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(54) **Opening mechanism to a smoke and heat ventilator**

Öffnungsmechanismus zum Entrauchen und Entlüften

Mécanisme d'ouverture pour évacuation de fumée et de chaleur

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Description

Field of the Invention

[0001] The present invention concerns a ventilation opening of the type which is built into roof constructions and typically includes a frame part and a lid part, where this lid part in case of fire or smoke formation is opened at a front edge and is hinged to the frame part at an opposing hinge line, thereby being used for ventilating a room, wherein the lid part under normal conditions is used for comfort ventilation, where the ventilation opening is provided with mechanical means mounted between frame parts extending in parallel with the hinge line, where the mechanical means include at least one controlled linear actuator, where the linear actuator is attached between a crossbar and at least one lift arm for opening the ventilation opening, and where activation of the opening is effected manually or automatically by the said mechanical means.

Description of Prior Art

[0002] Ventilation openings or ventilating windows for incorporation in roof constructions have been known for many years, and many different embodiments have been offered. In recent years, still higher requirements have been made to ventilation in connection with fire or smoke formation in commercial buildings, in industrial buildings as well as office buildings. Also, by the modem building design where glass fronts and large window sections are used, an increasing need for comfort ventilation has arisen. In many places, this is addressed by mechanical renewal of the air, but where possible, the installed ventilation openings are often used as a possibility of improving the indoor climate.

[0003] In daily use, where the ventilation opening is used for comfort ventilation, the opening speed is not crucial, but in case of smoke formation by a fire or similar, it is very important that the ventilation opening can open quickly and with a sufficient opening angle. This opening is to be effected at the required speed, irrespective if it is windy, if there is snow on the ventilation opening or if anything else loads the window. Therefore, prior art types of ventilation openings are made with ingenious mechanical opening mechanisms, typically with two or more strong actuators that are powered by electricity or pressurised air or by combinations of electricity and pressurised air connected in series. Other variants are with only one actuator, the actuator being so long that it can open the ventilation opening right away. These mechanisms are often rather distinct, and such solutions may e.g. be with an opening mechanism extending some distance down into the room below the ventilation opening Such a solution is not discreet and nice, and present-day architects, engineers and customers, not the least, expect solutions that are more unobtrusive and elegant while at the same tide enabling opening of the ventilation opening rapidly and efficiently at the desired and/or required opening angle.

[0004] From GB 2125884 a solution with two gas springs is known, where the ventilation opening is opened by releasing a latch, which can be done electrically or manually. The spring effect in the gas springs will then one by one act on the lid part and forces this to be opened and pivoted about the hinge line. This solution/mechanism is capable of opening the lid 91 degrees, but it is not possible to close the lid again without manual pulling a string hanging from the mechanism. As the opening angle only is 91 degrees this ventilation opening does not fulfil the demands of today, where different laws and regulations prescribes opening angles of up to 140 degrees. The solution described in GB 2125884 does not provide the possibility to such a opening angle and do also not provide for using the ventilation opening for comfort ventilation, but only deals with ventilating in a situation where smoke or fumes have to be lead to the open.

[0005] It is the object of the invention to indicate a ventilation opening that fulfils the demands made by the present, which is sturdy, with high opening speed, large opening angle and which at the same time only occupies minimal space and which does not appear dominating.

Description of the Invention

[0006] As mentioned in the introduction, the invention concerns a ventilation opening with mechanical means that include at least one controlled linear actuator, where the direction of movement of the linear actuator is preferably away from the front edge, where the actuator is pivotably fastened to a crossbar, preferably at one end, and is connected to a rod mechanism, preferably at the other end, where the rod mechanism via a movable bearing is connected to a displacing suspension/slide groove which is in fixed connection with the lid part of the ventilation opening. By such a ventilation opening there is achieved a solution wherein an actuator with relatively short stroke can be used for opening even large ventilation openings. By this solution there is provided optimal utilisation of the forces available from the actuator, as the point of attack on the lid part is moved all the time as the ventilation opening is opened or closed. This is achieved by the invention in that a displacing suspension/slide groove is applied between mechanism and lid part.

[0007] In a preferred embodiment of a ventilation opening according to the invention, the rod mechanism may include a first lever arm to which the actuator is movably connected, where the first lever arm is pivotably fixed at one end to the crossbar, and where a first lift arm is pivotably connected to the lever arm, where the first lift arm is further with a displacing suspension which is connected with a displacing suspension/slide groove in fixed connection with the lid part. This solution indicates a mechanism with a single lift arm and which is particularly suited

for ventilation openings of small size on which large external forces do not act. It is thus possible to make a simple mechanism according to the invention for the ventilation openings that do not require great forces in order to be opened.

[0008] A preferred embodiment includes a ventilation opening where the rod mechanism includes a first lever arm to which the actuator is movably connected, where the first lever arm is pivotably fixed at one end to the crossbar, and where a first lift arm is pivotably connected to the lever arm, where the first lift arm is further connected to a second lift arm, where the second lift arm is movably connected to the crossbar and is further provided with a displacing suspension which is connected with a displacing suspension/slide groove in fixed connection with the lid part. By applying yet a lift arm there is achieved the advantage that an even more optimised solution is achieved with regard to forces for opening a ventilation opening, and that an actuator with a given stroke may in principle open ventilation openings which are even larger.

[0009] In another preferred variant of the invention, the at least one controlled actuator is supplemented by a least one second actuator, preferably of the gas spring type, where the at least one second actuator is arranged between the crossbar and a lift arm such that a lifting force is exerted at least on the lid part of the ventilation opening during the first part of the opening action, preferably until the ventilation opening is opened at least 60°. By this embodiment there is achieved increased safety in connection with snow loads, wind loads or other conditions that may influence and counteract the opening of the ventilation opening. Alternatively, a given actuator may be used for a larger ventilation opening as it is supplemented by an additional actuator/gas spring.

