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(54) Arrangement for the locking of the door of an elevator car.

(57) The invention concerns an arrangement for the locking of the door of an elevator car, comprising a lock that latches the door (1), guide surfaces (2) provided at the landings, an actuating lever 7 controlled by the guide surfaces, and a transmission means connecting the lock and the actuating lever. According to the invention, the locking arrangement comprises an electrically operated actuator (5) serving to shift the fulcrum (17) of the actuating lever (7) in such a way that the part of the actuating lever which uses the guide surface as a bearing will remain at a distance from it, and a counter device (6) serving to move the fulcrum (17) in the opposite direction so that when the elevator car is at a landing, the actuating lever, leaning against the guide surface, will unlatch the lock.

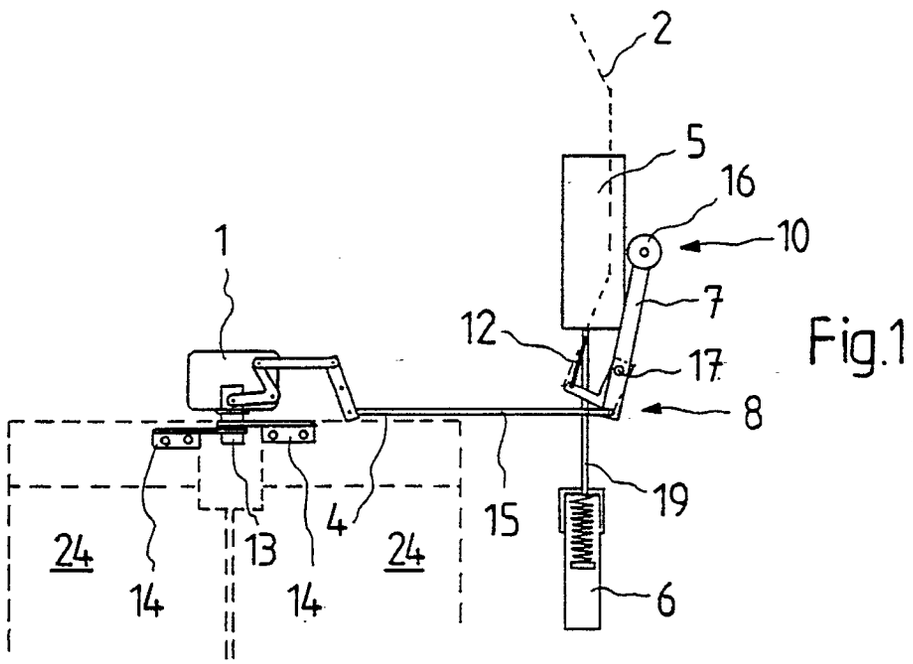

Fig.1

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ARRANGEMENT FOR THE LOCKING OF THE DOOR OF AN ELEVATOR CAR

The present invention relates to an arrangement for the locking of the door of an elevator car as defined in the introductory part of claim 1, said arrangement being designed to lock the car door so that it can never be opened when the elevator is moving or has stopped between landings e.g. due to a power failure.

The state of the art in the field of the invention is best represented by patent publication GB 2206331, which proposes an electromechanical arrangement for the locking of the door of an elevator car that keeps the car door locked when the elevator is moving and generally also when the elevator stops between landings e.g. due to a power failure.

However, a problem associated with the previously known techniques is that, when a power failure occurs, the doors are only locked in position after the failure has already occurred, and the locking is performed using a separate locking device, which means that immediately after the power failure there is a short interval during which it is possible to open the car doors manually even when the car is between landings.

Another problem with the previously known structures is that the joint structure 10, 14 may get struck due to wear, in which case the door may be left open and will not be closed even between landings. Also, lever 14 hits the guide surface 15 at every floor, even at the floors passed by, causing disturbing noise. A further drawback with the structure described in the publication is that, since the mechanism only locks one of the door leaves in position, it is necessary to use a suitable lever or rope arrangement or an equivalent complicated, expensive and vulnerable arrangement to prevent the other door leaf from being opened.

