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BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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- (54) **Title:** MECHANICAL EMERGENCY FALL BRAKE FOR ELEVATOR

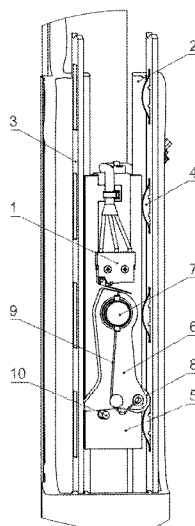


FIG. 1

(57) **Abstract:** This description presents emergency brake design used in elevators or other equipment requiring emergency stop functionality to be ensured in event of uncontrollable falling. The emergency brake device comprises stopping rail (consisting of working strips, guide rails etc), slider, stopping member, power switch, and other components. Functioning of emergency brake is based on inertial force, with the going above predetermined limit of which in case of increased speed of stopping member end of stopping member changes movement trajectory, gets in deeper and fails to get out of hole in stopping strip on time and props against hole edge. Stopping member is secured to elevator platform or other device the falling of which must be stopped. Emergency falling is stopped by stopping member propping against hole edge. The main advantages of this invention compared to other solutions in related art are: this system is fully autonomous, it needs no additional source of energy, it is adaptable for different elevator systems regardless of the way elevator platform is secured (with ropes or in some different way), and after engagement of emergency brake it is uncomplicated to put the elevator system back into normal working condition.

MECHANICAL EMERGENCY FALL BRAKE FOR ELEVATOR

FIELD OF THE INVENTION

The presented invention relates to elevation equipment, more specifically to elevator fall emergency stopping devices.

DESCRIPTION OF RELATED ART

The description contained herein presents technical solution for implementation of elevator fall emergency stopping device. The essential part of the solution is oblong swaying stopping member. Stopping member is pivotally secured to elevator platform via auxiliary member or without it. One end of base of stopping member has wheel and opposite end of the said base exhibits expansion of base. With elevator operating in normal conditions end of stopping member rests through wheel on stopping device strip with convexities and concavities and moving along this strip follows the said convexities and holes. Expanded end located at base part opposite to wheel sways and enters and exits holes located in front of said convexities and concavities. If elevator moves faster than normal, expanded end of stopping member gets late to exit hole and props against hole edge to stop elevator from moving or falling. Once emergency situation is resolved, elevator can be put back into normal operation as emergency brake does not get stuck and no additional measures are needed to ensure continuation of normal operation of elevator.

Patent application WO2011146073A1 (published on 24 November 2011) presents elevator car stopping device where stopping member when stopping becomes needed gets inserted into holes in car rail, causing elevator car to stop. Stopping member is controlled and pushed into stopping position in rail by electrically controllable solenoid. This stopping system needs electric power to work, system will not function without additional source of energy, in this respect the system is not autonomous and it is unreliable either.

Patent application US5651429A (published on 29 July 1997) presents elevator emergency stopping system where stopping member in case of emergency stopping gets lifted from its normal position and its free end props against stopping protrusions. This prevents elevator from free-falling. In its normal position stopping member is downwards inclined because of its own weight, but when free falling of elevator begins stopping member free end rises to stopping or near-stopping position. We can see that stopping member rises only if elevator fall acceleration is rapid. If elevator starts falling with low acceleration (for example, if regular brakes are partially working), there is a great possibility that stopping member will not rise and therefore not stop the falling. It should also be very complicated to adjust stopping member triggering moment so that it is appropriate. It is mentioned in the application that the stopping system is intended for stopping elevator as it is doing free-fall acceleration, however such great acceleration is often unacceptable and dangerous to emergency stopping systems.

There are quite a number of patent documents disclosing elevator fall systems that get activated after rope holding elevator car breaks. One of the oldest elevator emergency stopping systems of this type is described in patent document US1220992A (published on 27 March 1917). Stopping members attached to rope holding lift cage are in normal operating position when rope is tight. If holding rope breaks, one end of stopping member falls due to its own weight while lifting other end of stopping member which props against protrusions of emergency stopping system and stops the falling. Such emergency stopping system is not suitable for use in ropeless elevator systems. Furthermore, like in case of US5651429A equivalent, stopping member and structures supporting it are subjected to extreme loads during emergency stopping, making it necessary to properly ensure that all structures are capable of withstanding those loads.