[0010] By disposing this at least one second actuator between crossbar and lift arm it is achieved that by closing the ventilation opening, there is also exerted a lifting force on the lid part of the ventilation opening at least during the first part of the closing action, preferably until the lid part is only open at 90°. Thus is provided additional force just at the times where it is needed the most and where the self-weight of the lid part of the ventilation opening is to be lifted off the frame part or be closed after ending ventilation.

[0011] A ventilation opening according to the invention may advantageously be adapted such that the at least one actuator is connected with a system of one or more further actuators in other ventilation openings, where these actuators are controlled and regulated via one or more control and regulating units. It is thus possible to operate a plurality of ventilation openings at once and thus rapidly achieve an efficient ventilation.

[0012] A preferred variant of the invention includes a ventilation opening wherein actuator and rod mechanism are arranged at the end of the crossbar which is closest to the hinge line, where the crossbar thus is adaptable longitudinally at the other end. Hereby it is possible to use a standard mechanism for various sizes of ventilation openings, as adaptation to the actual ventilation opening only requires cutting off one end of the crossbar and the slide groove for the lid part.

[0013] A ventilation opening according to the invention may be designed such that the at least one actuator is an electric powered actuator, a pneumatically powered actuator or a hydraulically powered actuator. Irrespective of the type of actuator used, this may be supplemented by e.g. one or more gas springs that are arranged such that they exert a force assisting in opening and closing the lid part, respectively.

[0014] A ventilation opening according to the invention can open at least 150°, and it may be adapted such that the lid part can be opened at least 140° relative to the frame part in less than one minute.

[0015] A ventilation opening according to the invention may be designed in different ways than those indicated here. The mentioned variants are all preferred embodiments which the skilled in the art can provide in other variants which are not discussed in this publication. However, it is obvious that such variants will still be included in the scope of the invention.

Short Description of the Drawing

[0016] The invention is described in more detail with reference to the drawing, where:

FIG. 1 shows a ventilation opening as seen from the end.

FIG. 2 shows a mechanism for a ventilation opening in partly open position.

FIG. 3 shows a mechanism for a ventilation opening in completely open position.

FIG. 4 shows a mechanism for a ventilation opening in closed position.

FIG. 5 shows an isometrical view of a mechanism for a ventilation opening.

Detailed Description of the Invention

[0017] In Fig. 1 appears a ventilation opening 1 which in principle consists of a frame part 2 intended for incorporating in a roof construction, and a lid part 3 which is typically designed with a frame and with a lid of a translucent sheet material. The lid itself is typically made with curved shape or other shape allowing snow to fall off more easily. The lid part 3 is fixed to the frame part 2 via a hinge 4, and between the frame part 2 and the lid part 3 there is a mechanism 5 which is partly fixed to the frame part 2 and partly to the lid part 3, respectively, and which may act on lid parts 3 for opening and closing, respectively.

[0018] In Fig. 2 appears the same mechanism 5 as in Fig. 1, but here it is seen from the other side and without frame part 2 and lid part 3. Also, for more clearly seeing and overviewing the mechanism 5, some parts of the

mechanism itself, which otherwise would hide the details to be described below, are removed. The parts removed are, however, all parts of which there are a right and a left one, respectively. No removal of parts from the drawing that may disturb the understanding has thus taken place. To the extreme right in Fig. 2 appears the hinge 4, and for mounting the not shown parallel frame parts 2 is seen the crossbar 6 which at its ends is provided with mounting flanges 7 for mounting to the frame 2. This crossbar extends transversely in the frame part, and ample rigidity in the mechanism is attained in this way. In a rotatable fixed point 8 on the crossbar 6 is fastened an electric actuator 9 with connecting wire 10. The piston 11 of the actuator is fixed to a lever arm 12 at a rotary point 13. The lever arm 12 is fixed to the crossbar 6 close to the hinge 4 at a rotary point 14. On the lever arm 12 there is a further rotary point 15 at which the first lift arm 16 is fastened. At its other end, this first lift arm 16 is fastened to the second lift arm 17 at a further rotary point 18. The second lift arm 17 is fixed at one end at the rotary point 19 to a fitting 20 which is rigidly connected to the crossbar 6 and at the other end at a displacing suspension 21 connected with a slide rail 22 to be fixed to the lid part 3. This displacing suspension 21 includes a slide member which during opening and closing is moved back and forth in the slide rail 22, whereby the point of attack of the second lift arm 17 is moved in the slide rail 22, depending on how much open or closed the ventilation opening 1 is. As it appears from the Figure, there is a section of the crossbar 6 at the end opposite the hinge side to which nothing is fastened, and this section may be shortened such that a mechanism 5, as shown, may be adapted to other sizes of ventilation openings 1. The slide rail 22 may obviously also be shortened, and depending on the load etc., the second lift arm may also be shortened or, alternatively, replaced with a shorter one of the same kind. Similarly to a shortening, an elongation of the crossbar 6, slide rail 22 and possibly the second lift arm 17 may occur as well. Such an operation is, however, to be calculated accurately in order to ensure that sufficient force is available. In Fig. 2 appears furthermore a gas spring 23 which is fastened to the fitting 20 at one end 24 and to the second lift arm 17 at the other end 25. This gas spring 23 acts by a force in direction towards the second lift arm 17, thus assisting in lifting the slide rail 22 and the lid part 3. When the slide rail comes up to about vertical position, the gas spring 23 has performed its work and cannot become any longer. By further opening action, a compression of the gas spring 23 occurs due to the self-weight of the lid part 3 and due to the force from the actuator 3, thus causing the gas spring 23 also to assist in lifting the lid part 3 while closing from a position where the fitting 20 and the second lift arm 17 are flush with each other.