The object of the present invention is to eliminate the above-mentioned drawbacks. A specific object of the invention is to produce an arrangement for the locking of the door of an elevator car that keeps the elevator doors locked at all times when the elevator is moving or when it is standing still between landings, while still allowing the doors to be freely opened even during power failures when the elevator car is standing at a landing.

As for the features characteristic of the invention, reference is made to the claims.

The arrangement of the invention for the locking of the door of an elevator car comprises a lock which locks the doors the construction of the lock being in no way defined by the invention. Moreover, the arrangement comprises guide surfaces or equivalent areas or zones provided at the landings, allowing the presence of the elevator car at the landing to be recognized using a suitable means. Furthermore, the arrangement comprises an actuating lever for unlatching the lock, said lever being supported by the frame of the arrangement via a linkage and its motions controlled by said guide surfaces, and a transmission means connecting the lock and the actuating lever. The transmission means may be a suitable lever or linkage or a suitable connection consisting of ropes, chains or wire ropes. The locking arrangement of the invention comprises an electrically operated actuator designed to shift the fulcrum of the actuating lever in such a way that the part of the actuating lever which uses the guide surface as a bearing will remain at a distance from said surface, and a counter device which moves the fulcrum in the opposite direction when the actuator is not operating, so that the actuating lever, leaning against the guide surface, will unlatch the lock.

The electrically operated actuator may consist e.g. of an electromagnet whose attraction is applied to a suitable spindle. The counter device is preferably a spring connected to the other end of this spindle, so that when the magnet releases, the spring will return the spindle to the opposite extreme position. Naturally the counter device may also consist of some other known structure or device that returns the spindle to its other extreme position when the magnet releases.

The essential feature of the locking arrangement of the invention is that the actuating lever producing the unlocking thrust motion uses the guide surfaces at the landings as its bearings. Therefore, when the elevator car is between landings, the actuating lever motions produced by the actuator or the counter device will not cause any motion of that end of the actuating lever which is linked with the lock; instead, in this case the actuating lever will only pivot about its joint. However, when the elevator car enters a landing zone, one end of the actuating lever will lean against the corresponding guide surface, with the result that its other end will move, transmitting an unlatching motion to the lock.

In other words, the essential feature of the locking arrangement of the invention is that the fulcrum of the actuating lever is shifted in a controlled fashion in such manner that in one of its extreme positions the actuating lever cannot turn so as to unlatch the lock, whereas in the other extreme position the actuating lever can be turned so as to unlatch the lock, but only on condition that one end of the actuating lever leans against a guide surface, in which case the other end will undergo a motion that results in the unlatching of the lock.

The invention has the following advantages over previously known techniques:

- The locking arrangement can be installed on any type of door regardless of the door operating mechanism used.
- The locking arrangement involves no restrictions as to the door locks used but is compatible with nearly all locks in current use.
- If a power failure occurs while the elevator is travelling between floors, the door will remain locked and can never be opened between floors, not even during a short instant.
- The device is immune to disturbances in the control system: Even if, due to a malfunction, the elevator control system should instruct the car doors to open while the car is outside the landing zone, the doors will remain reliably locked.
- If, due to a power failure, the elevator has stopped between landings and is moved manually to a floor level, the lock will open automatically without requiring any further action.
- In a two-door application, the locking arrangement of the invention locks both door leaves simultaneously and without backlash by means of the locking bar of the lock, so that no separate locking devices are required to take care of the backlash.

In the following, the invention is described in detail by referring to the attached drawing, in which

fig. 1 presents a diagram of a locking arrangement as provided by the invention, in a situation where the doors are locked and the elevator car is at a landing level,

fig. 2 illustrates the arrangement of fig. 1 while the elevator car is at a landing and the lock is open,

fig. 3 illustrates the arrangement of fig. 1 with the elevator car standing between landings and with the lock latched after a power failure,

fig. 4 shows a diagram representing a bell crank lever mechanism.

