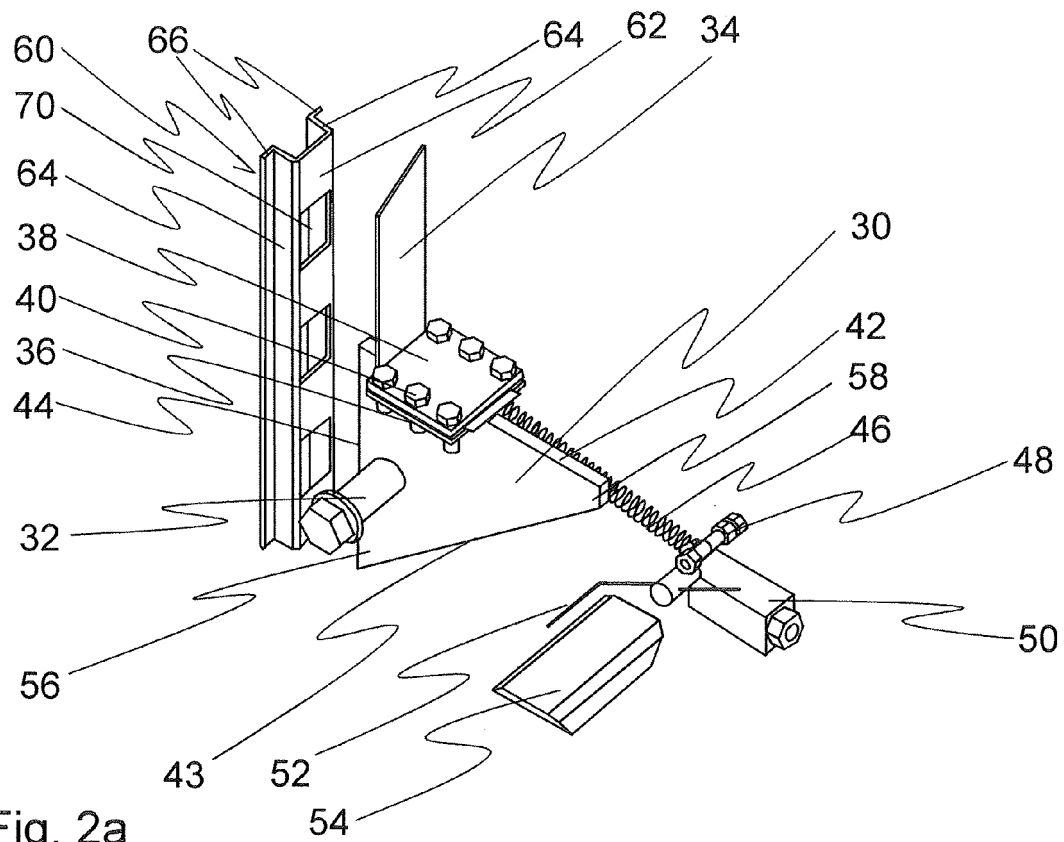
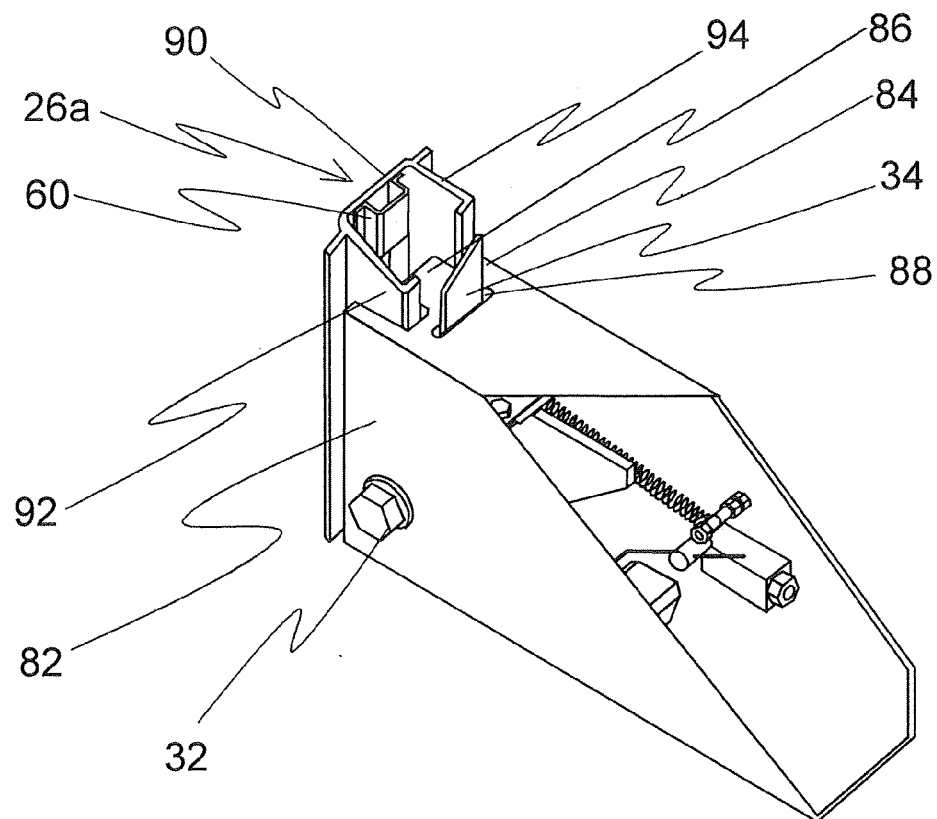
