Oct. 11, 1966

K. STUTZ

3,277,979

DOOR LOCKING MECHANISM

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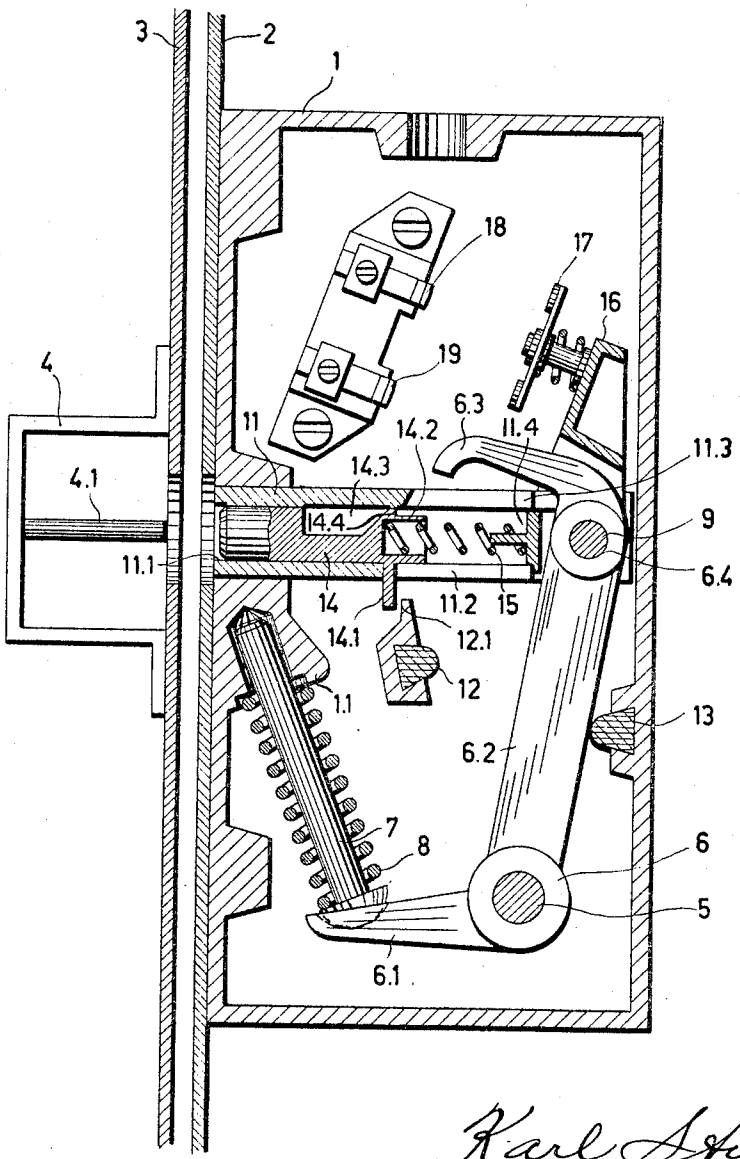
Fig.1



Karl Stutz

by: Edwin E. Greigg

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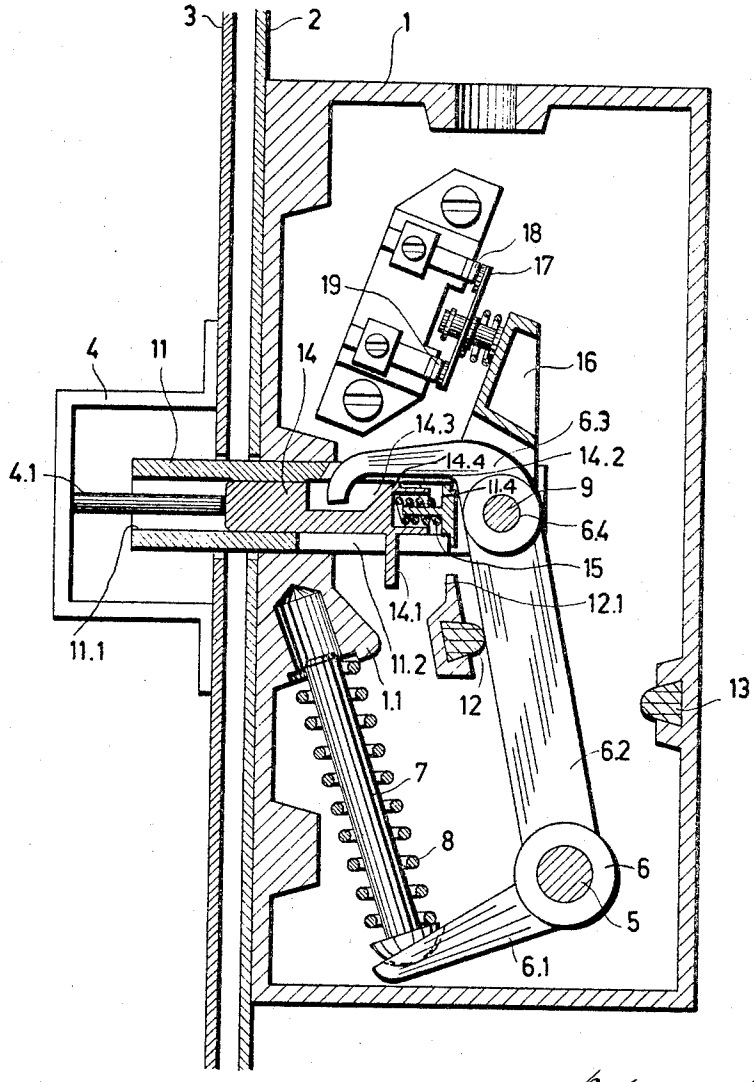
Fig.2