The closest prior art by principle of functioning of device is presented in patent document EP2213605A2 (published on 4 July 2010) and other documents describing similar solutions. Stopping system is installed on pulley on which elevator rope is wound. Stopping system incorporates oblong swaying stopping member pivotally secured approximately at its middle to stable base. One end incorporates wheel that rolls over protrusions and recesses of pulley, while the other end gets inserted and extracted from stopping hole. Stopping hole is on rope pulley surface. If rope pulley rotates at normal speed, insertable end of stopping member, under action of other end with wheel, gets

inserted and extracted from stopping hole. If rope pulley starts rotating at abnormally high speed, end of stopping member fails to get out of stopping hole on time and thus prevents rope pulley from rotating. Such stopping system can only be used in systems with rope.

The presented descriptions of related art have the following major drawbacks:

- emergency stopping system can only be used with elevator car held on rope;
- additional source of energy (such as electric power) is necessary for emergency stopping system to function;
- extreme acceleration or speed (near free fall) is necessary for emergency brake to get activated;
- emergency brake having been activated it takes considerable resources (time, replacement parts, tools etc) to get elevator back in normal operation.

The current description presents elevator emergency stopping technical solution free from drawbacks inherent to solutions presented in abovementioned documents.

SUMMARY OF THE INVENTION

The current description presents emergency brake design to be used in elevators or other devices where in case of uncontrollable falling emergency stopping function must be ensured. Emergency brake device having: stopping rail (comprising working strips, guide rails etc), slider, stopping member, power switch, and other components. Function of emergency brake is based on inertial force, with the going above predetermined limit of which in case of greater speed of stopping member end of stopping member changes its movement trajectory, gets in deeper and fails to get out of hole in stopping strip on time and props against hole edge. Stopping member is secured to elevator platform or other device the falling of which must be stopped. Emergency falling is stopped by stopping member propping against hole edge.

The main advantages of this invention compared to other solutions in related art are: this system is fully autonomous, it needs no additional source of energy, it is applicable to different elevator systems regardless of the way elevator platform is secured (with ropes or in some different way), and after the emergency stop is engaged it is uncomplicated to put the system back into normal working condition.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows emergency brake (side view).

Fig. 2 shows emergency brake (cross-cut cross-section view).

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In addition to drive mechanism ensuring elevator movement elevators also have brakes. There are at least two types of brakes: working brake stops elevator platform at certain height and emergency brake ensures that in case of elevator failure elevator platform does not fall down. It is desirable to achieve that emergency brake functions as a separate system independently from other systems and that it needs no additional source of energy. Therefore one of the best embodiments of technical system of emergency brake is mechanical stopping system without additional powering, which gets activated in case of elevator moving speed becoming higher than normal.

The current description presents elevator emergency fall brake. Emergency brake comprises, at least, the following main components: stopping rail, slider (5), stopping member (6), stopping member wheel (8), spring (9), and other components. Stopping rail comprises, at a minimum, working strip (4) with convexities and concavities, working strip (3) with holes, slider (5) movement guide rail (or rails) (2), and other components.

Emergency stop stopping rail comprises, at a minimum, two oblong working planes, strips (3) and (4), which are in front of each other in one of embodiments. There may be other plane, strip connecting the said two working strips (3) and (4) thus making a “U”-like shaped member, the said connecting plane may also be arched: in that case cross-cut cross-section of working strips (3) and (4) together with additional strip is U-like shaped. Stopping rail with working strips (3) and (4) extends all along the way of movement of elevator platform or other moving member. Stopping rail can be located at elevator platform movement (guide) rail or integrated in movement rail or, in certain cases, can replace movement rail, that is, serve both as elevator movement guide rail and stopping rail simultaneously. Stopping rail must be secured to a stable surface capable of withstanding both weight of elevator and objects travelling in it and resistance to forces acting on falling elevator. Stopping rail in accordance with this invention is tightly secured to elevator guide rail.

