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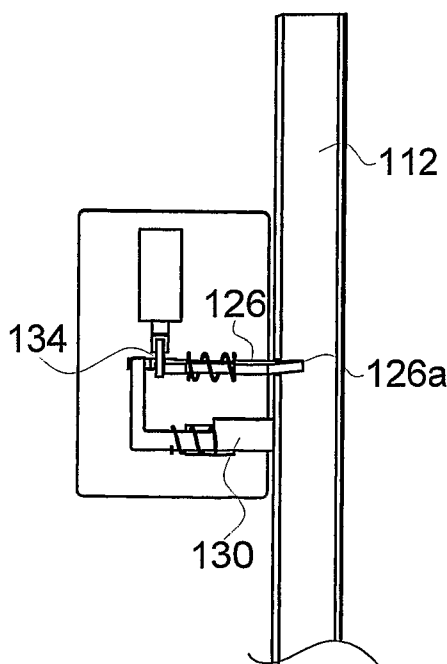
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(54) Title: LOCK DEVICE



(57) Abstract: A lock device comprises a locking bar (126), which is movable between an outer end position, which is a locking position, and an inner end position, which is an opening position. An interlocking bar (130) is movable between an outer and an inner end position. An electrically operable lock plate (134) is movable between a blocking position, in which it is placed between the locking bar and the interlocking bar and the movement of the locking bar from the locking position into the opening position is blocked, and a release position, in which the movement of the locking bar from the locking position into the opening position is allowed. A manually operable element is movable to and from an arresting position and is arranged so as, in the arresting position, to be blocked by the lock plate when this assumes its blocking position. Hence a secure lock device is produced, which has automatic mechanical locking and electrical unlocking, while, at the same time, the design remains simple.

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## LOCK DEVICE

Technical field

5 The present invention relates generally to a lock and more specifically to a lock device with electrical interlocking.

Background

10 The demands upon contemporary lock devices as regards, for example, security against unauthorized forcing are, generally speaking becoming ever greater. At the same time, there is the low-cost requirement, which means that the lock design must be kept relatively simple. In  
15 certain applications, there is an additional requirement that the lock must be remote-controllable. The last requirement exists, for example, in schools, where a large number of pupil lockers must be able to be remote-controlled centrally by the use of, for  
20 example, magnetic cards to allow individual lockers to be selectively unlocked.

A known way of increasing the security in a lock device is to provide an electrical interlocking, which means  
25 that, beyond the conventional mechanical blocking, there is also some type of electrically operated blocking or arresting of the lock bolt.

Preferably, only electrical interlocking can be used,  
30 the displacement of a manually operated bolt between an open and a locked position being permitted or blocked in dependence on an electrically operated interlocking element. An example of this is described in European patent application EP 1 528 200 A1.

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Summary of the invention

One object of the present invention is to produce a lock device which has a secure and cheap electrical interlocking.

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The invention is based on the insight that an electrically operated lock plate, in combination with a locking bar and an interlocking bar, allows automatic mechanical locking and electrical unlocking.

According to the invention, a lock device as defined by the appended patent claim 1, a locker as defined by the appended patent claim 12 and a lock system as defined by the appended patent claim 13 are therefore produced.

Hence a lock device is produced which has automatic mechanical locking and electrical unlocking, while, at the same time, the design remains simple. By virtue of the manually operable element, an active handling is required to lock the lock device. Hence a better control is obtained with respect to locking and the problem of inadvertently banging the door shut and thus locking it is averted. The manually actuable element further produces an increased security with respect to opening. The electrical unlocking can be controlled, for example, from a centrally placed panel which is common to a plurality of lockers or the like. When an authorized user, for example, swipes an authorization card or inputs an authorization code at the panel, the intended locker is electrically unlocked. In previously known systems of this kind which have no manually actuable element on the locker, the intended locker will then be opened and will often be pushed open. It hence becomes clearly apparent that the locker is unlocked, which entails a significant risk that unauthorized persons who can thus directly discover which locker is unlocked shall steal from the locker. This problem especially exists if the panel is remote from the locker which it controls, such as, for example, in public baths or schools. With the manually operable element according to the invention, this risk is considerably reduced, since it is not possible to

determine which cabinet has been unlocked other than by manually actuating the element.

Another advantage of the invention is that a very thin  
5 external lock device is obtained, since the bar and the interlocking bar can be configured as simple sheet metal parts. Thus a lock device is obtained which is very cheap and rational, both to produce and to fit. It is advantageous that the lock can be made thin, since  
10 the lock is fitted in a locker in which it occupies very little of the opening space. The risk of getting a bag or a jacket, for example, caught in the lock is thus reduced.

15 In a preferred embodiment, the lock device comprises a bolt, which constitutes the manually operable element and which is mechanically coupled to a door knob, a cylinder or the like, and a lock housing which is placed in a door frame and comprises the locking bar,  
20 the interlocking bar and the lock plate, the locking bar, in its locking position, being placed in a slot in the lock housing.

One advantage with this embodiment is that existing  
25 recesses in the locker door can be used for fitting the knob. The configuration involving a slot in which the bolt, in its arresting position, engages means that the lock device can be retrofitted on, broadly speaking, any locker whatsoever and continues to offer strong  
30 locking security. The lock is therefore easy to retrofit.

In an alternative embodiment, the manually operable element is constituted by the locking bar, which in  
35 this case is mechanically coupled to a handle for linear displacement of the locking bar. The locking bar preferably engages in a door frame when it is in its locking position.

Further preferred embodiments are defined by the subclaims.