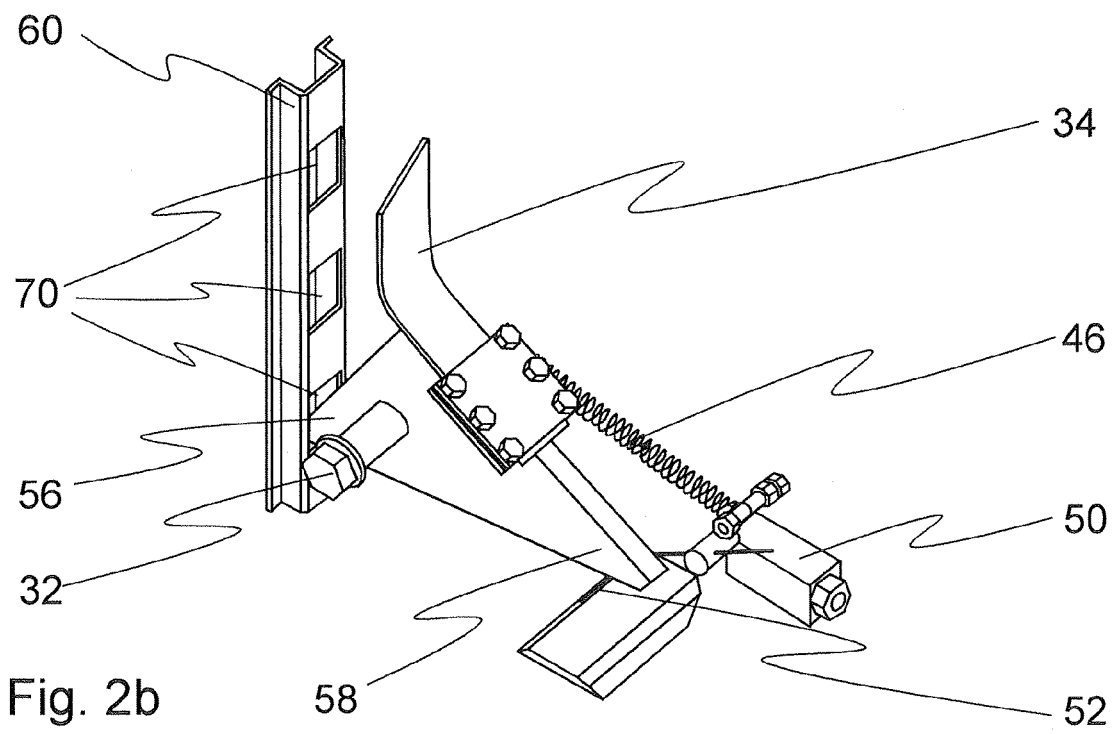


Fig. 2a



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4368770 A [0003]