As mentioned before, working strips (3) and (4) located on stopping rail face each other, they are parallel to each other. Stopping member (6) moves between stopping rail working strips (3) and (4). One of the working strips (4) features convexities with bevel sides. The said convexities are made along working strip (4), that is so that with sliding along the said working strip (4) the member (for example, wheel (8) of stopping member (6)) tracking its shape goes up at start of convexity and down at end of convexity. Convexity is followed by concavity that is followed by another convexity followed by another concavity etc. According to preferred embodiment, there must be no interruptions when member follows strip (4) with convexities, that is, path of member following strip (4) must be continuous, without breaks. Another working strip (3) located in front of strip (4) with convexities has holes under one of embodiments. Holes are rectangular-like shaped. Hole shape must match stopping member (6) edge shape, with which stopping member (6) can prop against hole edge during emergency stopping. Strip (3) and especially its portions between holes must be made of mechanically strong material. Holes made along stopping rail strip (3) are arranged in the same sequence as convexities in opposite strip (4): hole, plane, hole, plane etc. Under one of embodiments holes are made in areas that are in front of convexities of strip (4) located on opposite side. Stopping rail strip (4) with convexities can be made of aluminium (such as 6060-T6) or steel (such as S235) or other materials exhibiting similar characteristics. Stopping rail strip (3) with holes can be made of steel (such as S355) or other materials exhibiting similar characteristics.

Under yet another embodiment working strip (3) with holes can be replaced with strip with convexities instead of holes. In such case longitudinal cross-section of working strip resembles saw, but convexities giving saw blade shape must make right angles with strip at least vertically.

Stopping member (6) is pivotally secured to slider (5) through axle (7). To enable slider (5) movement direction support functionality another member (guide rail (2)) independent from said working strips (3) and (4) is added. Cross-cut cross-section of guide rail (2) is C-like shaped, with slider (5) placed between ends of cross-section shape of guide rail (2). Guide rail (2) is as long as or similarly long as stopping rail working strips (3) and (4). Guide rails can be two, each with L-like shaped cross-section the long ends of which are secured with another member, where cross-cut cross-section of all three interconnected members resembles above-described C shape.

There is slider (5) between ends of cross-section of guide rail of stopping rail. Slider (5) is made of steel (such as S235) or other materials exhibiting similar mechanical properties. Slider (5) is secured to moving structure of elevator with pin, axle (7). Axle (7) is secured to elevator platform so as to allow axle (7) horizontal movement in respect of structure of elevator. Axle (7) and moving structure of elevator must be reliably secured to each other vertically, that is members cannot move vertically in respect of each other. Possibility of horizontal movement of members in respect of each other must be ensured, because elevator platform movement trajectory may not match slider (5) movement trajectory precisely, leading to potential shift of stopping member (6) in respect of working strips (3) and (4), that is, to possibility of false triggering of emergency brake. Under another embodiment slider (5) may be integral part of elevator platform. Under present invention slider (5) shape resembles rectangular parallelepiped with two opposing lateral sides being concave all along (that is, slider (5) cross-cut cross-section being H-like shaped) and this concavity clasps with its edges guide rail (2). Stopping member (6) is pivotally secured to slider (5) with pin, said axle (7).

Stopping member (6) is made of steel (such as S355) or other material exhibiting similar properties. Stopping member (6) must be capable of resisting (that is, member must remain intact) loads acting on elevator platform at the moment of emergency stopping. Stopping member (6) is shaped like rectangle with its length at least several (for example, 2-3) times exceeding its width. One short base of stopping member (6) is longer than other short base of member (6), that is, stopping member (6) suddenly expands at one of its bases, that is, stopping member (6) is somewhat similar to "L" shape or to calf-length shoe. Shape and size of said sudden expansion of base must be smaller than size of hole in stopping rail strip (3) so that expansion can enter hole in stopping rail strip (3) when elevator exceeds normal descent speed. The other side of said expanded short base has wheel (8) pivotally secured to stopping member (6). Wheel (8) is secured at corner of stopping member (6) so that portion of wheel (8) extends beyond boundaries of stopping member (6) so that stopping member (6) touches working strip (4) with convexities not directly, but via wheel (8). Wheel (8) can be made of various materials, for the present invention it is made of PE1000 plastic. Stopping member (6) at its end other than with said expansion and wheel (8) has hole through which pin, said axle (7) with which stopping member is pivotally secured, is passed.