[0019] In Fig. 3 appears a mechanism 5 like the one shown in Fig. 3, but here shown in completely open position, and in Fig. 4 the same mechanism 5 is seen again, but here in closed position.

[0020] In Fig. 5 the same mechanism 5 is seen again at the same position as shown in Fig. 2, however this time viewed isometrically, so that it readily appears that the mechanism 5 is designed as a frame structure where practically all elements are in a right and in a left version, whereby a stable and robust construction is achieved and where a skew loading of the elements of the mechanism does not occur.

Claims

1. A ventilation opening (1) of the type which is built into roof constructions and typically includes a frame part (2) and a lid part (3), where this lid part (3) in case of fire or smoke formation in use is opened at a front edge and is hinged (4) to the frame part (2) at an opposing hinge line (4), thereby being used for ventilating a room, wherein the lid part (3) under normal conditions is used for comfort ventilation, where the ventilation opening (1) is provided with mechanical means (5) mounted between frame parts (2) extending in parallel with the hinge line (4), where the mechanical means (5) include at least one controlled linear actuator (9), where the linear actuator (9) is attached (8, 13) between a crossbar (6) and at least one lift arm (12) for opening the ventilation opening (1), and where activation of the opening is effected manually or automatically with the said mechanical means (5), where the actuator (9) is pivotably fastened (8) to the crossbar (6), preferably at one end, and is connected (13) to a rod mechanism (12, 16, 17), preferably at the other end, where the rod mechanism (12, 16, 17) via a movable bearing (21) is connected to a displacing suspension/slide groove (22) which is in fixed connection to the lid part (3) of the ventilation opening (1), **characterised in that** the rod mechanism (12, 16, 17) includes a first lever arm (12) to which the actuator (9) is movably connected (13), where the first lever arm (12) is pivotably fixed (14) at one end to the crossbar (6), and where a first lift arm (16) is pivotably connected (15) to the lever arm (12), where the first lift arm (16) is further connected (18) to a second lift arm (17), where the second lift arm (17) is movably connected (19) to the crossbar (6, 20) and is further provided with a displacing suspension (21) which is connected with a displacing suspension/slide groove (22) in fixed connection with the lid part (3).

2. Ventilation opening (1) according to claim 1, **characterised in that** the at least one controlled actuator (9) is supplemented by a least one second actuator (23), preferably of the gas spring type, where the at least one second actuator (23) is arranged between the crossbar (6, 20) and a lift arm (17) such that a lifting force is exerted at least on the lid part (3) of the ventilation opening (1) during the first part of the

opening action, preferably until the ventilation opening (1) is opened at least 60°.

3. Ventilation opening (1) according to any of claims 1 and 2, **characterised in that** the at least one second actuator (23) is arranged in such a way between crossbar (6, 20) and lift arm (12, 16, 17) that by closing the ventilation opening (1), there is also exerted a lifting force on the lid part (3) of the ventilation opening (1) at least during the first part of the closing action, preferably until the lid part (3) is only open at 90°.

4. Ventilation opening (1) according to any of claims 1 - 3, **characterised in that** the at least one actuator (9) is connected with a system of one or more further actuators (9) in other ventilation openings (1), where these actuators (9) are controlled and regulated via one or more control and regulating units.

5. Ventilation opening (1) according to any of claims 1 -4, **characterised in that** actuator (9, 23) and rod mechanism (5) are arranged at the end of the crossbar (6) which is closest to the hinge line (4), where the crossbar (6) thus is adaptable longitudinally at the other end.

6. Ventilation opening (1) according to any of claims 1 -5, **characterised in that** the at least one actuator (9) is an electric powered actuator.

7. Ventilation opening (1) according to any of claims 1 -5, **characterised in that** the at least one actuator (9) is a pneumatically powered actuator.

8. Ventilation opening (1) according to any of claims 1 -5, **characterised in that** the at least one actuator (9) is a hydraulically powered actuator.

Patentansprüche

1. Entlüftungsöffnung (1) von dem in Dachkonstruktionen eingebauten Typ, und die typischerweise einen Rahmenteil (2) und einen Deckelteil (3) umfasst, wobei der Deckelteil (3) im Brand- oder Rauchbildungsfall an einer Vorderkante geöffnet wird und an dem Rahmenteil (2) an einer gegenüberliegenden Scharnierlinie (4) angelenkt ist und somit für das Lüften von Räumen verwendet wird, wobei der Deckelteil (3) unter normalen Umständen für Komfortlüftung verwendet wird, wobei die Entlüftungsöffnung (1) mechanische Mittel (5) aufweist, die zwischen parallel zur Scharnierlinie (4) verlaufenden Rahmenteilen (2) montiert sind, wobei die mechanische Mittel (5) wenigstens einen gesteuerten Linearantrieb (9) umfassen, wobei der Linearantrieb (9) zwischen einer Wange (6) und wenigstens einem Hubarm (12) zum Öffnen der Entlüftungsöffnung (1) angebracht (8, 13) ist, und wobei die Betätigung der Öffnung durch die erwähnten mechanischen Mittel (5) manuell oder automatisch erfolgt, wobei der Antrieb (9), vorzugsweise an einem Ende, zur Wange schwenkbar befestigt ist (8) und mit einem Gestängesystem (12, 16, 17), vorzugsweise an dem anderen Ende, verbunden (13) ist, wobei das Gestängesystem (12, 16, 17) durch ein bewegliches Lager (21) mit einer verschiebbaren, in fester Verbindung mit dem Deckelteil (3) der Entlüftungsöffnung (1) angeordneten Unterstützung/Gleitschiene (22) verbunden ist, **dadurch gekennzeichnet, dass** das Gestängesystem (12, 16, 17) einen ersten, mit dem Antrieb (9) beweglich verbundenen Hebelarm (12) umfasst, wobei der erste Hebelarm (12) an einem Ende zur Wange (6) schwenkbar befestigt (14) ist, und wobei ein erster Hubarm (16) mit dem Hebelarm (12) schwenkbar verbunden ist, wobei der erste Hubarm (16) ferner mit einem zweiten Hubarm (17) verbunden ist, wobei der zweite Hubarm (17) mit der Wange (6, 20) beweglich verbunden (19) und ferner mit einer verschiebbaren Unterstützung (21) versehen ist, die mit einer verschiebbaren Unterstützung/Gleitschiene (22) in fester Verbindung mit dem Deckelteil (3) verbunden ist.