Brief description of the drawings

5 The invention will be described in greater detail below by way of example with reference to the appended drawing, in which:

fig. 1 is a general view of a locker door which is  
10 lockable by means of a first embodiment of a lock device according to the invention,

fig. 2 is a view of the interior of the locker in fig.  
1, which shows the placement of the first embodiment of  
15 a lock device according to the invention,

fig. 3 is a view which shows a bolt engagement in the  
lock device shown in fig. 2,

20 figs. 4-8 show various steps with respect to locking and unlocking with the first embodiment of a lock device according to the invention,

fig. 9 is a general view of a locker door which is  
25 lockable by means of a second embodiment of a lock device according to the invention,

fig. 10 is a view of the inner side of the door in fig.  
9, which shows the placement of the second embodiment  
30 of a lock device according to the invention,

fig. 11 is a view which shows a bolt engagement in the  
lock device shown in fig. 10,

35 figs. 12-17 show different steps with respect to locking and unlocking with the second embodiment of a lock device according to the invention, and

fig. 18 shows a lock system comprising lock devices according to the invention.

#### Embodiments

5 Preferred embodiments of a lock device according to the invention will be described in detail below, first with reference to fig. 1. Even though in this description reference is made to different directions, such as upper and lower, vertically and horizontally, etc., it  
10 will be appreciated that these references relate to what is shown in the various figures and they should not therefore be regarded as limiting beyond this.

In fig. 1, a locker 1 is shown, in which a lock device  
15 according to a first embodiment of the invention is disposed. This lock device is mechanically operated by means of a rotatable knob 14, which is fitted to a door 10, in this case a locker door.

20 In fig. 2, a view from the interior of the locker 1 is shown. The lock device comprises a lock housing 20, configured with an elongated slot 22 designed to receive a pivotable bolt 12 which is mechanically coupled to the rotatable door knob 14. The knob is  
25 preferably provided with an overload protection 14, so that the lock device cannot be wrenched apart by the application of an excessively high torsional force to the knob.

30 A clamp 16 is fixed to the locker door 10. This clamp 16 extends, in the closed position for the door 10, through a reinforcing clamp 24, which is fixed in the wall of the locker. This makes it harder to break open the door when the lock device is locked.

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In fig. 3, a corresponding view to that in fig. 2 is shown, but with the door 10 omitted, so that the engagement of the bolt 12 in the elongated opening 22 in the lock housing 20 is shown.

The working of the lock device will now be described in detail with reference to figs. 4-8. In these figures, the lock housing 20 is shown with the cover removed, whereby the inner parts are exposed. These parts comprise a horizontally movable locking bar 26, which is spring-loaded by means of a spring 28 toward a position in which the arrow-shaped tip 26a of the locking bar engages in the slot 22. In addition, an L-shaped, horizontally movable interlocking bar 30 is likewise spring-loaded by means of a spring 32 toward a position in which the flat end of the interlocking bar engages in the slot 22.

A lock plate 34 is vertically movable under the control of a solenoid 36. This means that the lock plate 34 is movable in a direction which is perpendicular to the motional direction of the locking bar and the interlocking bar. The solenoid has a spring (not shown), which in the currentless state, automatically pushes the lock plate into a vertically lower end position. This means that, when a gap appears between the locking bar and the interlocking bar, the lock plate is pushed into this gap. A purely mechanically interlocked locking is thereby obtained. When a current pulse is sent to the solenoid, the lock plate is lifted into a vertically upper end position, in which the lock plate is not in the gap between the locking bar and the interlocking bar.

30

Fig. 4 shows the lock device in the open position. The bolt 12 is in a vertical position, i.e. is not engaged in the clamp 16 or in the slot 22, and the door 10 can be displaced between the open and closed position.

35

Fig. 5 shows the lock device during a locking operation. The bolt 12 engages in the slot 22 and has pushed the locking bar 26 out of engagement with the slot 22. This is enabled by the arrow-shaped tip 26a of

the locking bar 26. The locking bar, whose other end opposite to the arrow-shaped tip bears against the interlocking bar 30, has thus displaced the latter to a corresponding degree. This means that the interlocking bar, too, has left the engagement with the slot 22, thereby allowing the bolt 12 to engage with the lower end part of the slot.

Fig. 6 shows when the bolt 12 has assumed a vertical position, in which it occupies the lower end part of the slot 22. The locking bar 26, which had previously been moved out of engagement with the slot 22, has now, as a result of the spring bias, resumed the position in which it engages with the slot 22.

Since the locking bar 26 has been displaced horizontally into engagement with the slot, but the interlocking bar has been prevented from performing a corresponding movement as a result of the placement of the bolt 12 in the slot, a gap appears between the locking bar 26 and the interlocking bar 30. The lock plate 34 has been displaced into this gap by the spring bias produced by the solenoid spring. The situation of the lock plate between the locking bar and the interlocking bar prevents the locking bar from leaving its engagement with the slot 22. This means, in turn, that the bolt 12 cannot leave its vertical position in which it engages in the lower end part of the slot 22. The position shown in fig. 6 is therefore a locking position.

When the current to the solenoid is broken, the lock plate will therefore be pretensioned such that it automatically locks when the bolt is turned down. Automatic mechanical locking is thereby obtained. This is desirable, since the activation device which produces unlocking is located at a distance from the device on which the lock is disposed. This applies particularly when a centrally placed card reader or the

like activates the solenoid for the lock belonging to the cardholder, as can be the case where a central card reader activates school locks placed in a corridor. If automatic mechanical locking does not occur, the user must move between the reader and the lock device not only when opening but also when locking.

Fig. 7 shows how the lock plate 34, under the control of the solenoid, has been displaced into an upper end position in which it is not placed in the gap between the locking bar 30 and the interlocking bar 34. This means that, if a displacement upward within the slot 22 is imparted to the bolt 12, the arrow-shaped tip 26a of the locking bar 26 will be forced out of its engagement with the slot 22 and will be displaced into the open position shown in fig. 4.

In the embodiment shown in figs. 1-8, the pivot bolt 12 can be replaced with a hook bolt, in which case a non-load continuous working, which becomes very strong, is obtained.

A second embodiment of a lock device according to the invention will now be described with reference to figs. 9-17. In figs. 11-17, the lock housing 120 is shown with the cover removed, whereby the inner parts are exposed. In fig. 9, the outer side is shown of a locker door 110, in which a lock device is disposed. This lock device is mechanically operated by means of a linearly displaceable handle 114, which is fitted to the locker door 110.

