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(54) **Smoke evacuation shutter**

(57) The present invention is directed to a smoke evacuation shutter comprising a frame and a door assembly mounted in the frame, characterized in that the

door assembly comprises a channel formed by a plurality of panels. Additionally, the present invention is directed to a smoke evacuation system using such smoke and heat evacuation shutters.

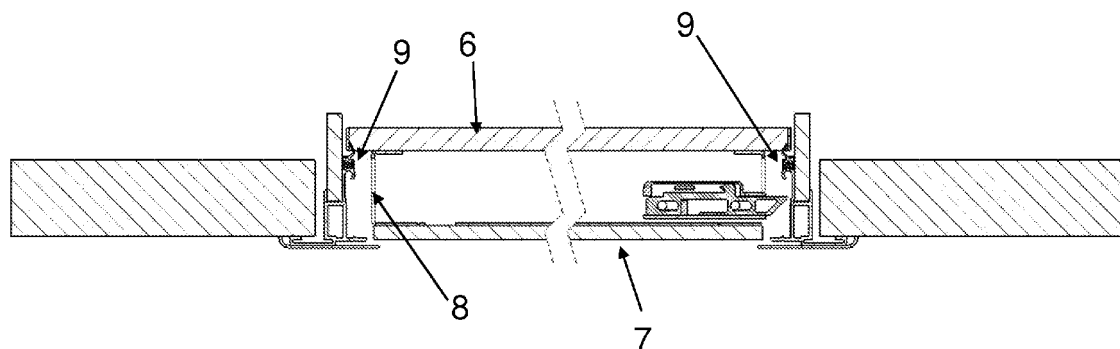


FIG 2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to smoke evacuation shutters having a frame and a door assembly mounted in the frame. 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 the smoke evacuation shutter is installed in connection to an exhaust air duct and is default in closed position. Only in case of fire in the room where the shutter is installed and where the evacuation of smoke and heat is desired, the shutter is opened either manually by the fireman or remotely via a control system.

[0005] As a result of international standards, in particular European Standard EN 1366-10, closed smoke evacuation shutters need to be resistant against extreme temperatures in the exhaust air duct for a significant period of time. Accordingly, shutters require, among others, specific considerations as to the design, engineering and selection of materials.

[0006] Typical conventional smoke evacuation shutter do not comply satisfactorily with the above standard. Said conventional smoke evacuation shutters usually comprise a frame holding a relatively thick heat resistant panel which is moveably between an open and closed position, and a locking mechanism for opening manually and/or remotely. Thicker heat resistant panel have been studied in order to comply with the standard, leading to significantly higher material cost.

[0007] Considering the above drawbacks, it is now an objective of the present invention to provide a cost efficient and effective smoke evacuation shutter that complies with European standard EN 1366-10.

[0008] By cost-effective is meant that the smoke evacuation shutter of the present invention is more heat resistant i.e. withstanding heat for a longer time period or withstanding higher temperatures for an equal time compared to conventional shutters.

[0009] By cost-efficient is meant that the smoke evacuation shutter of the present invention has less heat resistant material consumption as compared to conven-

tional shutters.

[0010] The present invention meets the above objects by providing a smoke evacuation shutter comprising a frame and a door assembly mounted in the frame, wherein the door assembly comprises a channel formed by a plurality of panels.

SUMMARY OF THE INVENTION

[0011] The present invention is directed to a smoke evacuation shutter comprising a frame and a door assembly mounted in the frame, characterized in that the door assembly comprises a channel formed by a plurality of panels.

[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 figure 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 to mount 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. Such frames are well-known in the art and will not be described in more detail herein.

[0017] In the represented embodiment, the frame 2 is

rectangular and comprises four T-shaped profiles 4a-4d 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 4a is provided with two pins 5 for a pivoting connection with the door assembly 3.

[0018] According to the present invention and as represented in figure 2, the door assembly comprises a plurality of preferably parallel spaced apart panels. In the represented embodiment, the door assembly comprises two panels 6 and 7 that are mutually connected by distance holders 8 to form a single door element.

[0019] 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.

[0020] 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.

[0021] In the represented embodiment the door assembly further comprises two torsion spring loaded hinges that are designed to cooperate with the pins 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.

[0022] Between the spaced apart panels 6 and 7 a (through) channel is defined that in a closed position of the shutter is in fluid connection with a room side of the building. The fluid connection can be obtained by maintaining passages between the frame 2 and the interior panel 7 facing the room side such that the through channel can be defined between the panels 6 and 7 and further between the edges of interior panel 7 and the frame 2 of the shutter 1. Preferably said passages are provided along two opposite edges of the interior panel 7, most preferably along the lower and upper edges of said interior

panel 7 when in a mounted position, while the other (vertical) edges of interior panel 7 are sealed in view of the frame by for example sealing strips.

