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(54) **Smoke evacuation shutter**

Rauchablassverschluss

Obturbateur d'évacuation de fumée

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to smoke evacuation shutters having a frame, a door assembly mounted in the frame, and a locking mechanism. Additionally, the present invention relates to a smoke and heat ventilation system using such smoke evacuation shutters.

BACKGROUND OF THE INVENTION

[0002] In modern fire fighting, the concept of tactical ventilation is commonly used. Tactical ventilation can be described as performing specific venting and fire isolation actions in order to evacuate smoke and heat, to provide firefighters a clear view on the seat of fire, to pull fire away from trapped occupants, and to limit property damage.

[0003] Since in modern buildings, modern materials, especially the polymers, produce a lot more heat than traditional materials (wood, plaster, stone, bricks, etc.), tactical ventilation is even more crucial, such that ventilation systems with dedicated smoke evacuation shutters have been developed and introduced in the buildings.

[0004] Typically, a conventional smoke evacuation shutters as disclosed in eg. EP0412903 and US 4054008, comprise a frame holding a heat resistant panel which is pivoting between an open and closed position in connection to an exhaust air duct, and a locking mechanism for opening manually and/or remotely.

[0005] Locking mechanisms for smoke evacuation shutters typically have three operation requirements, namely (i) the lock must be operatable electronically (e.g. by an automated process); and (ii) the lock must be operatable manually. Another important requirement (iii) is that once the shutter has been opened it should be prevented from closing either by itself or by an unauthorized person to ensure correct functioning in case of danger (fire).

[0006] Such locking mechanisms are known in the field of industry and are described in for example FR 2770613. Smoke evacuation shutters however have another stringent requirements namely; and (iv) the shutter should be secured against opening by unauthorized persons.

[0007] Existing smoke evacuation shutters address the above requirement (iv) by providing a grid in front of the door assembly such that one has no access to the lock unless removing the grid. Clearly such solution is non-ideal in that it has severe drawbacks in that it requires removing of the grid for manually operating the locking mechanism for opening said shutter. As for limiting access to the shutter these grids are secured with a plurality of preferably special bolts for which only fire departments or other authorized persons have the tools to unscrew, it is clear that removing the grid is time consuming especially in emergency situations.

[0008] Another requirement (v) of a smoke evacuation shutter is that the air flow through the shutter in open

position is as less as possible restricted by the locking mechanism in order to provide an as efficient as possible smoke and heat transport.

[0009] Therefore, it is now an objective of the present invention to provide a smoke evacuation shutter meeting the above requirements without being secured by a grid, such that in case of emergency, authorized person can open the shutter without losing valuable time.

[0010] The present invention meets the above objective by providing a smoke evacuation shutter wherein the locking mechanism is positioned in the door assembly.

SUMMARY OF THE INVENTION

[0011] The present invention is directed to a smoke evacuation shutter according to claim 1. Preferred embodiments are covered by the dependent claims.

[0012] Additionally, the present invention is directed to a ventilation system using such smoke evacuation shutters.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG 1 represents a perspective view of a smoke evacuation shutter according to the present invention;

FIG 2 represents a cross-sectional view of the smoke evacuation shutter according to the present invention;

FIG 3 represents a locking mechanism applicable in the smoke evacuation shutter in different positions of said locking mechanism.

DESCRIPTION OF THE INVENTION

[0014] Typically a smoke evacuation system of a building comprises air inlet duct and an air exhaust duct that are in fluid connection with the different floors of that building through side ducts, wherein at least in the air exhaust duct means are provided for creating a forced air stream (creating an under pressure in said exhaust duct).

[0015] In said side ducts, smoke evacuation shutters are provided that are closed in a normal position and that - in the event of a fire at a certain floor- open on that floor to evacuate smoke produced by the fire. In this case the smoke evacuation shutters on all other floors of the building are designed to remain closed to prevent smoke entering said floor.

[0016] As represented in FIG 1, the smoke evacuation shutter 1 comprises a frame 2 and a door assembly 3. The frame 2 can be any known type of frame allowing mounting said door assembly in the concerning side duct or in a hole in a wall in fluid communication with said side duct, whereby the frame engages the wall parts defining the hole or the inner circumference of the duct in an air

tight manner.

[0017] As represented in FIG 2, a smoke evacuation shutter in accordance with the present invention comprises a locking mechanism 25 positioned in the door assembly. By positioning the locking mechanism 25 in the door assembly instead of at the front side of the door assembly, the locking mechanism itself is not reachable by anyone unauthorized.