A locking arrangement as provided by the invention and illustrated by the drawings comprises a lock 1 whose locking bar 13 latches the lock plates 14 mounted on the elevator doors so as to render them immovable. Linked with the lock is a lever mechanism 4 comprising a straight bar 15, one end of which is pivoted on one end 8 of an actuating lever 7, the other end 10 of this lever being provided with a bearing roller 16 which, in certain positions, leans against the guide surfaces 2 provided in the landing zones. In addition, the actuating lever 7 is pivoted at point 17 on a bell crank 9, which in turn is pivoted at point 18 (fig. 2) on the frame of the device.

In addition, the arrangement comprises an electromagnet used as an actuator 5 and a spring used as a counter device 6, said components being connected by a connecting rod 19. The bell crank 9 is linked with the connecting rod 19 by a lever structure 12 consisting of a first arm rigidly joined with the bell crank and a second arm linking the free end of the first lever with the connecting rod 19, so that when the connecting rod is moved by the electromagnet or the counter spring, the lever structure 12 will cause the bell crank 9 to turn about its fulcrum 18.

Fig. 4 illustrates the principle of the arrangement of the bell crank 9 and the lever structure 12. As shown, the bell crank 9 consists of a rigid angular body pivoted by its elbow 18 on the frame of the arrangement, one end 17 of the angular body being connected to the actuating lever 7 and the other end 22 to the lever structure 12 linking this end of the bell crank with the connecting rod 19. Thus, the motion of the connecting rod 19 will cause the bell crank to turn about point 18, thereby shifting the position of the fulcrum 17 of the actuating lever 7.

The locking arrangement of the invention functions as follows. When the elevator car is moving, a voltage is supplied to the magnet 5, which therefore attracts the connecting rod 19, causing the lever structure 12 to turn the bell crank 9 to the position shown in fig. 1. In this situation, a clearance is produced between the bearing roller 16 and the guide surface 5. Because of this clearance, the floors where the elevator will not stop can be passed by without the bearing roller 16 hitting the guide surfaces, resulting in a smoother and quieter elevator travel. In this situation, the spring-loaded locking bar 13 of the lock 1 is in its lower position, locking both door leaves 24 by means of lock plates 14.

When the elevator car arrives at a landing, the supply voltage to the magnet is switched off. The counter device 6 or spring will now pull the connecting rod 19 downwards, causing the lever structure 12 to turn the bell crank 9, which in turn transmits a force via the fulcrum 17 to the actuating lever 7, causing it to turn so as to bring the bearing roller 16 onto the guide surface 2. After this, the actuating lever 7, with its fulcrum point 11 thrust against the guide surface 2, acts as an unlocking lever, pushing the bar 15 until the lock is unlatched (fig 2).

Fig. 3 illustrates a situation where the magnet 5 has released, i.e. the spring 6 has drawn the connecting rod 19 to the lower position. Since the actuating lever 7 is outside the region of the guide surface 2, no bearing is provided for the actuating lever 7, which is why bar 15 receives no thrust that would open the lock 1. This corresponds to a situation where the elevator car has stopped between landings e.g. due to a power failure. Thus, the arrangement of the invention allows the fulcrum 17 of the actuating lever 7 to be shifted to different

positions in different situations, so that the actuating lever 7 will act in the desired manner, i.e. the door lock will only unlatch when the car is at a landing, and even then only if desired.

However, if in the case of fig. 3 the elevator car is moved manually to a landing level, the bearing roller 16 at the end of the actuating lever 7 will hit the guide surface 2 and the situation corresponds to the case of fig. 2, in which the lock can be opened.

Although the invention has been described above by referring to one of its preferred embodiments, various embodiments are possible within the scope of the idea of the invention as defined in the following claims.