Stopping member (6) short base (without expansion) at which stopping member (6) securing axle (7) is located may be rounded, that is short base may be not straight, but bent, arch-shaped.

One end of slider (5) which expanded end of stopping member (6) faces has holding pin (10). Holding pin (10) is immovably secured to slider (5), above slider (5) plane facing stopping member (6), it protrudes slightly more than stopping member (6) thickness. Purpose of holding pin (10) (DIN 1474 in this case) is to limit swaying amplitude (working strip (3) hole penetration depth) of stopping member (6). Other embodiments may feature a different penetration depth limiter or emergency stopping device to enable operation without this functionality and devices ensuring it. Holding pin (10) also serves to lock position of stopping member (6) in case of emergency stopping.

Stopping member (6) and axle (7) have spring (9) secured. The present invention utilises not coil spring, but straight (or near straight) stiff wire (or plate) resistant to repeated compression at bending while also exhibiting long-lasting ability to restore its original position. The present invention utilises spring (9) made of steel (such as 60C2A). One end of spring (9) is passed crosswise stopping member (6) axle (7), through hole in axle (7), whole spring (9) extends along entire stopping member (6) until expanded base with wheel (8). Spring (9) is secured at its other end to expanded end of stopping member (6). In addition to already described shape of spring (9), part of coil spring can be put between spring (9) securing points, that is, conventional, cylinder-shaped wound spring is used, ends of which extend to said securing points at ends of stopping member (6). The present invention utilises cylinder-shaped part of spring (9) close to edge of expanded base, that is the part is at maximum distance from rounded end of stopping member (6) but does not go beyond boundary of stopping member (6). Pin is passed through said cylinder and secures one end of spring to stopping member (6). Behind pin, spring end extends towards securing point near wheel (8). From pin to said securing point spring (or part of it) is V-like shaped where spike of shape protrudes beyond boundary of stopping member. Size of protrusion must be such that with expanded end of stopping member (6) propping against edge of hole in working strip (3) (that is, upon engagement of emergency brake) spike of spring has already passed holding pin (10) hitting it. Thus holding pin via spring (9) must hold stopping member (6) a bit when member (6) is inserted in hole in working strip (3).

As mentioned, one end of stopping member (6) is expanded, this expansion props against working strip (3) with holes in emergency situation, the other end of stopping member (6) is rounded. In another embodiment convexity is made on said end of stopping member (6), this convexity protrudes beyond arc of said rounding, that is distance from arc centre to convexity top is greater than distance from arc centre to arc. Convexity is made so that when expanded end of stopping member (6) enters hole in working strip (3) in emergency situation, said convexity as it makes axial turn hits and lifts switch (1) hook (or other member activating switch (1)). Switch (1) is secured next to stopping member (6) rounded end with convexity, at such distance from stopping member (6) that switch (1) is triggered only in emergency, when stopping member (6) end enters hole in working strip (3). Switch (1) generates electric signal intended to notify of triggering of emergency brake, shut drive engine down, or for other functions. Switch (1) and its triggering member must be made and secured to stopping device so that switch (1) is triggered before emergency brake is activated. On the other hand, false triggering of switch (1) must be reliably prevented.

With elevator platform moving up and down slider (5) with stopping member (6) and other members of emergency brake move too. Stopping member (6) is hung on axle (7) securing it to slider (5) and other members. Under action of spring (9) stopping member (6) reclines towards working strip (4) with convexities and concavities and touches it with wheel (8). With elevator moving at working, normal speed stopping member (6) under action of spring (9) always touches working strip (4) with wheel (8), that is wheel (8) is rolling over convexities and concavities. As elevator moves, other end of expanded base of stopping member (6) enters and exits holes in other working strip (3). As wheel (8) of stopping member (6) rolls over convexity on working strip (4) other end of expanded base enters hole in other working strip (3); as stopping member (6) rolls down from peak of convexity on working strip (4) other end of base exits hole; as wheel (8) is at the deepest point of concavity of working strip (4) other end of base is completely out of hole in working strip (3) and can pass strip (3) portion separating holes, which it would prop against in case of emergency stopping.