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by Edwin E. Greigg

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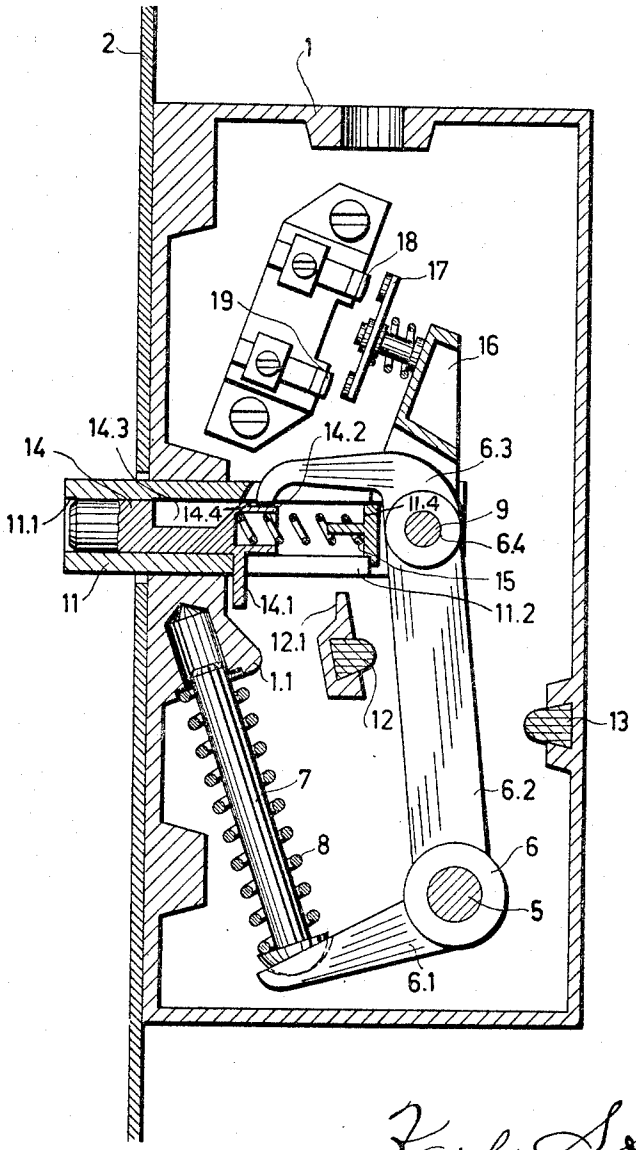
Fig.3



Karl Stutz
by: Edwin L. Greigg

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DOOR LOCKING MECHANISM

Karl Stutz, Friedberghalde 8, Lucerne, Switzerland

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4 Claims. (Cl. 187—50)

This invention relates to locking mechanisms for elevator doors.

The avoidance of the danger of accidents in elevators requires a reliable securing of the access to the shaft, namely in such manner that a shaft door can be opened only when the elevator cabin is behind it and the elevator cabin can be set in motion only when the door is closed and locked. These requirements are usually satisfied by the installation of door switches operated by the door in their closed position and door locking mechanisms which may be unlocked by a movable sliding cam secured on the elevator cabin. The door switch interrupts the control circuit of the elevator, as long as the door is open. The door locking mechanism has a locking switch which controls the position of the bolt and interrupts a lock mechanism checking circuit of the elevator controls as long as the door is not locked.