2. Entlüftungsöffnung (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der wenigstens eine gesteuerte Antrieb (9) durch wenigstens einen Nebenantrieb (23), vorzugsweise vom Gasfedertyp, ergänzt wird, wobei der wenigstens eine Nebenantrieb (23) zwischen der Wange (6, 20) und einem Hubarm (17) angeordnet ist, so dass eine Hubkraft auf wenigstens den Deckelteil (3) der Entlüftungsöffnung (1) während der ersten Phase des Öffnungsvorgangs ausgeübt wird, vorzugsweise bis die Entlüftungsöffnung (1) wenigstens 60° geöffnet ist.

3. Entlüftungsöffnung (1) nach irgendeinem der Ansprüche 1 und 2, **dadurch gekennzeichnet, dass** der wenigstens eine Nebenantrieb (23) zwischen der Wange (6, 20) und dem Hubarm (12, 16, 17) in der Weise angeordnet wird, dass beim Schließen der Entlüftungsöffnung (1) auch eine Hubkraft auf den Deckelteil (3) der Entlüftungsöffnung (1), wenigstens während der ersten Phase des Schließvorgangs, ausgeübt wird, vorzugsweise bis der Deckelteil (3) nur 90° offen ist.

4. Entlüftungsöffnung (1) nach irgendeinem der Ansprüche 1-3, **dadurch gekennzeichnet, dass** der wenigstens eine Antrieb (9) mit einem System von einem oder mehreren weiteren Antrieben (9) in anderen Entlüftungsöffnungen (1) verbunden ist, wobei diese Antriebe (9) durch eine oder mehrere Steuerungs- und Regeleinheiten gesteuert und geregelt werden.

5. Entlüftungsöffnung (1) nach irgendeinem der Ansprüche 1-4, **dadurch gekennzeichnet, dass** der Antrieb (9, 23) und das Gestängesystem (5) an dem am nächsten zur Scharnierlinie (4) befindlichen Ende der Wange (6) angeordnet sind, wobei die Wange (6) somit am anderen Ende in der Längsrichtung anpassbar ist.

6. Entlüftungsöffnung (1) nach irgendeinem der Ansprüche 1-5, **dadurch gekennzeichnet, dass** der wenigstens eine Antrieb (9) ein elektrisch betriebener Antrieb ist.

7. Entlüftungsöffnung (1) nach irgendeinem der Ansprüche 1-5, **dadurch gekennzeichnet, dass** der wenigstens eine Antrieb (9) ein pneumatisch betriebener Antrieb ist.

8. Entlüftungsöffnung (1) nach irgendeinem der Ansprüche 1-5, **dadurch gekennzeichnet, dass** der wenigstens eine Antrieb (9) ein hydraulisch betriebener Antrieb ist.

Revendications

1. Ouverture de ventilation (1) du type qui est intégrée dans des constructions de toit et comprend typiquement une partie de cadre (2) et une partie de couvercle (3), où cette partie de couvercle (3) en cas d'incendie ou de formation de fumée, lors de l'utilisation, est ouverte au niveau d'un bord avant et est articulée (4) à la partie de cadre (2) au niveau d'une ligne d'articulation (4) opposée, étant ainsi utilisé pour ventiler une pièce, dans lequel la partie de couvercle (3), dans des conditions normales, est utilisée pour la ventilation de confort, où l'ouverture de ventilation (1) est prévue avec des moyens mécaniques (5) montés entre des éléments de cadre (2) s'étendant en parallèle avec la ligne d'articulation (4), où les moyens mécaniques (5) comprennent au moins un actionneur linéaire commandé (9), où l'actionneur linéaire (9) est fixé (8, 13) entre une barre transversale (6) et au moins un bras de levier (12) pour ouvrir l'ouverture de ventilation (1), et où l'activation de l'ouverture est effectuée manuellement ou automatiquement avec ledit moyen mécanique (5), où l'actionneur (9) est fixé de manière pivotante (8) à la barre transversale (6), de préférence au niveau d'une extrémité, et est relié (13) à un mécanisme de tige (12, 16, 17), de préférence au niveau de l'autre extrémité, où le mécanisme de tige (12, 16, 17) par l'intermédiaire d'un palier mobile (21) est relié à une suspension de déplacement/rainure de coulissement (22) qui est en liaison fixe avec la partie de couvercle (3) de l'ouverture de ventilation (1), **caractérisée en ce que** le mécanisme de tige (12, 16, 17) comprend un premier bras de levier (12) auquel l'actionneur (9) est relié de manière amovible (13), où le premier bras de levier (12) est fixé de manière pivotante (14) au niveau d'une extrémité à la barre transversale (6), et où un premier bras de relevage (16) est relié de manière pivotante (15) au bras de levier (12), où le premier bras de relevage (16) est en outre connecté (18) à un second bras de relevage (17), où le deuxième bras de relevage (17) est relié de manière amovible (19) à la barre transversale (6, 20) et est en outre pourvu d'une suspension de déplacement (21) qui est reliée à une suspension de déplacement/rainure de coulissement (22) en liaison fixe avec la partie de couvercle (3).