If elevator is moving down faster than normal speed, stopping member (6) wheel (8) tracking convexities and concavities of working strip (4) goes up convexity and having reached its peak gets off working strip (4) (fails to maintain contact with its surface) as a result of speed being higher than normal, that is, due to greater inertial force acting on stopping member (6). Expanded end of stopping member (6) with wheel (8) moves away

from working strip (4) with convexities and concavities and shifts towards working strip (3) with holes as a result of speed being higher than normal. As stopping member (6) continues travelling down with its said end being closer to working strip (3) with holes than normal, it fails to approach working strip (4) with convexities and concavities on time; that is it fails to get back on its normal trajectory on time and its expanded end props against hole edge. If due to failure elevator is no longer supported by any members at all, elevator props against lower edge of hole in working strip (3) through axle (7), slider (5), and stopping member (6). Elevator emergency fall has been stopped. Once repairs are completed elevator needs to be put back into operation. With some emergency braking systems it may be necessary to replace parts of emergency fall brake or other systems after engagement of emergency fall brake. For example, if emergency stopping system utilizes wedge between car-holding rope and stop prop, it sometimes happens that this wedge gets stuck immovably, necessitating replacement of system parts that are out of order. With this invention, provided that materials selected are sufficiently strong and remain intact, stopping member (6), after elevator car having been lifted a little, gets out of hole in working strip (3), comes into contact with working strip (4) with convexities and concavities, and can be used again without making any replacements or modifications.

To prevent situation where in case of mistaken lifting of elevator after engagement of emergency brake (for example, cause of emergency stopping not having been eradicated yet) stopping member (6) comes out of hole in working strip (3), there are holding pin (10) and spring (9) V-like shaped part installed. For stopping member (6) to enter hole in working strip (3) in case of emergency stopping, V-like shaped spike of spring must pass holding pin (10). Emergency brake having been engaged and stopping member (6) end being in hole in working strip (3), holding pin (10) via spring (9) supports stopping member (6) in such position. When lifting elevator from emergency stop position, expanded and downwards sloping end of stopping member (6) starts propping against upper edge of hole in working strip (3), which, as lifting of elevator continues, pushes stopping member (6) out of hole, overcoming resistance caused by spring (9) caught by holding pin (10).

As mentioned before, slider (5) moves on guide rail (2). The function of slider (5) is to ensure accurate trajectory of movement of stopping member (6). It is problematic and often unnecessary to ensure high accuracy of trajectory of movement of elevator platform. Meanwhile inaccuracy of trajectory of movement of stopping member (6) may lead to false triggering of emergency brake. In addition to continuous upward and downward movement elevator platform and stopping member (6) may slightly move sideways (for various

reasons), that is, during upward and downward movement elevator and stopping member (6) may slightly move horizontally as well. Such horizontal motion of elevator does not affect (to certain limit) functioning of elevator, but horizontal movement may cause stopping member (6) to spark false triggering of emergency brake. Horizontal movement of elevator platform leads to horizontal movement of stopping member (6), but slider (5) compensates for this horizontal movement.

Technical solution the current description presents has been embodied on elevator that moves no faster than at 0.15 m/s. Similar technical solution with modifications within the scope of this description can also be embodied on other devices that require emergency fall brake.

To illustrate and describe this invention, description of preferred embodiments is given above. This is not a complete or limiting description aimed at prescribing a precise embodiment or implementation option. The description given above should be regarded more as an illustration than a constraint. Obviously, the specialists in this field may clearly see a multitude of modifications and variations. The embodiment has been selected and described so as to enable the specialists in this field to best understand the principles behind this invention and their best practical application for different embodiments with different modifications fit for a specific application or embodiment customisation. The invention scope is defined by the attached claims and their equivalents wherein all the terms used have the broadest possible meanings unless stated otherwise.

Embodiments described by specialists in the respective field may contain changes that do not depart from the scope of this invention, as described in the claims given next.