Claims

1. Arrangement for the locking of the door of an elevator car, comprising
- a lock that locks the door (1),
- guide surfaces (2) provided at the landings,
- an actuating lever 7 linked with the frame of the arrangement and designed for unlatching the lock, the motions of said lever being controlled by said guide surfaces,
- a transmission means (4) connecting the lock and the actuating lever,
characterized in that the locking arrangement comprises
- an electrically operated actuator (5) designed to shift the fulcrum (17) of the actuating lever (7) in such a way that the part of the actuating lever which uses the guide surface as a bearing will remain at a distance from said surface, and
- a counter device (6) designed to move the fulcrum (17) in the opposite direction so that when the elevator car is at a landing, the actuating lever, leaning against the guide surface, will unlatch the lock, whereas between landings the actuating lever 7, being not supported by a guide surface, will leave the lock in the latched position.

2. Locking arrangement according to claim 1, **characterized** in that the actuator (5) is a pulling means operated using electromagnet.

3. Locking arrangement according to claim 1, **characterized** in that the counter device (6) is a spring.

4. Locking arrangement according to claim 1, **characterized** in that the pulling means (5) and the counter device (6) constitute a rigid assembly moving together.

5. Locking arrangement according to any one of claims 1 - 4, **characterized** in that the first end (8) of the actuating lever (7) is pivoted on the transmission means (4) and that, at a point between its ends, said lever (7) is pivoted on the bell crank (9), which is mounted on the frame of the device and turned by the actuator/counter device.

6. Locking arrangement according to claim 5, **characterized** in that one end (10) of the actuating lever (7) forms a turning point (11) using the guide surface (2) as a bearing.

7. Locking arrangement according to claim 5, **characterized** in that the bell crank (9) is connected to the actuator/counter device assembly by a lever structure (12).

8. Locking arrangement according to claim 7, **characterized** in that the bell crank (9) consists of a rigid angular body accommodating the fulcrum (17) at one end and pivoted on the lever structure (12) at the other, said body being pivoted between its ends on the frame of the arrangement.

9. Locking arrangement according to any one of claims 1 - 8, **characterized** in that both door leaves (20) of the elevator car are provided with lock plates (14), which are locked together by the locking bar (13) of the lock (1).