[0018] Another benefit is that the air flow through the shutter in open position is less (or even not) restricted by the locking mechanism integrated in the door assembly, thereby providing a more efficient smoke and heat transport into the side duct. Consequently, while having the same air flow, the cross-section of the door assembly may be made smaller compared to conventional shutters

[0019] Either, the locking mechanism may be positioned in a recess in a massive panel door assembly, either, in case the door assembly is not made of a massive panel but of a plurality of panels, the locking mechanism may be positioned in between the panels of the door assembly.

[0020] Preferably and as illustrated in FIG 2, said lock mechanism is fixed to the interior panel 7 in between the panels 6 and 7 of door assembly 3 and is accessible through a key hole 10 provided in the interior panel 7 of the shutter 1.

[0021] In a particular embodiment, the door assembly has a front facing the room and a back facing the air exhaust duct, wherein the front of the door assembly is planar to the wall. By configuring the shutter such that its front is planar to the wall, in combination with positioning the locking mechanism in the door assembly, opening by unauthorized persons is even more prohibited as it becomes very difficult to force the door assembly by using for example a screwdriver or a pry bar.

[0022] In accordance with the present invention, the smoke evacuation shutter may be configured as an integrated wall module. Such integrated wall module is understood as a kit of parts comprising the frame to be fixed in the wall and puttied up, only leaving pivoting means (e.g. hinges, or pens) uncovered, and a door assembly with integrated locking mechanism to be fixed on the pivoting means.

[0023] In the represented embodiment of FIG 1 the frame 2 is rectangular and comprises four T-shaped profiles made of a fire resistant material, for example aluminum profiles shielded with a layer of fire resistant material such as calcium silicate. In this case, one of said profiles provided with two pens 5 for a pivoting connection with the door assembly 3.

[0024] Part of the frame may be configured such that it covers the front contact area of the frame and the door assembly. The frame 2 may comprise a rim 4 covering the slit between the frame and the door assembly at the front side. Such rim is very effective in prohibiting unauthorized persons to force the door assembly by pushing for example a screwdriver between the frame and the door assembly.

[0025] It is clear that the door assembly can be realized according several alternatives as long as the locking mechanism can be installed within the door assembly. For example, it may comprise one panel, a plurality of panels, two separate single panel doors being mounted parallel and at a distance of each other, multiple wall saloon type doors, even a roll down panel.

[0026] Preferably, as illustrated in FIG 2, the door assembly may comprise a plurality of preferably parallel spaced apart panels 6 and 7 that are mutually connected by distance holders 8 to form a single door element.

[0027] At least one of said panels, i.e. the exterior panel 6 that in a mounted and closed position of the smoke evacuation shutter faces the air exhaust duct is preferably manufactured of a heat resistant material. The heat insulating material may, of course, be selected from foamed or non-foamed inorganic heat insulating materials such as glass wool, rock wool, calcium silicate, glass reinforced gypsum, magnesium based materials, perlite and vermiculite.

[0028] The interior panel 7 (the panel facing a room of the building in a mounted and closed position of the smoke evacuation shutter) has less stringent heat resistance requirements and can be made out of gypsum or another construction material such as MDF or wood. However this second panel too can be manufactured in for example calcium silicate or other heat resistant materials as exemplified above or synthetic resin materials exemplified by a polyurethane resin material (any one of a hard material, a semi-hard material and a soft material), a denaturated polyisocyanurate resin material exhibiting excellent heat insulating characteristics, a polyethylene resin material, a polystyrene resin material, a urea resin material, a phenol resin material and a polyvinyl chloride resin material. Furthermore, the following heat insulating materials may be employed solely or in a properly combined manner: various rubber materials possessing elasticity such as natural rubber and synthetic rubber.

[0029] In the represented embodiment the door assembly further comprises two torsion spring loaded hinges that are designed to cooperate with the pens 5 in said frame 2 to pivotably mount the door assembly in the frame such that the door assembly preferably can pivot from a closed to an open position in a direction inwards the side shaft. The hinges force the door assembly to an open position.

[0030] In an additional embodiment, a ventilation system is provided using smoke evacuation shutters as described above.

[0031] Applicant also elaborated a new type of locking mechanism 25 that addresses the above requirements and that can be used in a smoke evacuation shutter as described above.

[0032] The locking mechanism 25 comprises a housing 11 that is preferably made of a heat resistant material such as aluminum or stainless steel defining a guide way 12 guiding a spring 13 actuated bolt 14. The bolt 14 comprises a protrusion 15.