CLAIMS

1. Emergency fall brake device having:

stopping rail extending all along elevator movement way, on which stopping member (6) and other members of device move; and
stopping member (6) that, if elevator is going down faster than normal speed, enters hole in working strip (3) thus stopping falling of elevator;

characterized in that

stopping rail has two working strips (3) and (4) of which
one strip (4) has convexities and concavities making moving stopping member (6) sway around its axle as it tracks them and
another strip (3) has holes which part of expanded base of stopping member (6) enters.

2. Emergency fall brake device according to claim 1, characterised in that guide rail (2) or rails intended to ensure precision of trajectory of slider (5) is, are placed all along stopping rail.

3. Emergency fall brake device according to all preceding claims, characterised in that slider (5) is installed between ends of cross-section of guide rail (2)

4. Emergency fall brake device according to all preceding claims, characterised in that stopping member (6) is pivotally secured to slider (5) through axle (7).

5. Emergency fall brake device according to all preceding claims, characterised in that axle (7) is secured to elevator structure so that it can move horizontally in respect of elevator structure, but cannot move vertically in respect of elevator structure.

6. Emergency fall brake device according to all preceding claims, characterised in that one end of stopping member (6) has expanded base with which it props against working strip (3) hole edge in case of emergency fall while another end is rounded and with convexity.

7. Emergency fall brake device according to all preceding claims, characterised in that power switch (1) is installed at slider (5) above stopping member (6), this power switch (1) gets pressed with convexity of rounded end of stopping member (6) before stopping member (6) props against working strip (3) hole edge, that is before engagement of emergency brake.

8. Emergency fall brake device according to all preceding claims, characterised in that stopping member (6) at its expanded end has wheel (8) that presses against working strip (4) with convexities and concavities.

9. Emergency fall brake device according to all preceding claims, characterised in that it has spring (9) one end of which is passed crosswise stopping member (6) axle (7), through hole in axle (7), whole spring (9) extends all along stopping member (6) until expanded base with wheel (8), other end of spring (9) is secured to expanded end of stopping member (6).

10. Emergency fall brake device according to all preceding claims, characterised in that slider (5) part which expanded end of stopping member (6) faces has holding pin (10) immovably secured to slider (5) and protruding above slider (5) plane facing stopping member (6).

11. Emergency fall brake device according to all preceding claims, characterised in that spring (9) is V-like shaped at expanded end of stopping member (6), where spike of said shape must pass holding pin (10) hitting it as stopping member (6) enters hole in working strip (3) during emergency stopping and where said shape of part of spring (9) together with holding pin (10) keep stopping member (6) in hole of working strip (3) until cause of emergency stopping is eradicated.