In figs. 10 and 11, the door 110 is shown from its inner side. The lock device comprises a lock housing 120, having a horizontally movable locking bar 126 which is spring-loaded by means of a spring 128 toward a position in which the beveled outer part 126a of the locking bar engages in a door frame 112 of a locker or the like (not shown) and, more precisely, in a cutout

112a in the door frame. The beveled outer end part of the locking bar acts therefore as a latch bolt, as will be explained below. The locking bar is mechanically coupled to the handle 114 and can hence be manually operated by the latter. In addition, there is an L-shaped, horizontally movable interlocking bar 130, which likewise is spring-loaded by means of a spring 132 toward an outer end position in which the flat end of the interlocking bar protrudes beyond the lock housing 120.

A lock plate 134 is vertically movable under the control of a solenoid 136. This means, as in the first embodiment, that the lock plate 134 is movable in a direction which is perpendicular to the motional direction of the locking bar and the interlocking bar. The solenoid has a spring (not shown), which in the currentless state, automatically pushes the lock plate into a vertically lower end position. It will be appreciated that the working of the parts included in the lock housing 120 corresponds to the working of the parts in the first embodiment. The difference is that in the second embodiment the outer end part of the locking bar, and the interlocking bar, interact with the door frame 112 instead of with a slot in the lock housing.

Various working steps for the second embodiment will now be described with reference to figs. 12-17. In fig. 12, the door 110 is shown in the open position. The locking bar 126 is in its outer end position. There is no gap between the locking bar and the interlocking bar 130 and the lock plate is therefore in its upper end position.

In fig. 13, the closing operation is shown. The locking bar 126 is pressed in toward its inner end position by virtue of the beveled outer end part 126a, which is pressed in by the door frame 112 as a latch bolt. The

interlocking bar 130 is pressed in by the locking bar, so that it too assumes an inner end position.

In fig. 14, the door is shown fully shut. The locking  
5 bar 126 has been displaced by the spring action into  
its outer end position, when the outer end part 126a  
engages in the door frame 112 and, more precisely, in  
the cutout 112a in said door frame. By contrast, the  
10 interlocking bar 130 cannot be displaced into its outer  
end position, since the door frame prevents this. Hence  
a gap appears between the locking bar 126 and the  
interlocking bar 130, and the lock plate 134 has been  
pushed into this gap by the spring action. This  
15 position is therefore a locked position for the door;  
the displacement of the locking bar toward its inner  
end position is blocked by the lock plate 134.

The unlocking operation is shown in fig. 15-17. In fig.  
15, the lock is shown when the solenoid has been  
20 activated by means of a current pulse. The lock plate  
has been displaced into its upper end position and is  
no longer found in the gap between the locking bar 126  
and the interlocking bar 130. The locking bar can hence  
be manually displaced into its inner end position, when  
25 it no longer engages in the door frame 112, see fig.  
16. Upon this displacement, the locking bar presses in  
the interlocking bar, so that it no longer bears  
against the door frame 112, whereby wear is avoided  
when the door 110 is opened, see fig. 17.

30

In fig. 18, in general view, a central unlocking unit  
200 is shown, which is electrically connected to a  
plurality of lockers 1 provided with lock devices  
according to the invention. In this system, the  
35 solenoid in one of the lockers can be activated by  
means of, for example, a magnetic card for a  
predetermined period, for example 10 seconds, whereby  
the locker can be manually opened during this period.  
Subsequent locking of the locker is effected

automatically and mechanically, as has been described above.

Preferred embodiments of a lock device according to the invention have been described. The person skilled in the art within the relevant technical field will appreciate that these embodiments can be varied within the scope of the appended patent claims. Thus, an electrically controlled actuating element other than a solenoid, for example an electrical motor, can be used for the displacement of the lock plate 34. In the examples described above, the manually operable element is coupled to a door knob or a handle. It will be appreciated, however, that this element can also be manually operated by means of a host of other elements, such as, for example, a lock cylinder for the reception of a key, a trigger, a push button, a lever or a manually actuatable electrical device.

## Patent claims

1. A lock device, comprising:

5

- a locking bar (26; 126), which is movable between an outer end position, which is a locking position, and an inner end position, which is an opening position, and

10

- an interlocking bar (30; 130), which is movable between an outer and an inner end position,

**characterized by**

15

- an electrically operable lock plate (34; 134), which is movable between a blocking position, in which it is placed between the locking bar and the interlocking bar and the movement of the locking bar from the locking position into the opening position is blocked, and a release position, in which the movement of the locking bar from the locking position into the opening position is allowed, and by

20

25

- a manually operable element, which is movable to and from an arresting position and which is arranged so as, in the arresting position, to be blocked by the lock plate when this assumes its blocking position.

30

2. The lock device as claimed in patent claim 1, in which the manually operable element comprises a bolt (12), which is mechanically coupled to an operating element, such as a door knob (14) or a cylinder, and a lock housing (20) which is placed in a door frame (1) and comprises the locking bar (26), the interlocking bar (30) and the lock plate (34), the locking bar, in

35

its locking position, being placed in a slot (22) in the lock housing.

3. The lock device as claimed in patent claim 2, in which the interlocking bar (30), in its outer end position, engages in the slot (22) in the lock housing.

4. The lock device as claimed in patent claim 1, in which the manually operable element comprises the locking bar (126), which is mechanically coupled to the operating element, such as a handle (114) for linear displacement of the locking bar.

5. The lock device as claimed in patent claim 4, in which the locking bar (126), in its locking position, engages in a door frame (112).

6. The lock device as claimed in patent claim 5, in which the interlocking bar (130), in its outer end position, engages in a door frame (112).

7. The lock device as claimed in any one of patent claims 1-6, in which the locking bar (26; 126), when it is displaced from its locking position into its opening position, is designed to move the interlocking bar (30; 130) from its outer into its inner end position.