[0033] The locking mechanism further comprises a notch 16 that is rotatably mounted in the housing 11 for opening the locking mechanism. In this case the notch 16 is part of a cylinder 16a that can be actuated by a key and said notch further comprises a cam 17 cooperating with a spring 18 loaded lever 19 that at one end is provided with a counter plate 20. As represented in the drawing the counter plate 20 cooperates with an electrically induced solenoid 21 fixed on the housing. Preferably a further spring 22 is provided between the lever and the counter plate, essentially to force the counter plate 20 against the solenoid 21 when in a locked position.

[0034] In between the bolt and said lever or the housing is provided the above-mentioned spring 13 forcing the bolt in a locking direction.

[0035] The locking mechanism can be operated in two manners, in a first manual operation, the key is inserted in the cylinder 16a and can be turned in an unlocking direction P1 in which the notch forces the bolt to retreat into the housing. In this unlocked condition, the key can preferably be retreated from the cylinder by virtue of the design of the lock cover plate 23 and the bolt is forced in a locking position by spring 13.

[0036] In a second electronically controlled operation, the solenoid is deactivated such that the magnetic attraction between the solenoid 21 and the counter plate 20 is interrupted and the torsion spring 18 forces the lever 19 to rotate in direction P1. As such the lever 19 will engage the cam 17 provided on the cylinder 16a. Hence the cylinder and its notch 16 will rotate thereby engaging the sidewall of protrusion 15 in the bolt that as such retreats into the housing (open position of the locking mechanism). It is preferred that a clearance is provided between the lever 19 and cam 17 in a position wherein the counter plate 20 engages the solenoid 21, such that upon interruption of the magnetic attraction between both, the torsion spring 18 will allow the lever to achieve a high kinetic energy before engaging the cam 17 on the cylinder. As such a fail proof opening of the locking mechanism is guaranteed.

[0037] To rearm the locking mechanism after electronically controlled operation, the key needs to be introduced into the cylinder and rotated in a direction P2, such that the cam 17 on the cylinder 16a forces the lever back to a position wherein the counter plate contacts the solenoid 21. The contact is further improved by virtue of spring 22 acting on the counter plate 20.

[0038] The described locking mechanism can be applied for smoke evacuation shutters or fire dampers of all kinds, and can be integrated in either the frame or the door assembly. This locking mechanism is particularly suited for use in a smoke evacuation shutter as described above wherein the lock mechanism is preferably mounted in between the exterior panel 6 and the interior panel 7, whereby the locking mechanism can be mounted on the interior panel or on a distance holder 8 close to the interior panel 5, whereby the key hole 10 in the interior panel gives access to the key hole in the cylinder 16a.

[0039] In this embodiment, it is preferred that the key when introduced in the cylinder can be turned in a direction P2 beyond its insertion position, whereby the key is prevented from being removed from the key hole by the cover plate 23 such that in this position, the key provides a handle function for closing the door against the force of the torsion springs provided on the hinges of the door assembly. It is noted that when turning the key beyond the insertion position in a direction P2, the cam on the cylinder will engage the lever and push the counter plate 20 against the solenoid 21 against the force of spring 22. As such when releasing the key, it will be forced back to its insertion position for easily removing the key.

Claims

1. A smoke evacuation shutter suitable to be mounted in a duct fluidly connecting a room of a building with a smoke exhaust duct, the smoke evacuation shutter comprising:

- a frame (2),
- a door assembly (3) pivotally mounted in the frame (2), the door assembly comprising a panel having a front surface facing said room;
- a locking mechanism (25) positioned in the door assembly (3),

characterized in that the frame and the door assembly are configured such that, when said frame and door assembly are mounted on the wall of said room, the front of said door assembly (3) is planar to the wall of said room wherein the duct fluidly connecting the room with the exhaust duct is provided and **in that** door assembly pivots versus the frame from a closed position to an open position in a direction inwards the duct wherein the smoke evacuation shutter is mounted.

2. A smoke evacuation shutter according to claim 1, wherein a part of the frame (2) is configured such that it covers the front contact area of the frame and the door assembly.

3. A smoke evacuation shutter according to any of the above claims, wherein the door assembly comprises a plurality of panels (6, 7).

4. A smoke evacuation shutter according to any of the above claims, wherein the plurality of panels (6, 7) are fixed to each other.

5. A smoke evacuation shutter according to claims 3 or 4, wherein the locking mechanism (25) is mounted in between the plurality of plates (6, 7).