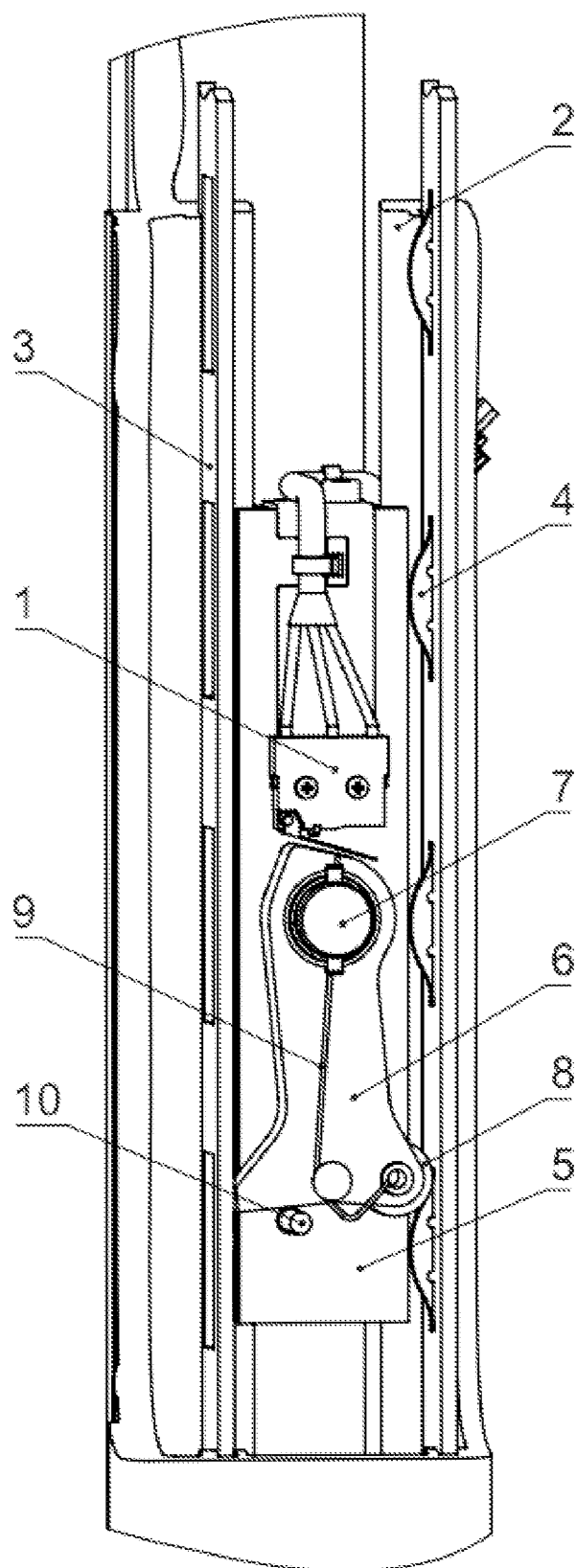


FIG. 1

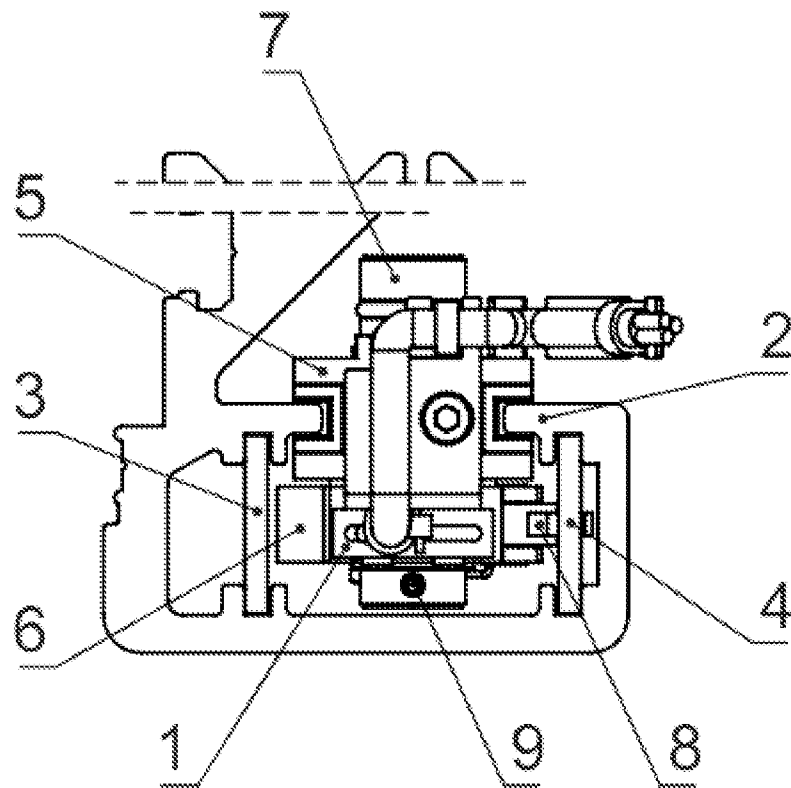


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/050645

A. CLASSIFICATION OF SUBJECT MATTER
INV. B66B5/04 B66B5/26
ADD.

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)
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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2009 055768 A1 (LOEDIGE FOERDERTECHNIK [DE]) 26 May 2011 (2011-05-26) abstract; figures 1, 2 paragraphs [0012] - [0014], [0016] - [0018] -----	1-11
X	US 167 560 A (PEARCE H.) 7 September 1875 (1875-09-07) the whole document -----	1-11
X	US 1 024 943 A (MASON VOLNEY W [US]) 30 April 1912 (1912-04-30) the whole document -----	1-8,10

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

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

19 September 2016

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28/09/2016

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2016/050645

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102009055768 A1	26-05-2011	DE 102009055768 A1	26-05-2011
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US 167560	A	07-09-1875	NONE

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