[0023] Alternatively, holes (not depicted) can be provided at distinct spots in the panel 7 such that the through channel is defined between the panels 6 and 7 and further by said holes in interior panel 7. Again it is preferred that said holes are provided adjacent to two opposite edges of the interior panel 7, preferably the upper and lower edges.

[0024] It is clear that in case holes are provided in the interior panel 7, such holes should be provided at distinct places to positively create a channel between both panels 6 and 7 of the door assembly, which is not the case when said interior panel 7 facing the room side is a grid.

[0025] As represented in the figure 2, the exterior panel 6 preferably sealingly engages the frame 2 by means of sealing strips 9. Additionally strips of intumescent material can be provided between the exterior panel 6 and the frame, such that in case of a temperature rise due to the presence of hot smoke in the air exhaust duct, the intumescent material expands and ensures an airtight sealing between the exterior panel 6 and the frame 2.

[0026] Finally, the smoke evacuation shutter comprises means allowing to lock the shutter and to open the shutter automatically and/or manually. Said means comprising a lock that can be provided in the door assembly or on the frame.

[0027] In the present embodiment, said lock is fixed to the interior panel 7 in between the panels 6 and 7 and is accessible through a key hole 10 provided in the interior panel 7 of the shutter 1.

[0028] 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).

[0029] 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.

[0030] 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.

[0031] Hence there remains a need for locking mechanisms that combine the requirements (i) to (iv) identified above.

[0032] Applicant now elaborated a new type of lock that addresses the above requirements and that can be used in a smoke evacuation shutter as described above.

[0033] The locking mechanism 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.

[0034] 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.

[0035] In between the bolt and said lever or the housing is provided the above-mentioned spring 13 forcing the bolt in a locking direction.

[0036] 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.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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.

[0041] The functionality of the shutter according to the present invention is simple and will be described in more detail hereafter.

[0042] As described, the shutter is closed and remains closed under normal conditions. However when a fire is detected at a certain floor of a building, the smoke evacuation shutters at that specific floor are triggered to open thereby creating an air stream from the air inlet duct through said floor and the air exhaust duct to outside the building, whereby said air stream evacuates the smoke produced by the fire.

[0043] While opening the smoke evacuation shutters at the floor where a fire is raging, it is important to keep the smoke evacuation shutters at the other floors closed in order to prevent hot smoke entering said floors and to prevent sudden and large temperature rises at said floors due to smoke ingress.

[0044] In this case, the closed smoke evacuation shutters should resist the high temperatures reached in the air exhaust duct and according to existing and upcoming standards; the temperature gradient over the shutter should be sufficiently large.

[0045] With a smoke shutter according to the present invention, the required temperature gradient can be maintained and the upcoming standards can be met even when applying a rather thin fire resistant exterior panel 6. Indeed, the channel defined between the panels 6 and 7 of the smoke shutter will allow a continuous convection driven air flow from the lower part of the channel along the surface of the exterior panel 6 and out of the air channel (or better air duct) into the room of the building as the temperature at the interior surface of the exterior panel 6 rises. Due to the continuous air stream a cooling effect on the exterior panel 6 can be realized such that it can

be designed thinner than in conventional smoke evacuation shutters while providing optimal security.

[0046] According to a preferred embodiment the channel defined between the panels 6 and 7 comprises holes 24 provided in the exterior panel 6. In this embodiment the channel is actually defined by an inlet formed by maintaining passages between the edges of interior panel 7 and frame 2, by the space between panels 6 and 7 and by an outlet defined by said holes 24 in the exterior panel 6.

[0047] The holes 24 will result in air being aspirated into the channel due to the under pressure maintained in the air exhaust duct. Clearly, the dimensioning of holes 24 is function of a trade off between increased cooling of the exterior panel (hence increasing the temperature gradient over the smoke evacuation shutter) and decreasing the capacity of the means for maintaining an under pressure in the outlet ventilation duct necessary for optimal smoke evacuation from the floor where fire is raging.

[0048] Said holes in the exterior panel 6 are preferably sealed under normal (non-fire) conditions with a fusible material such as thermoplastic material that melt in case of a temperature rise in the air exhaust duct or by means of a controllable valve. Sealing of said holes in normal conditions is beneficial in order to prevent unwanted draught. It is clear that the door assembly can be realized according several alternatives, such as a roll-down shutter; by two separate single panel doors being mounted parallel and at a distance of each other or by multiple wall saloon type doors, multi blade shutters or guillotine type shutters.

[0049] The present invention is by no means limited by the embodiments described herein; on the contrary multiple alternatives of a smoke evacuation valve can be designed while still falling within the scope of the present invention.