6. A ventilation system using smoke evacuation shutter

according to any of the above claims.

comprenant :

Patentansprüche

1. Rauchabführungsklappe, die geeignet ist, in einer Leitung befestigt zu werden, die einen Raum eines Gebäudes mit einer Rauchabzugsleitung fluidisch verbindet, wobei die Rauchabführungsklappe Folgendes umfasst:
 - einen Rahmen (2),
 - eine Türanordnung (3), die schwenkbar im Rahmen (2) befestigt ist, wobei die Türanordnung eine Platte mit einer Frontfläche umfasst, die dem Raum zugewandt ist;
 - einen Verriegelungsmechanismus (25), der in der Türanordnung (3) angeordnet ist, **dadurch gekennzeichnet, dass** der Rahmen und die Türanordnung so ausgelegt sind, dass, wenn der Rahmen und die Türanordnung an der Wand des Raums befestigt sind, die Vorderseite der Türanordnung (3) mit der Wand des Raums ebenflächig ist, in dem die Leitung bereitgestellt ist, die den Raum mit der Abzugsleitung fluidisch verbindet, und dass die Türanordnung gegen den Rahmen von einer geschlossenen Stellung in eine offene Stellung in eine Richtung schwenkt, die einwärts in die Leitung verläuft, in der die Rauchabführungsklappe befestigt ist.
2. Rauchabführungsklappe nach Anspruch 1, wobei ein Teil des Rahmens (2) so ausgelegt ist, dass er den vorderen Kontaktbereich des Rahmens und der Türanordnung abdeckt.
3. Rauchabführungsklappe nach einem der vorhergehenden Ansprüche, wobei die Türanordnung eine Vielzahl von Platten (6, 7) umfasst.
4. Rauchabführungsklappe nach einem der vorhergehenden Ansprüche, wobei die Vielzahl von Platten (6, 7) miteinander verbunden sind.
5. Rauchabführungsklappe nach Anspruch 3 oder 4, wobei der Verriegelungsmechanismus (25) zwischen der Vielzahl von Platten (6, 7) befestigt ist.
6. Lüftungssystem mit einer Rauchabführungsklappe nach einem der vorhergehenden Ansprüche.

- un cadre (2),
 - un ensemble porte (3) monté de manière pivotante dans le cadre (2), l'ensemble porte comprenant un panneau ayant une surface avant faisant face à ladite pièce ;
 - un mécanisme de verrouillage (25) positionné dans l'ensemble porte (3),
caractérisé en ce que le cadre et l'ensemble porte sont configurés de telle sorte que lorsque ledit cadre et ledit ensemble porte sont montés sur la paroi de ladite pièce, l'avant dudit ensemble porte (3) est plan par rapport à la paroi de ladite pièce, dans lequel le conduit reliant de manière fluide la pièce au conduit d'échappement est prévu **et en ce que** l'ensemble porte pivote vers le cadre d'une position fermée à une position ouverte dans une direction vers l'intérieur du conduit dans lequel l'obturateur d'évacuation de fumée est monté.

2. Obturateur d'évacuation de fumée selon la revendication 1, dans lequel une partie du cadre (2) est configurée de telle sorte qu'elle couvre la zone de contact avant du cadre et de l'ensemble porte.
3. Obturateur d'évacuation de fumée selon l'une quelconque des revendications précédentes, dans lequel l'ensemble porte comprend une pluralité de panneaux (6, 7).
4. Obturateur d'évacuation de fumée selon l'une quelconque des revendications précédentes, dans lequel la pluralité de panneaux (6, 7) sont fixés l'un à l'autre.
5. Obturateur d'évacuation de fumée selon les revendications 3 ou 4, dans lequel le mécanisme de verrouillage (25) est monté entre la pluralité de panneaux (6, 7).
6. Système de ventilation utilisant un obturateur d'évacuation de fumée selon l'une quelconque des revendications précédentes.