The door locking mechanism should be of such construction that all movement of the elevator cabin is positively prevented even if the door switch is bridged over and the door is open. This problem is best solved by preventing the bolt from assuming the locking position when the door is open. The lock mechanism check circuit is closed only when the door is closed and locked.

Various door locking mechanisms working in this manner have already become known. These all possess a lock catch which is released through an operating piece by the door when the latter is in the closed position.

In a first group of such door locking mechanisms the operating piece for release of the lock catch is situated outside the lock bolt and does not come into contact therewith. On the door leaf there is secured for example a bolt which, upon closing of the door, engages in the housing of the door locking mechanism and there releases the lock catch. Or, the lock catch itself possesses an operating bolt which in the blocking condition extends beyond the housing of the door locking mechanism and upon closing of the door is pushed back by the door, so that the lock catch is released. Such constructions are very expensive and render additional adjustment work necessary on every door. In another door locking mechanism of the same group a permanent magnet is secured in the door leaf and actuates a release lever for the lock catch, arranged in the housing part, by magnetic force action when the door is in the closed position. Generally, in the case of door locking mechanisms of this group it is quite easy to tamper with the lock catch.

In a second group of door locking mechanisms the operating piece for the release of the lock catch is assembled with the locking bar. The release of the lock catch is effected for example by rotation of the locking bar. The rotation of the locking bar is effected due to the fact that a spiral groove provided on the periphery of its free end comes into engagement with a tooth protruding from the lock opening in the door leaf. This construction requires high precision in production and in installation and is also very liable to failure. Another door locking mechanism provides a pawl secured on the locking bar, which upon entry of the lock bolt into a corresponding counterpiece in the door leaf is operated and thus releases the lock catch. This pawl involves the disadvantage that it can be operated very easily by unauthorized persons when the door is open. In a

further construction of this group the release of the lock catch is effected by a control bolt which is displaceably arranged in a longitudinal bore of the locking bar. The control bolt is shifted in relation to the locking bar, as the latter is pushed forward into the locking opening of the door leaf, by a stop pin protruding in the lock opening, and in being shifted effects the release of the lock catch. The present invention relates to a door locking mechanism, the lock catch of which is released in the manner last stated.

In a known door locking mechanism of this kind the lock catch consists of a catch pin engaging in the locking bolt perpendicularly thereof, which pin is pressed by means of a spring against a cam-shaped supporting surface on the control bolt. When the control bolt is in the blocking position the catch pin protrudes beyond the lock bolt and limits the locking movement of the locking bar by abutment on the housing part, if the door is not closed. On the other hand when the door is closed the control bolt is shifted by the stop pin in the lock opening of the door leaf in relation to the lock bolt. In the new position of rest of the catch pin on the control bolt the surface of engagement is set back so that the catch pin enters the lock bolt completely under the action of its spring. Consequently, the locking bar can now completely carry out the locking movement. In such a lock catch the release does not take place positively. Jamming or sticking of the catch pin can hinder the correct working of the door locking mechanism, that is to say the lock catch can become effective when the door is closed.

In another but similar embodiment not only the control bolt but also the passage opening for the locking bolt in the housing part is provided with a cam-shaped support surface for the catch pin. The catch pin is no longer pressed by a spring against the cam-shaped support surface of the control bolt, but, provided that the position of the control bolt permits it, it is shifted by the cam-shaped support surface on the housing part in the locking movement of the locking bolt. This door locking mechanism works positively. The catch pin and the cam-shaped support surfaces are however subjected to heavy wear, since friction work must be performed in every locking movement. Moreover the danger of jamming is again present.

It is an object of the invention to provide a door locking mechanism which possesses a positively actuated lock catch, avoiding the above-mentioned disadvantages.

The locking mechanism for elevator doors according to the present invention possesses a locking bolt slidably guided in a housing and articulately connected to a lever rotatably mounted on the housing. The locking bolt is subject to the action of a spring which thrusts it out of the housing and a movable sliding cam on the elevator cabin which draws it into the housing against the action of said spring. The bolt has a lock catch adapted to cause a shift in the relative position between the locking bolt and a control bolt arranged displaceably in a longitudinal bore thereof and possessing a groove-shaped recess. The said catch positively interrupts the outward movement of the locking bolt before its locking position is reached, if the control bolt is not shifted in the locking bolt by a predetermined amount out of its initial position positively assumed in every unlocking movement by striking upon a stop secured on the housing. On this locking bolt there is secured an elastic contact bridge which when the lock bolt is advanced into its locking position by cooperation with two contacts secured in insulated fashion on the housing closes a current circuit of the elevator controls and when the lock bolt is withdrawn out of the locking position interrupts this current circuit.