Claims

1. A smoke evacuation shutter comprising:

- a frame (2),
- a door assembly (3) mounted in the frame

characterized in that the door assembly comprises a channel formed by a plurality of panels (6, 7).

2. A smoke evacuation shutter according to claim 1, which is configured such as to allow an air flow through the channel.

3. A smoke evacuation shutter according to claims 1 to 2, wherein part of said channel is formed by a first panel of said plurality of panels (6, 7) and said frame (2).

4. A smoke evacuation shutter according to claims 1

to 3, wherein a number of holes are provided relatively close to the top and the bottom of a first panel (7) of said plurality of panels (6, 7).

5. A smoke evacuation shutter according to claims 1 to 4, wherein a second panel (6) is heat resistant and comprises a number of holes (24) defining part of said channel.

6. A smoke evacuation shutter according to any of the above claims, wherein the plurality of panels (6, 7) are pivotally mounted on the frame (2).

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

8. A smoke evacuation shutter according to any of the above claims, comprising a locking mechanism.

9. A smoke evacuation shutter according to claim 7, wherein the locking mechanism is mounted in the door assembly between the plurality of panels.

10. A smoke evacuation system comprising a smoke evacuation shutter as identified in any of the preceding claims.

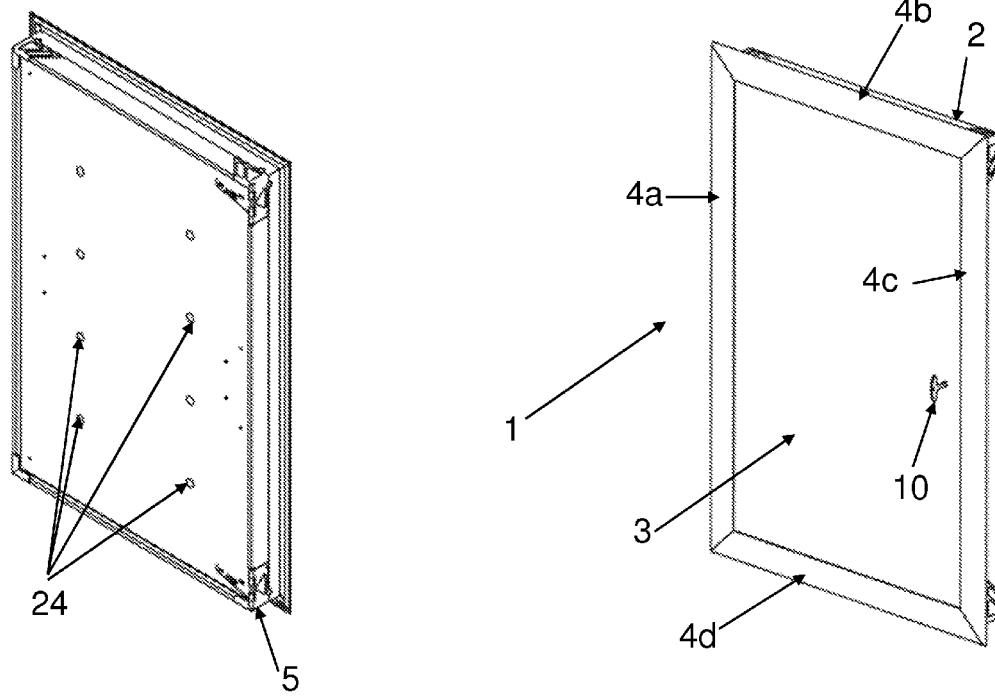


FIG 1

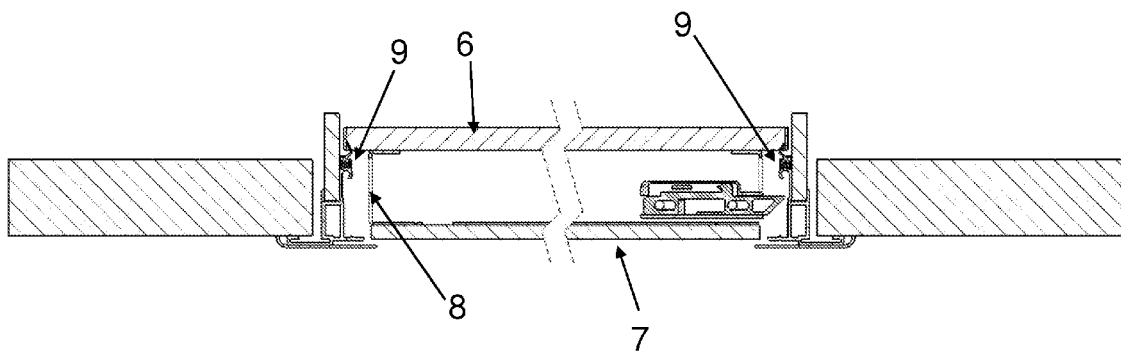