2. Ouverture de ventilation (1) selon la revendication 1, **caractérisée en ce que** ledit au moins un actionneur commandé (9) est complété par au moins un deuxième actionneur (23), de préférence du type à ressort à gaz, où ledit au moins un deuxième actionneur (23) est arrangé entre la barre transversale (6, 20) et un bras de relevage (17) de telle sorte qu'une force de levage est exercée au moins sur la partie de couvercle (3) de l'ouverture de ventilation (1) pendant la première partie de l'action d'ouverture, de préférence jusqu'à ce que l'ouverture de ventilation (1) est ouverte au moins 60°.

3. Ouverture de ventilation (1) selon l'une quelconque des revendications 1 et 2, **caractérisée en ce que** ledit au moins un deuxième actionneur (23) est agencé de telle sorte entre la traverse (6, 20) et le bras de levage (12, 16, 17) que par fermeture de l'ouverture de ventilation (1), une force de levage est également exercée sur la partie de couvercle (3) de l'ouverture de ventilation (1) au moins pendant la première partie de l'action de fermeture, de préférence jusqu'à ce que la partie de couvercle (3) ne soit ouverte qu'à 90°.

4. Ouverture de ventilation (1) selon l'une quelconque des revendications 1-3, **caractérisée en ce que** ledit au moins un actionneur (9) est relié à un système d'un ou de plusieurs actionneurs ultérieurs (9) dans d'autres ouvertures de ventilation (1), où ces actionneurs (9) sont commandés et régulés par l'intermédiaire d'une ou de plusieurs unités de commande et de régulation.

5. Ouverture de ventilation (1) selon l'une quelconque des revendications 1-4, **caractérisée en ce que** l'actionneur (9, 23) et le mécanisme de tige (5) sont disposés à l'extrémité de la barre transversale (6) qui est la plus proche de la ligne d'articulation (4), où la barre transversale (6) est ainsi adaptable longitudinalement au niveau de l'autre extrémité.

6. Ouverture de ventilation (1) selon l'une quelconque des revendications 1-5, **caractérisée en ce que** ledit

au moins un actionneur (9) est un actionneur à commande électrique.

7. Ouverture de ventilation (1) selon l'une quelconque des revendications 1-5, **caractérisée en ce que** ledit au moins un actionneur (9) est un actionneur à commande pneumatique.

8. Ouverture de ventilation (1) selon l'une quelconque des revendications 1-5, **caractérisée en ce que** ledit au moins un actionneur (9) est un actionneur à commande hydraulique.