8. The lock device as claimed in any one of patent claims 1-7, in which the electrically operable lock plate (34; 134) is movable in a direction perpendicular to the motional direction of the locking bar (26; 126) and the interlocking bar (30; 130).

9. The lock device as claimed in any one of patent claims 1-8, in which the locking bar (26; 126) is spring-loaded toward its locking position.

10. The lock device as claimed in any one of patent claims 1-9, in which the locking bar (26; 126) has a beveled outer end part (26a; 126a).
- 5 11. The lock device as claimed in any one of patent claims 1-10, in which the interlocking bar (30; 130) is spring-loaded toward its outer end position.
- 10 12. A locker (1), comprising a lock device according to patent claim 1.
- 15 13. A lock system, comprising a plurality of lockers (1) as claimed in patent claim 12 and further comprising a central unlocking device (200), which is electrically coupled to said plurality of lockers, thereby allowing these lockers to be unlocked from the central unlocking device.

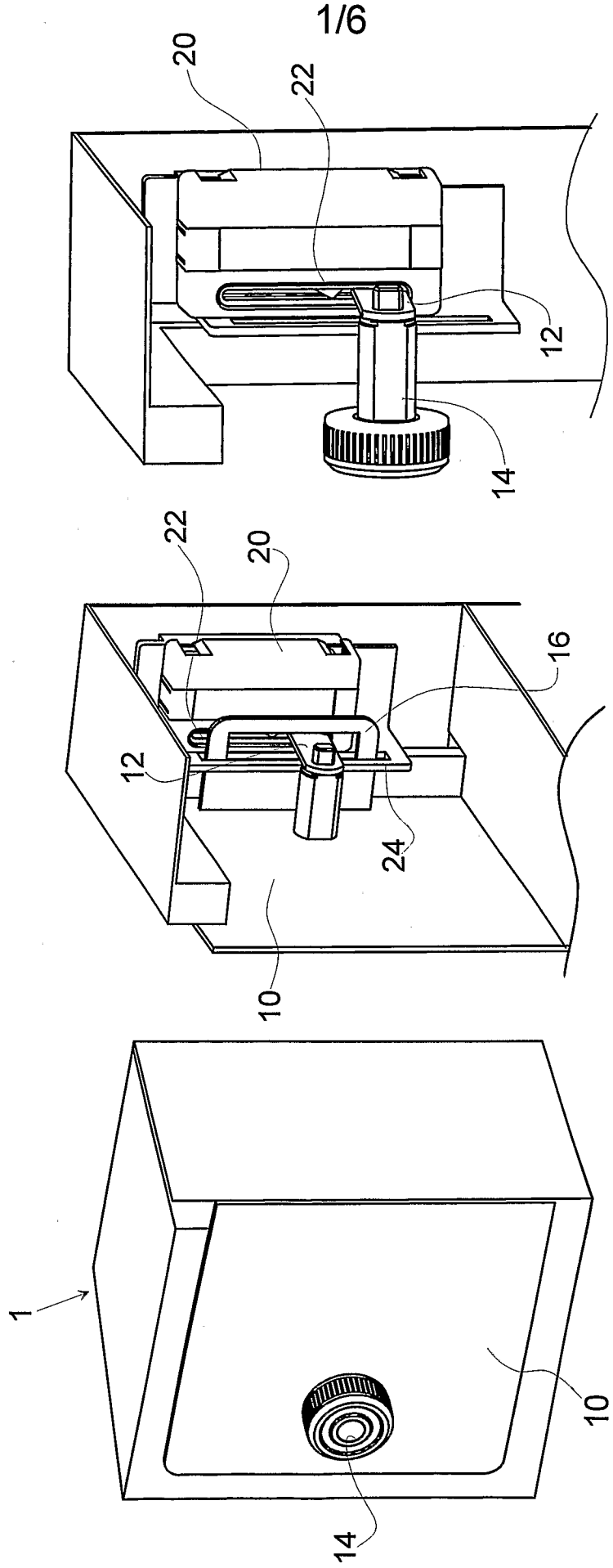


Fig. 1

Fig. 2

Fig. 3

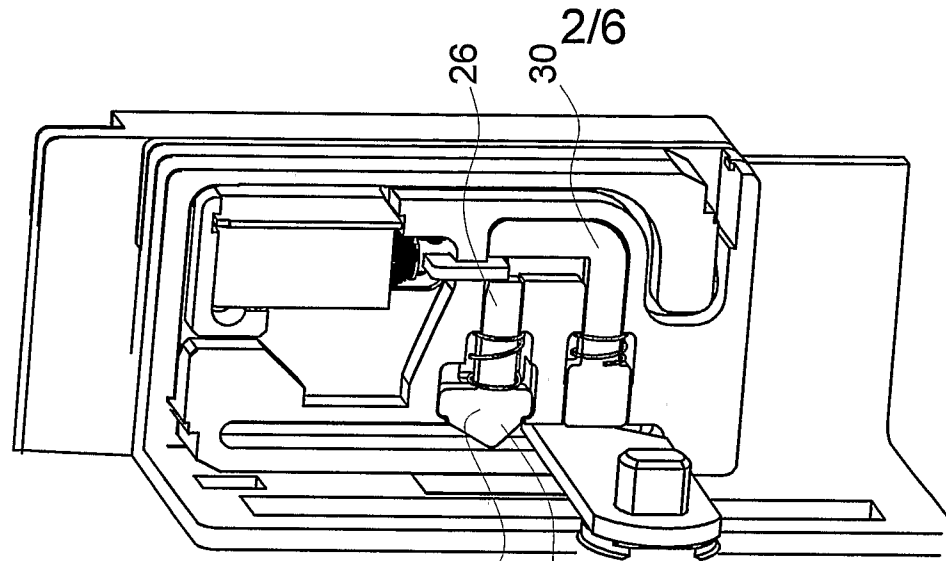


Fig. 4

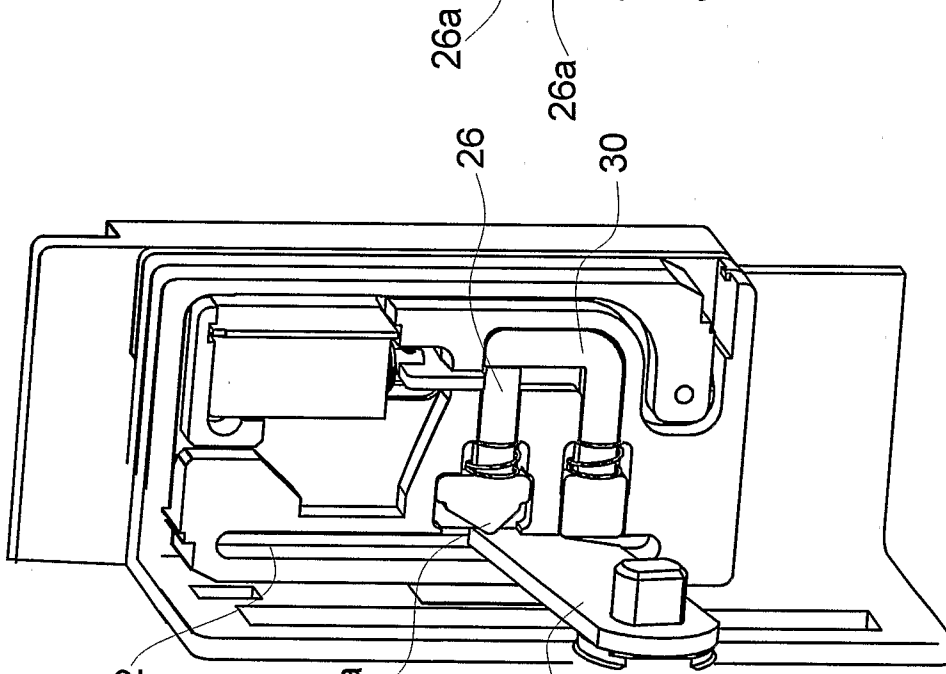


Fig. 5

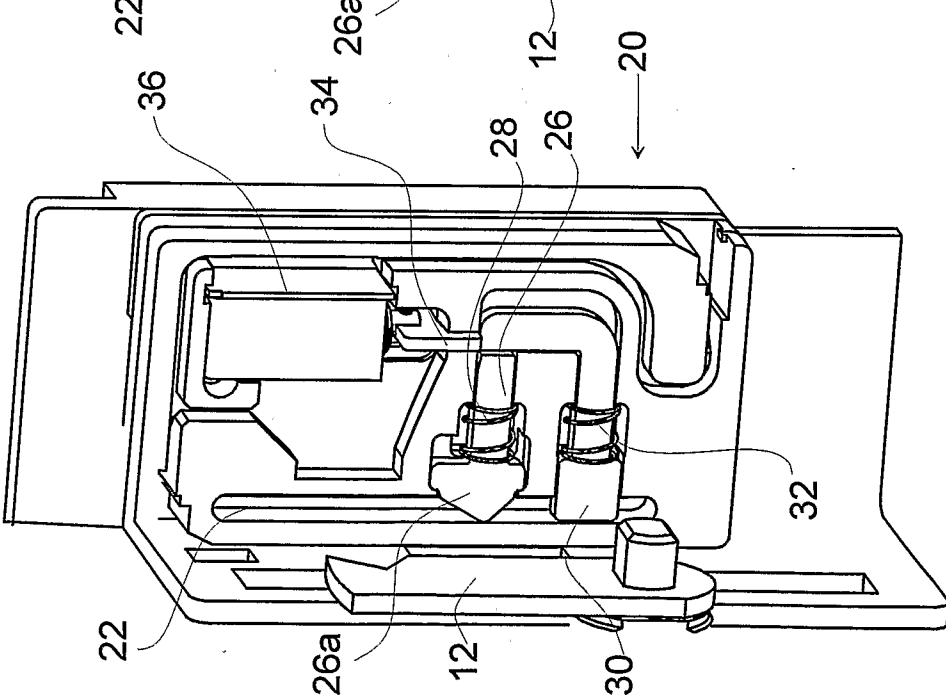


Fig. 6

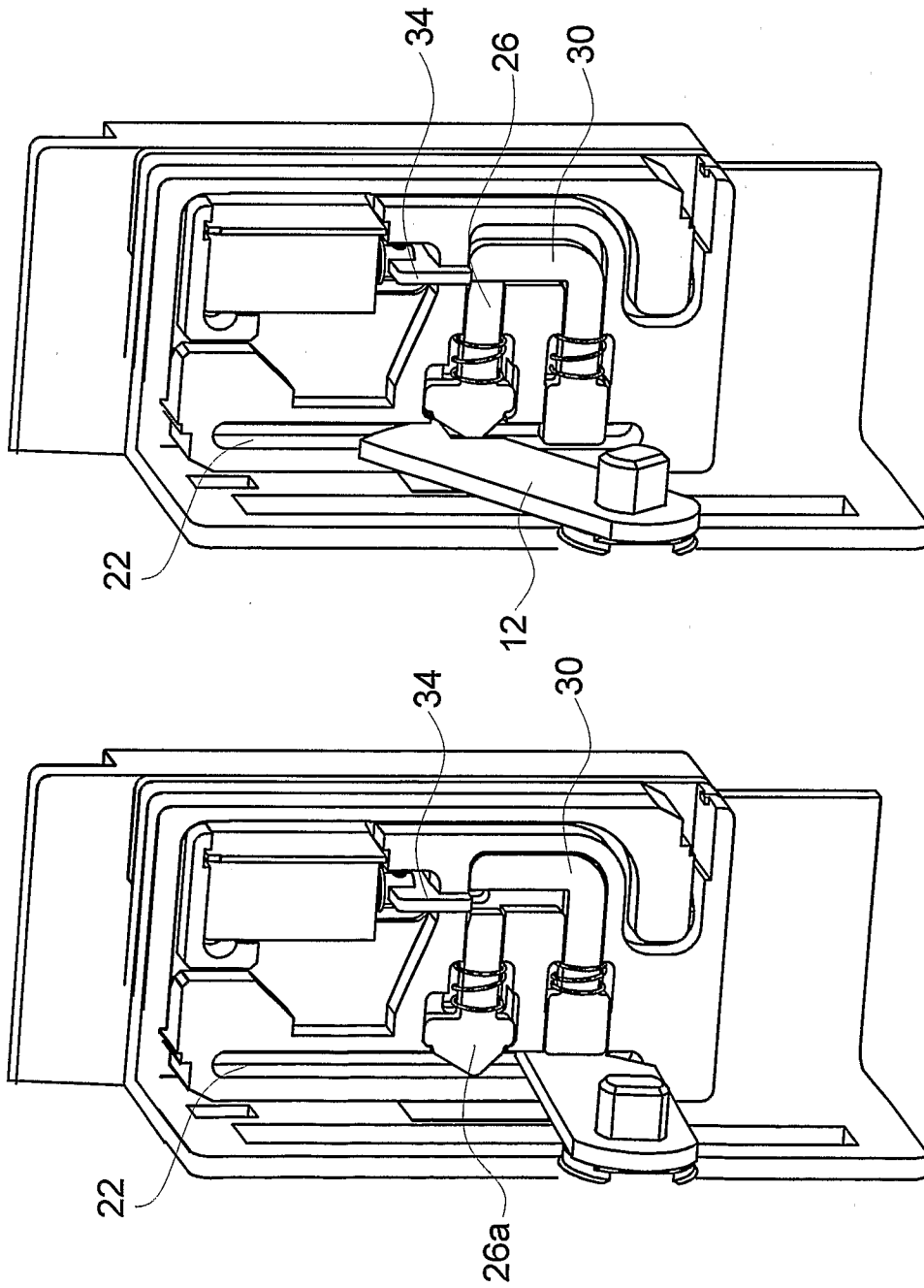
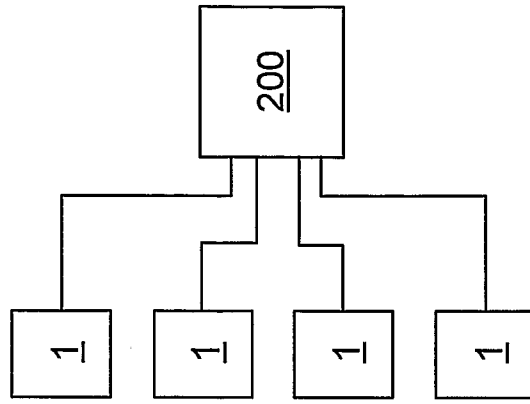