Revendications

1. Obturateur d'évacuation de fumée adapté pour être monté dans un conduit reliant de manière fluide une pièce d'un bâtiment à un conduit d'échappement de fumée, l'obturateur d'évacuation de fumée

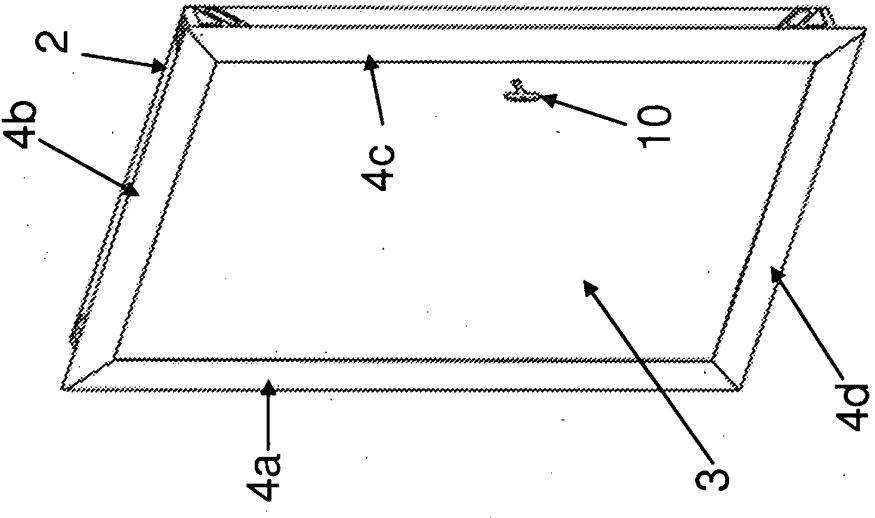
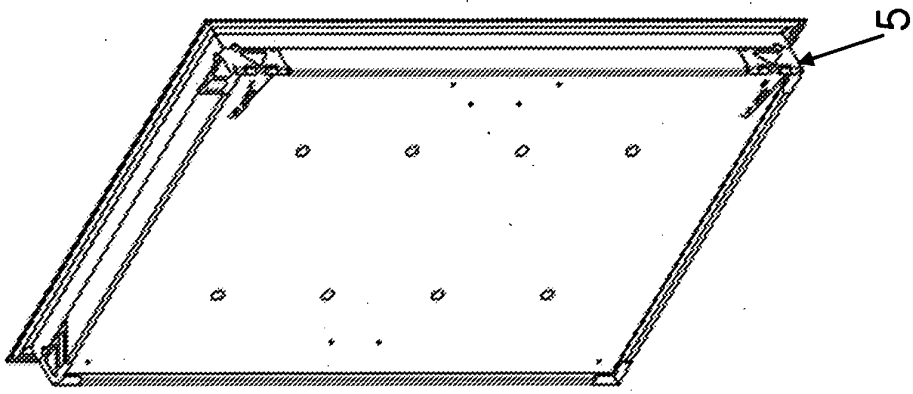