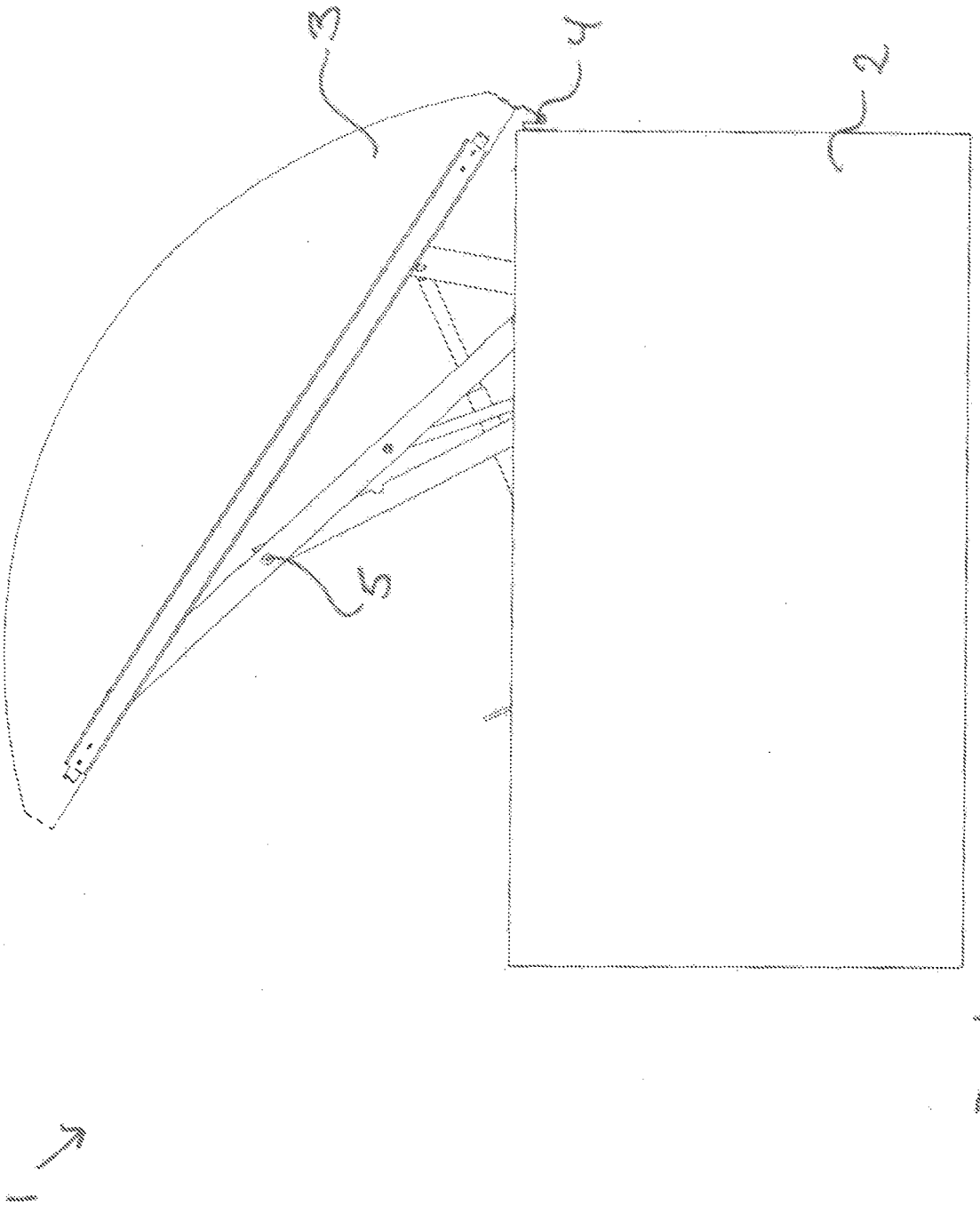

Fig. 3

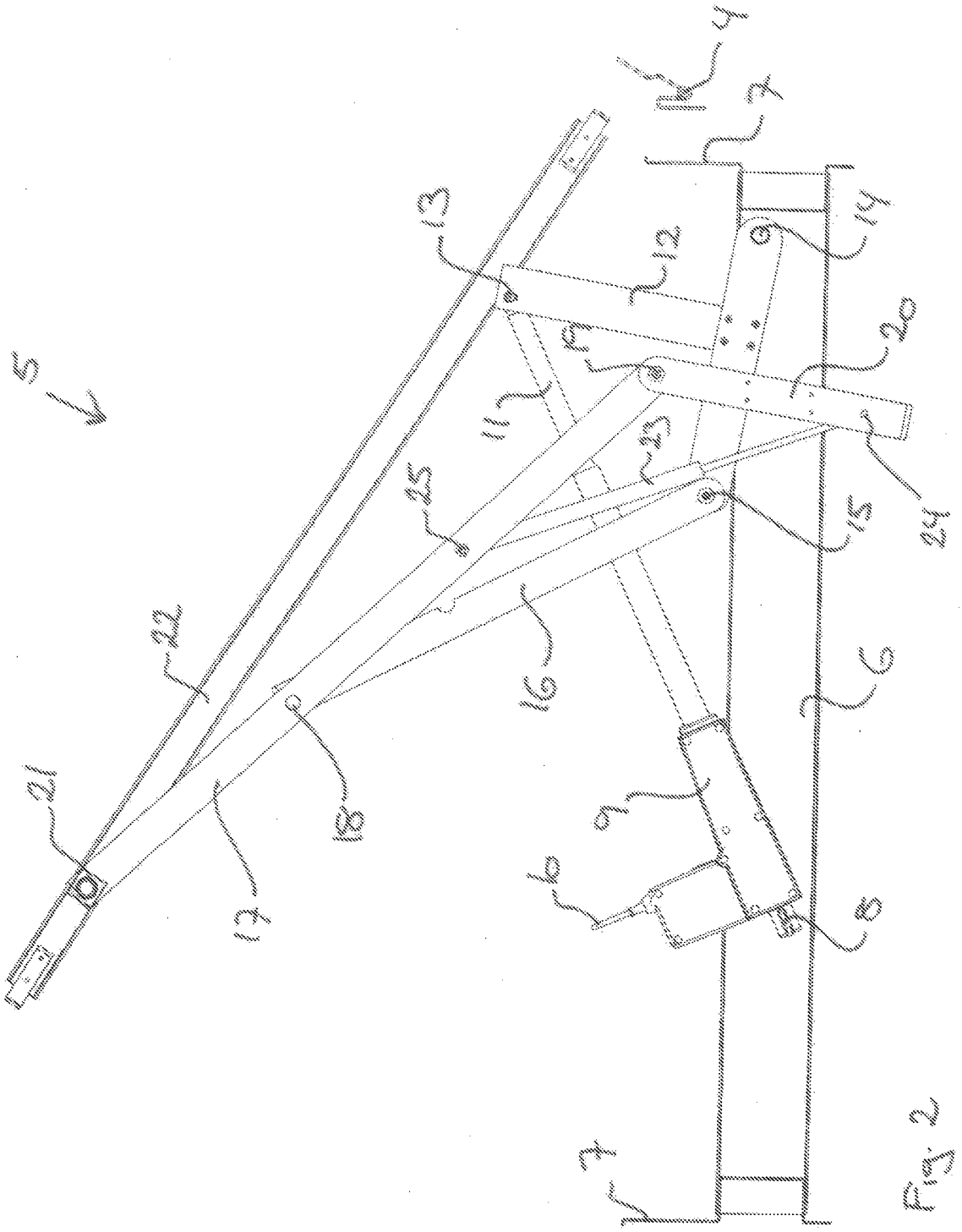

Fig. 2