Fig. 7

Fig. 8



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Fig. 18

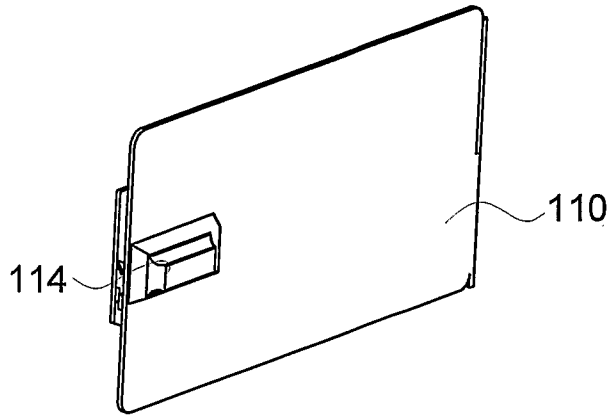


Fig. 9

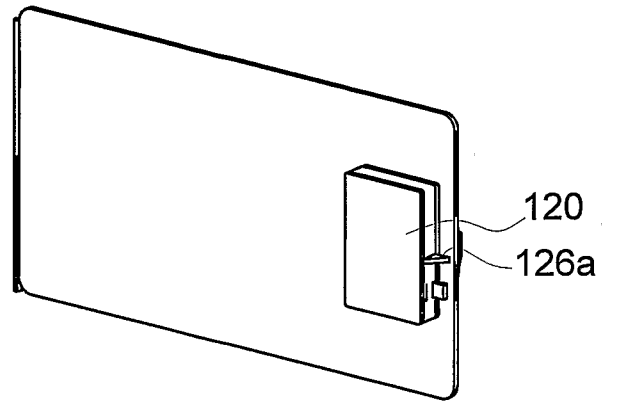


Fig. 10

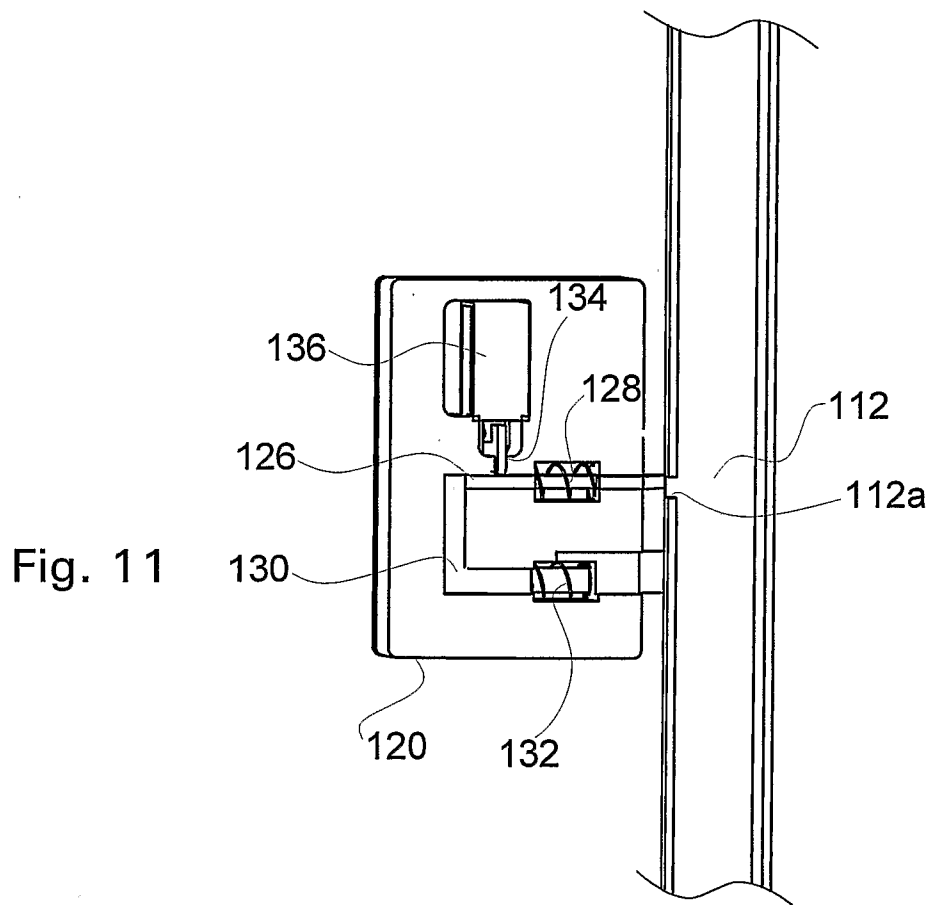


Fig. 11

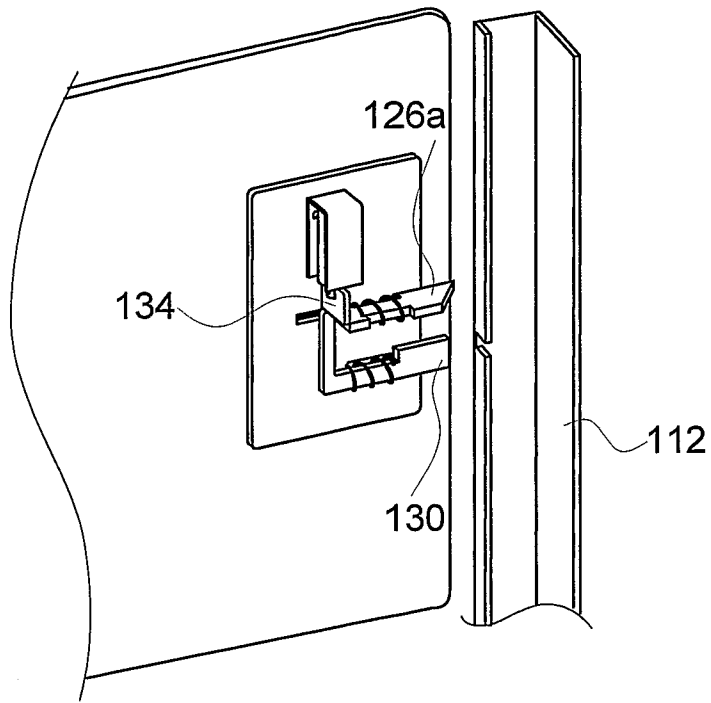


Fig. 12

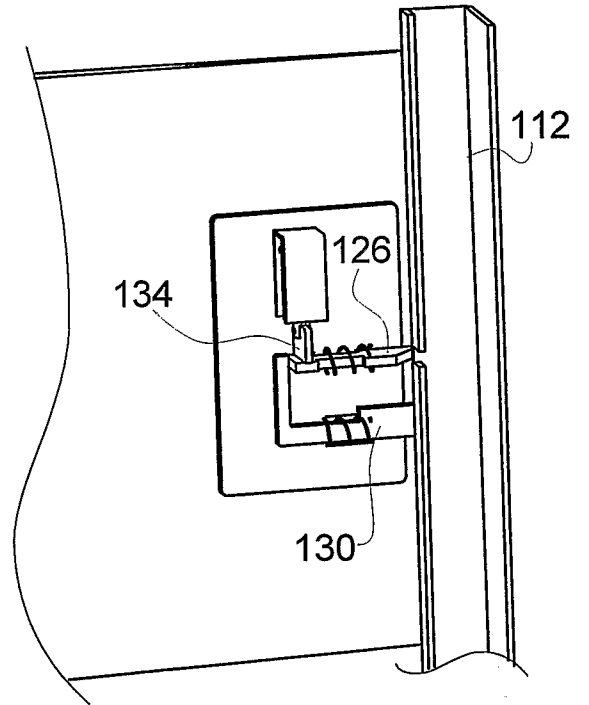


Fig. 13

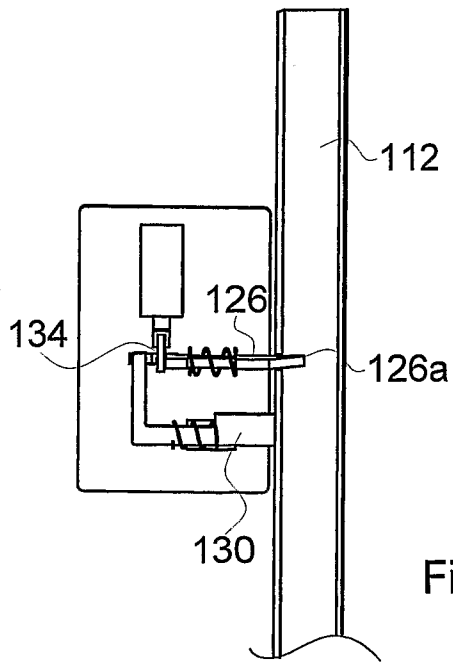


Fig. 14

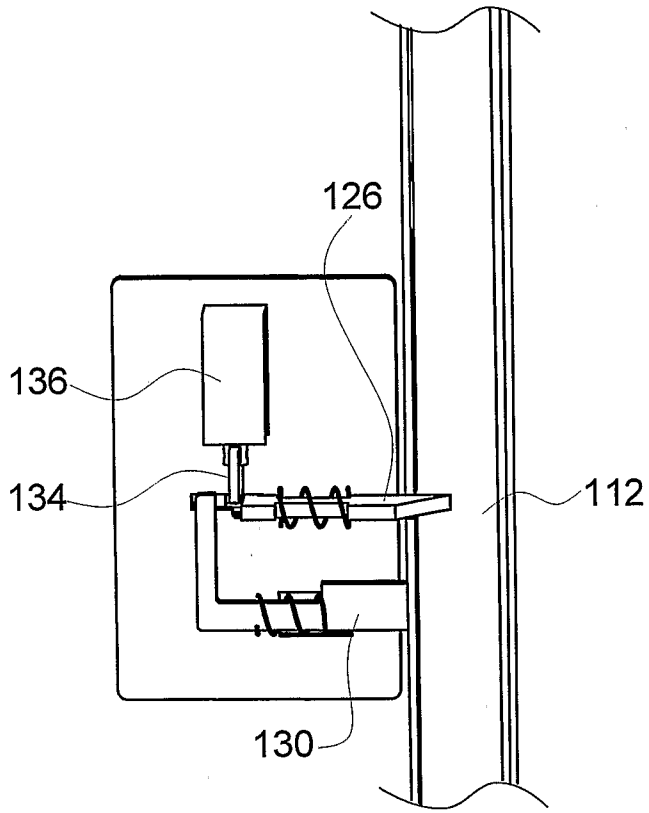


Fig. 15

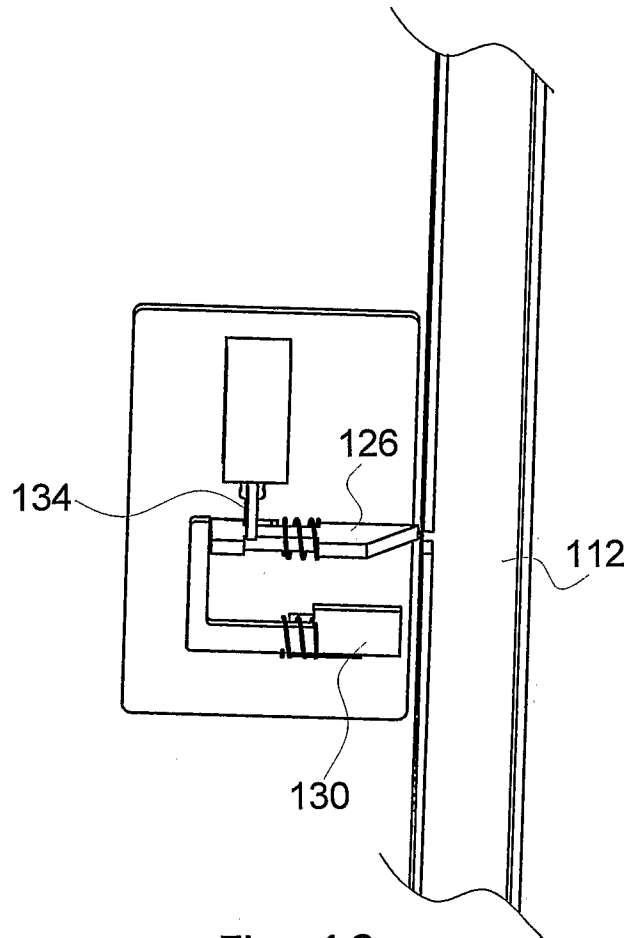