FIG 1



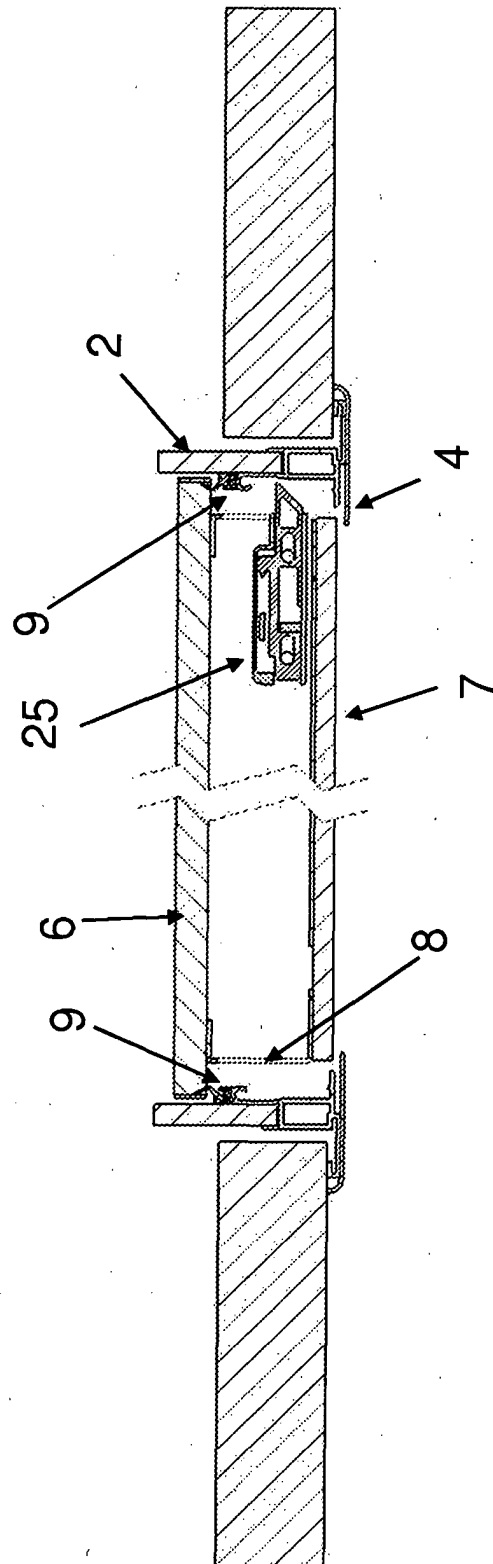


FIG 2

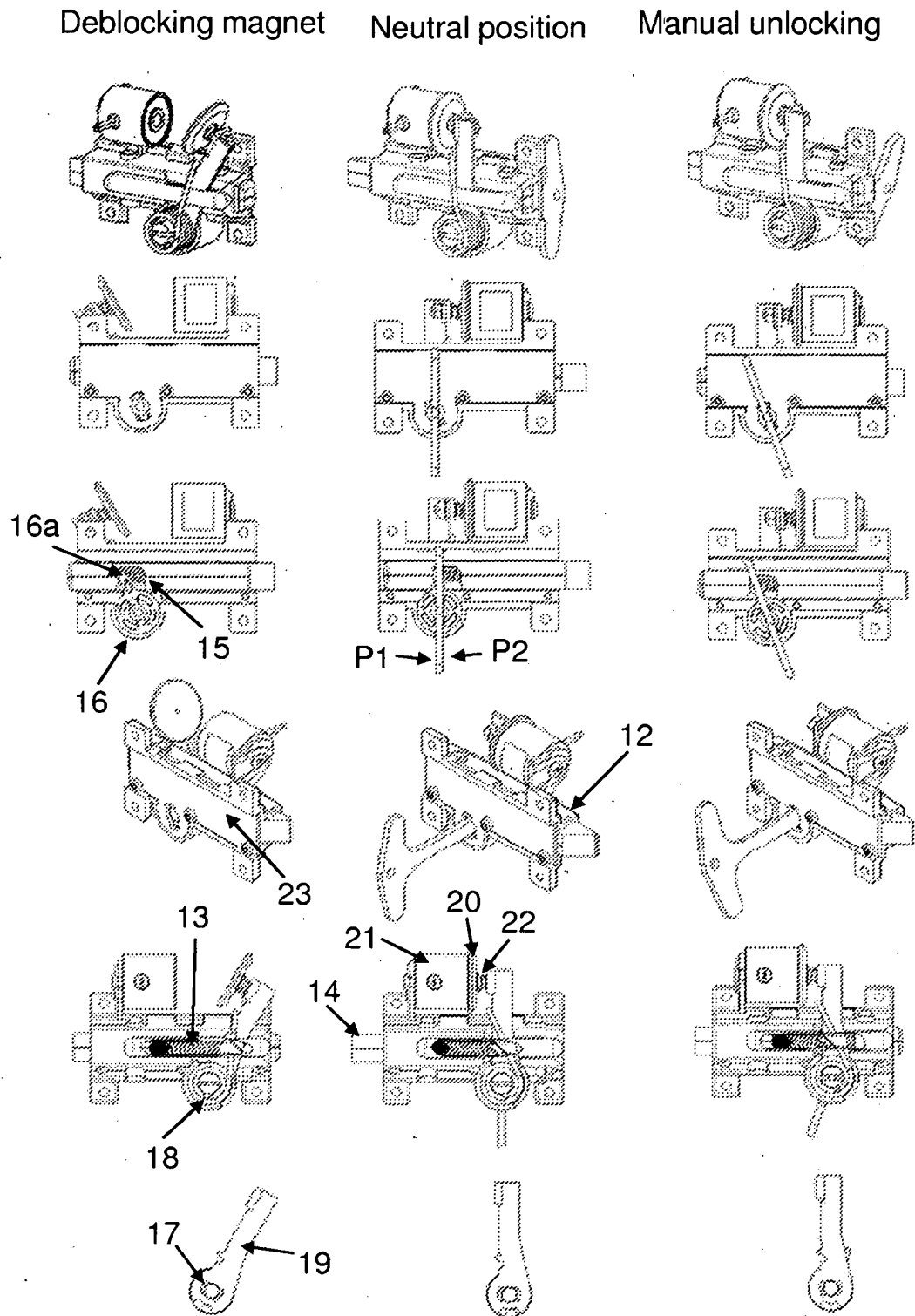


FIG 3

REFERENCES CITED IN THE DESCRIPTION

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