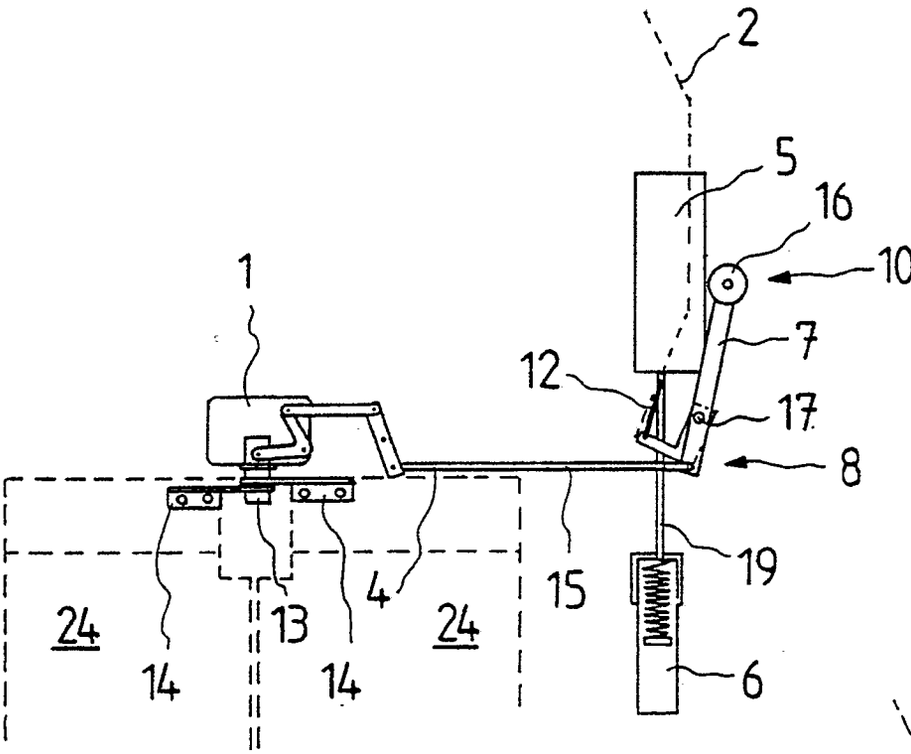

Fig.1

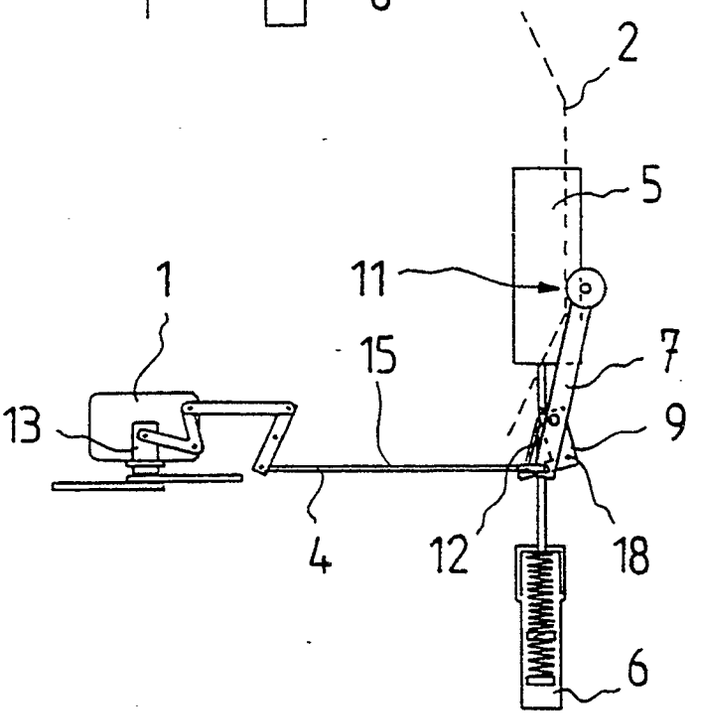

Fig.2

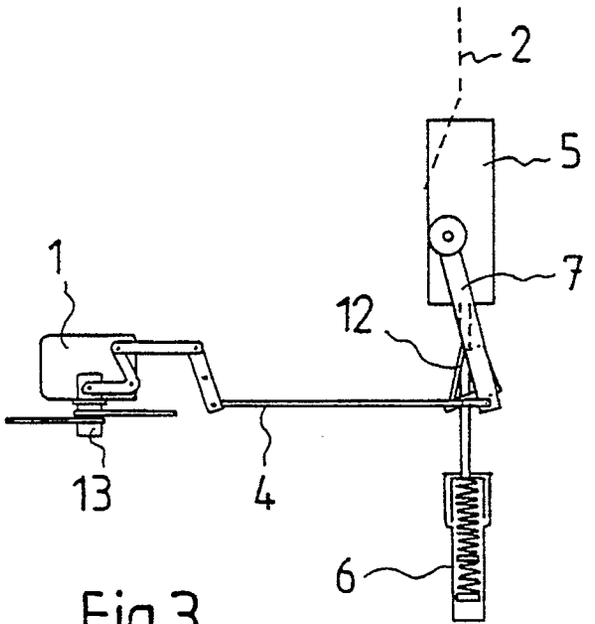

Fig.3

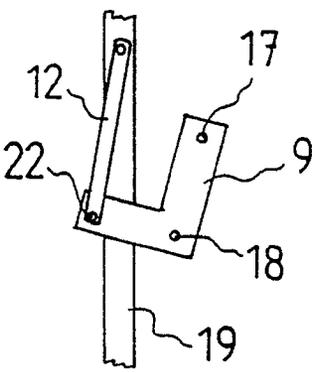

Fig.4