The invention consists in that the end articulatedly connected with the lock bolt of the lever rotatably mounted

on the housing is formed as a catch finger which in the outward movement of the lock bolt constantly and positively approaches this bolt, and when the control bolt is pushed by the predetermined amount out of the initial position, engages the recess of the control bolt, so that the lock bolt can move out into the locking position, but when the control bolt remains in the initial position, the finger comes to rest on the periphery of the control bolt against a stop surface and thus prematurely interrupts the locking movement.

The invention will be further explained hereinafter with reference to an exemplary embodiment of the invention which is represented in the three characteristic positions in the accompanying drawings, wherein:

FIGURE 1 shows the mechanism in the unlocked position with the door closed,

FIGURE 2 shows the mechanism in the locked position with the door closed and

FIGURE 3 shows the mechanism in the blocking position when the door is opened.

In the figures, **1** designates the housing of the door lock, which is secured on a door post **2**. **3** is a shaft door into which there is welded a bolt receiving means or lock stop **4** with a stop pin **4.1**. The door lock includes a shaft **5** rotatably mounted in the housing **1**. A lever **6** is secured inside the housing **1** on shaft **5** and on its outside end there is secured a roller lever (not shown) cooperating in known manner with a movable sliding cam on the cabin.

The lever **6** is formed as a bell-crank lever with the two lever arms **6.1**, **6.2**. Against one end of the lever arm **6.1** rests a compression spring **8** guided by means of a bolt **7** and engaging a housing projection **1.1**. The end of the lever arm **6.2** is formed as a blocking finger **6.3**. The lever arm **6.2** has a bore **6.4** in which there is secured a spindle **9**. **11** designates the lock bolt of the door lock. This bolt is pivotally mounted on the spindle **9** and guided in the exit opening of the housing **1**. The compression spring **8** tends to rotate the bell-crank lever **6** in such manner that the lock bolt **11** is thrust out of the housing **1**. **12** and **13** designate two rubber stops secured on the housing **1** and limiting the movement of the lever arm **6.2**.

The lock bolt **11** possesses a longitudinal bore **11.1** and two longitudinal slots **11.2**, **11.3**. In the longitudinal bore **11.1** there is arranged a control bolt **14** displaceable in relation to the lock bolt **11**. The control bolt **14** has a guide nose **14.1**, which extends out beyond the lock bolt **11** through the longitudinal slot **11.2**. The guide nose **14.1** is adapted to move along a path which is limited at one end by a stop **12.1** formed by the securing of the rubber stop **12**. The control bolt **14** is further provided with a stop surface **14.2** and a groove-shaped recess **14.3**. At one end of surface **14.2** there is provided a shoulder **14.4**. According to the position of the control bolt **14** with respect to the lock bolt **11**, during the locking movement of the door lock the blocking finger **6.3** will either engage the recess **14.3** or come to rest on the stop surface **14.2**. In the longitudinal bore **11.1** of the lock bolt there is arranged a control spring **15** supported on a support surface **11.4** of the lock bolt **11**. Spring **15** urges the control bolt **14** out of the lock bolt **11**.

On the lock bolt **11** there is further secured an arm **16** which carries a resilient contact bridge **17**. The contact bridge **17** cooperates with two fixed contacts **18**, **19** secured in insulated fashion on the housing, and forming part of the locking mechanism check check circuit of the elevator controls.

In the unlocked position according to FIGURE 1 the lock bolt **11** is withdrawn under the action of the unlocking force exerted by the movable sliding cam on the cabin and transmitted through the shaft **5** by the lever arm **6.2** to the lock bolt **11**. The lever arm **6.2** rests on the rubber stop **13**. The contact bridge **17** is lifted away from the fixed contacts **18**, **19**. Under the action of the control spring **15** the control bolt **14** rests with its guide nose **14.1** at the end of the longitudinal slot **11.2** on the control bolt **11**. Before the cabin travels away the movable sliding cam is withdrawn, so that under the action of the spring **8** the lock bolt **11** is thrust out of the housing **1**. During the locking movement the end of the catch finger **6.3** approaches the lock bolt **11** and extends through longitudinal slot **11.3**. The lock bolt **11** and the control bolt **14** retain their relative position until the control bolt **14** abuts the stop pin **4.1**.