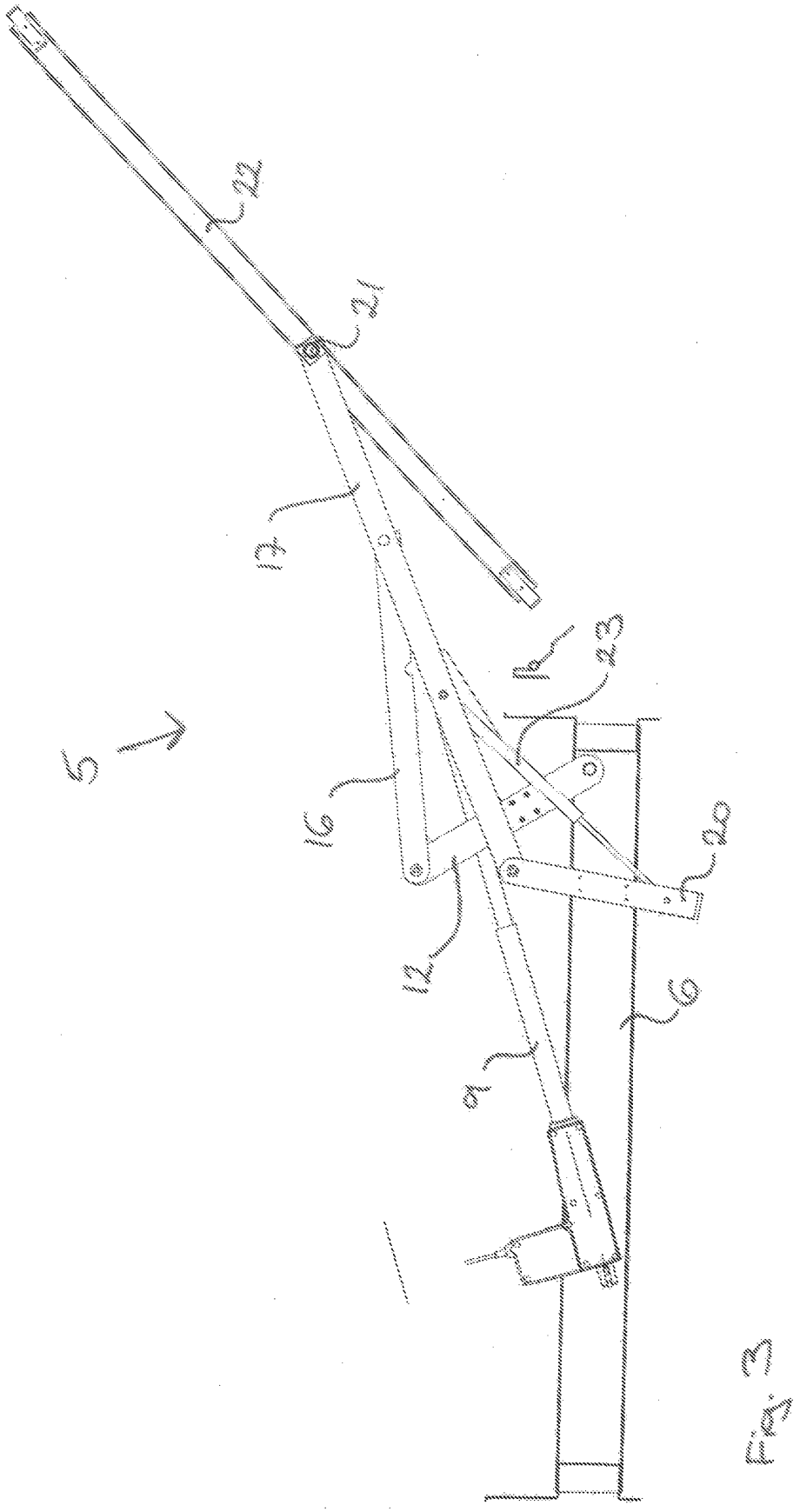

Fig. 3

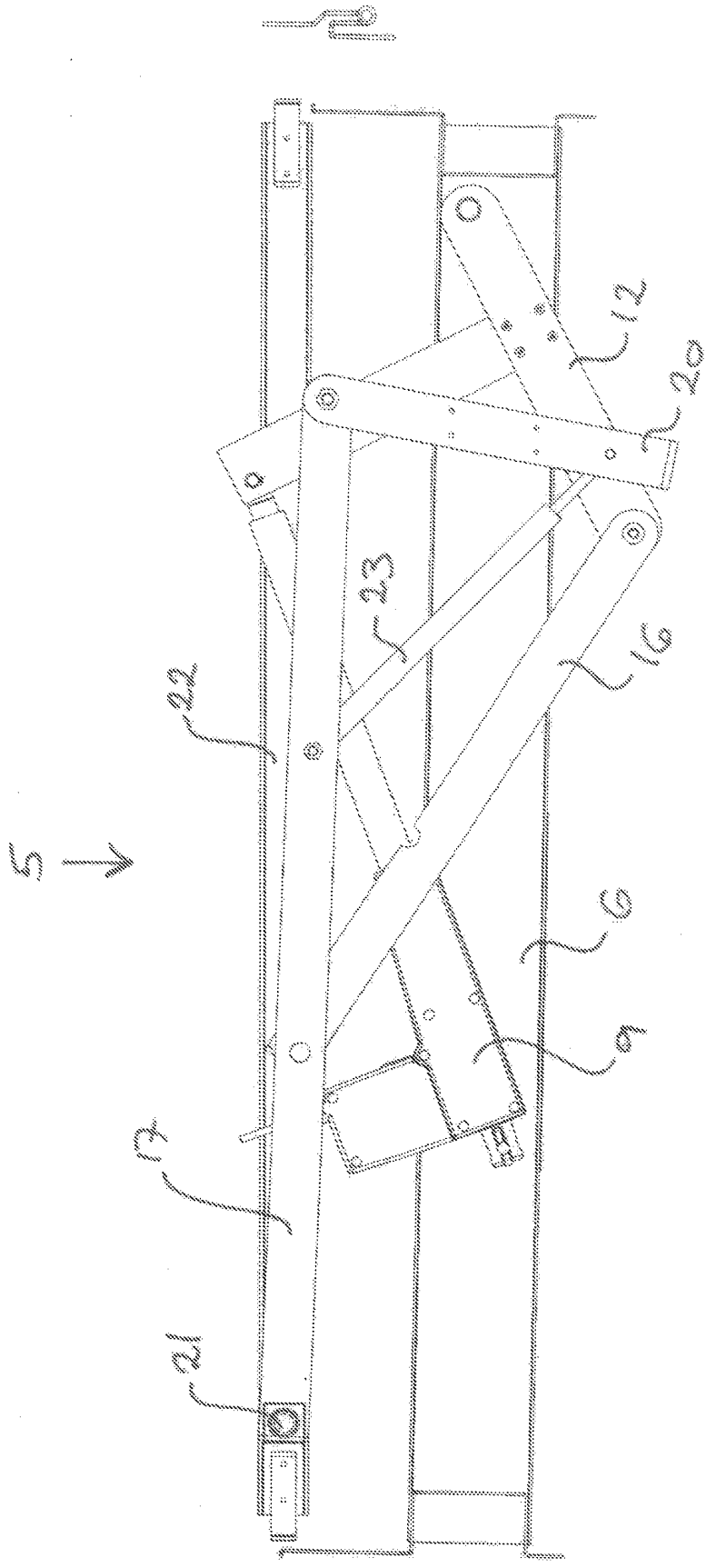

Fig. 4

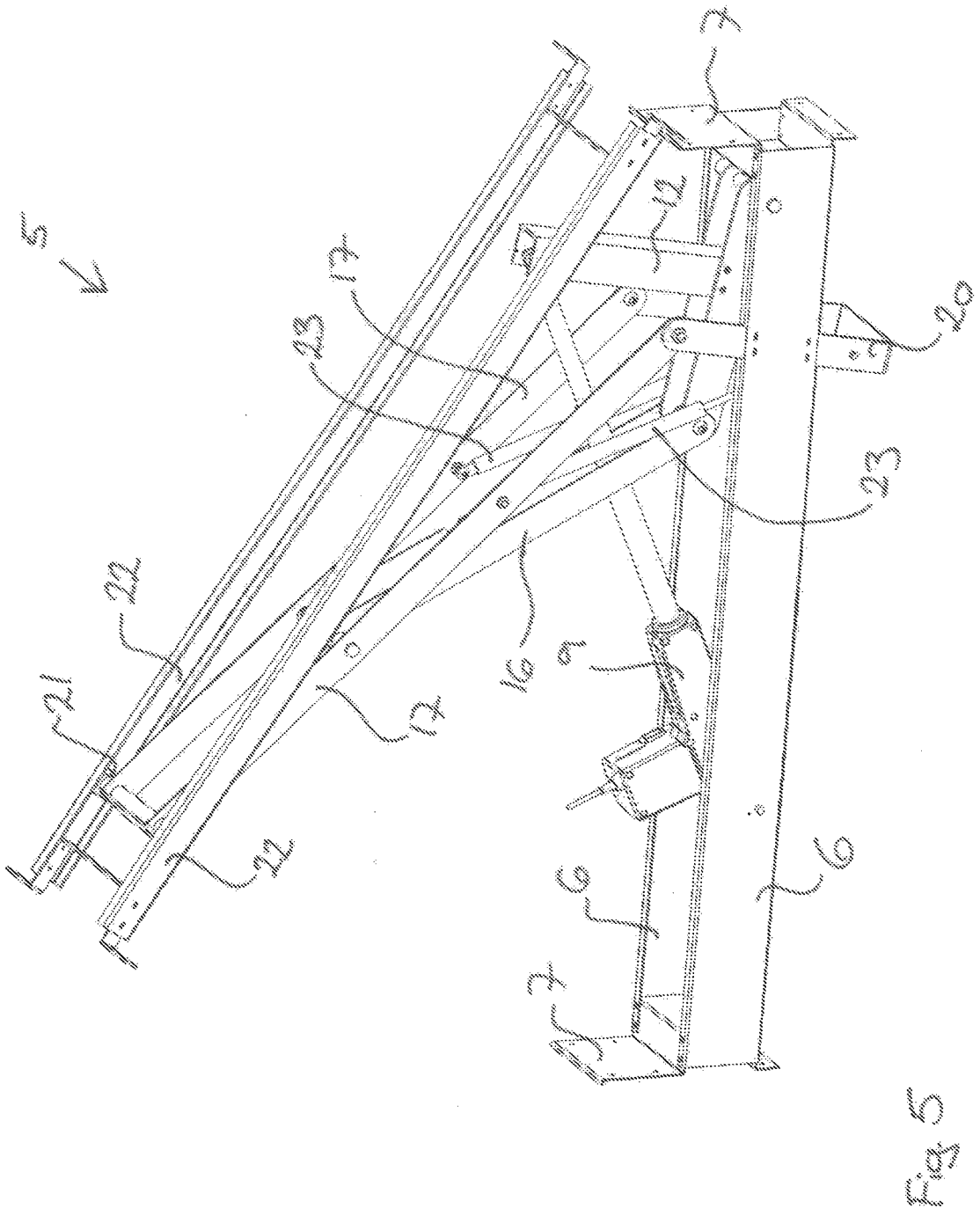

Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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