Fig. 16

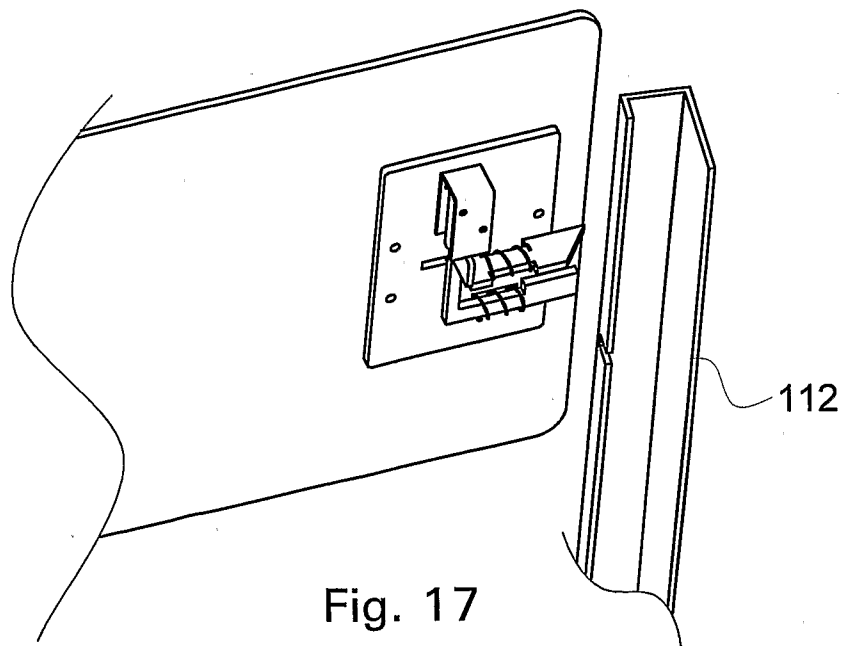


Fig. 17

**INTERNATIONAL SEARCH REPORT**

International application No.

**PCT/SE2007/000872**

**A. CLASSIFICATION OF SUBJECT MATTER**

**IPC: see extra sheet**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

**IPC: E05B**

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**EPO-INTERNAL, WPI DATA, PAJ**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 8001186 A1 (STENDALS ELEKTRISKA AB), 12 June 1980 (12.06.1980)  --	1,4-13
A	US 4262504 A (A. INOUE), 21 April 1981 (21.04.1981)  -- -----	1-13

Further documents are listed in the continuation of Box C.

See patent family annex.

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Cited literature, if any, will be enclosed in paper form.

**INTERNATIONAL SEARCH REPORT**

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01/09/2007

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