FIG 2

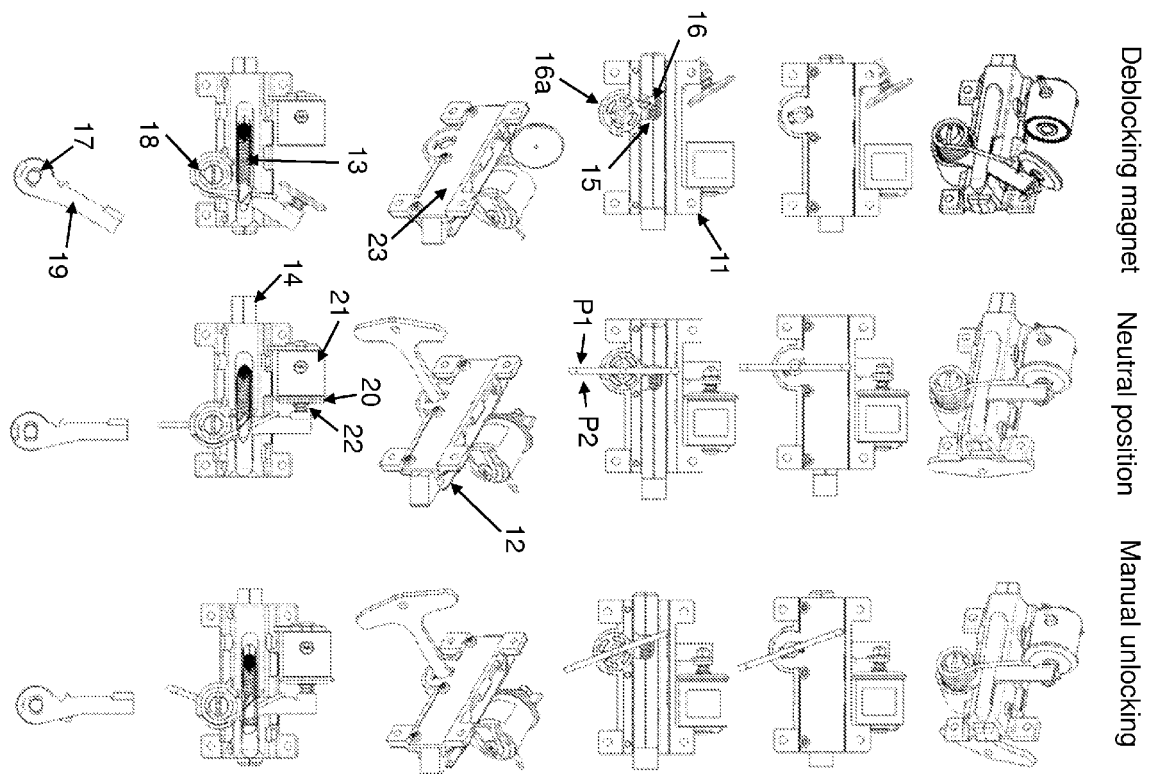


FIG 3



EUROPEAN SEARCH REPORT

Application Number
EP 11 17 1244

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 595 729 A1 (FRANCE AIR [FR]) 4 May 1994 (1994-05-04)	1,6,7,10	INV. A62C2/12
A	* column 1, line 1 - line 7 * * column 4, line 12 - line 43; figures 1, 3, 4 *	2-4	
X	FR 2 615 225 A1 (EBERSPAECHER J [DE]) 18 November 1988 (1988-11-18)	1,6,7,10	
A	* page 5, line 5 - line 13 * * page 7, line 35 - page 8, line 21; figures *	9	
X	US 4 208 840 A (COUTURE PAUL A [US] ET AL) 24 June 1980 (1980-06-24)	1,6-8,10	
A	* abstract; figures 1-4 * US 2010/304078 A1 (STOL ISRAEL [US] ET AL) 2 December 2010 (2010-12-02) * paragraph [0089]; figure 4 *	5	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A62C E04C E06B F24F
Place of search		Date of completion of the search	Examiner
The Hague		25 November 2011	van Bilderbeek, Henk
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 17 1244

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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25-11-2011

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0595729	A1	04-05-1994	EP	0595729 A1	04-05-1994
			FR	2697435 A1	06-05-1994

FR 2615225	A1	18-11-1988	AT	400166 B	25-10-1995
			CH	675443 A5	28-09-1990
			DE	3716244 A1	01-12-1988
			FR	2615225 A1	18-11-1988

US 4208840	A	24-06-1980	NONE		

US 2010304078	A1	02-12-2010	US	2010304078 A1	02-12-2010
			WO	2010141489 A2	09-12-2010

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- FR 2770613 [0029]