The control bolt **14** then remains blocked in the position assumed, while the lock bolt **11** is shifted still further. The catch finger **6.3** now engages the recess **14.3** of the control bolt **14** whereupon the contact bridge **17** interconnects the contacts **18**, **19**. Thus the locking mechanism check circuit is closed, so that the elevator cabin can now travel away. The locking movement of the lever arm **6.2** is limited by the rubber stop **12**. The door locking mechanism then is in the locking position as represented in FIGURE 2.

During the unlocking movement, effected by the movable sliding cam upon the arrival of the elevator cabin, the same actions take their course in the opposite direction and sequence. The control bolt **14** here remains pressed against the stop pin **4.1** under the action of the control spring **15** during the return of the lock bolt **11**, until the nose **14.1** abuts again at the end of the longitudinal slot **11.2**. In case the control spring **15** is defective, the control bolt **14** is entrained by the lock bolt **11** even at the commencement of the unlocking movement, then it is positively brought back into its initial position by striking of its guide nose **14.1** on the stop **12.1**.

If in the case of a defect the movable sliding cam on the elevator cabin is lifted away when the shaft door **3** is open, the door locking mechanism moves into the position as shown in FIGURE 3. Under the action of the spring **8** the lock bolt **11** is thrust out of the housing **1**. During the locking movement the catch finger **6.3** again extends through the longitudinal slot **11.3** of the lock bolt **11**. The lock bolt **11** and the control bolt **14** are pushed forward, without changing their relative position, until the catch finger **6.3** abuts the stop surface **14.2** of the control bolt **14**, so that the locking movement is positively interrupted. The contact bridge **17** follows the movement of the lock bolt **11**. Since, however, the latter is halted before it reaches its locking position, the contact bridge **17** does not engage the fixed contacts **18**, **19**, so that the locking mechanism check circuit remains open. It is further seen that any attempt to push the control bolt **14** inward from its forward position shown in FIG. 3 would fail since such motion would be positively prevented by the abutting relationship of finger **6.3** and shoulder **14.4**.

What I claim is:

1. In a device for locking doors including, in a unitary structure, a locking mechanism and a circuit maker responsive to said locking mechanism, the improvement in said device comprising,

(a) a door adapted to assume an open and a closed position,

(b) bolt receiving means including stop means carried by said door,

(c) a housing affixed to a door frame,

(d) a hollow locking bolt slideably mounted in said housing and registering with said bolt receiving means when said door is in its closed position, said locking bolt adapted to assume an advanced position and a retracted position, said locking bolt adapted to project from said housing and extend into said bolt receiving means in said advanced position,

(e) a swingable lever arm disposed in said housing and secured to said locking bolt by pivotal means, said arm adapted to impart a sliding motion to said locking bolt,

(f) a control bolt slideably disposed within said hollow locking bolt and movable as a unit therewith, said control bolt, when said locking bolt is in said advanced position, being adapted to assume a forward position in the absence of said stop means and a blocked position in the presence thereof, said control bolt including

(1) a recess,

(2) a stop face spaced from said recess,

(3) spring means urging said control bolt away from said pivotal means and

(4) means restraining said control bolt within said locking bolt,

(g) an electric contact including

(1) stationary contact means disposed in said housing,

(2) movable contact means fixedly secured to said lever arm and adapted to be displaced toward said stationary contact means when said locking bolt is being moved toward said advanced position urged by said arm and

(h) a finger integral with said lever arm and adapted to swing toward said control bolt as said locking bolt and said control bolt are being advanced by said lever arm as a unit, said finger adapted to engage said recess when said control bolt is in said blocked position causing said arm to assume a position whereby said movable contact engages said stationary contact, and said finger adapted to engage said stop surface when said control bolt is in said forward position causing said arm to assume a position whereby said movable contact remains separated from said stationary contact to prevent the making of an electric circuit when said door is in said open position and said locking bolt is in said advanced position.

2. A device as defined in claim 1, wherein said stop face is provided with a shoulder adapted to abut against said finger for preventing said control bolt to be shifted from its said forward position to said blocked position.

3. A device as defined in claim 1, wherein said stop means comprises a pin adapted to extend into said locking bolt when said locking bolt extends into said bolt receiving means causing said control bolt to abut thereagainst and assume its blocked position.

4. A device as defined in claim 1, wherein said lever arm is pivotally secured within said housing.

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EVON C. BLUNK, *Primary Examiner.*

ANDRES H. NIELSEN, *Examiner.*