

(19)



(11)

EP 3 926 134 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.12.2021 Bulletin 2021/51

(51) Int Cl.:
E05D 7/081 ^(2006.01) **E05F 1/12** ^(2006.01)
E05F 1/14 ^(2006.01) **E05D 5/04** ^(2006.01)

(21) Application number: **21460028.0**

(22) Date of filing: **21.06.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **19.06.2020 PL 43438620**

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(54) SELF-CLOSING HINGE AND A DOOR ASSEMBLY WITH A SELF-CLOSING HINGE

(57) The object of the invention is a self-closing hinge (1) especially designed for refrigerated racks and containing a gas spring (2), characterized in that it consists of a hinge (3) in the shape of a flat polygon on one apex of which there is a pin (31) perpendicular to the surface of the hinge (3) and on the other apex there is a ball pin (33), on which a ball socket (21) of one end of the gas spring (2) is movably fixed, while on the opposite side to

the second apex of the hinge (3) there is at least one mounting hole (32) intended for fixing the hinge (3) on the door leaf, furthermore the other end of the gas spring (2) is intended to be fixed via the ball socket (21) on the ball pin located on the door frame.

The object of the invention is also door assembly, especially of a refrigerated rack, with a self-closing hinge.

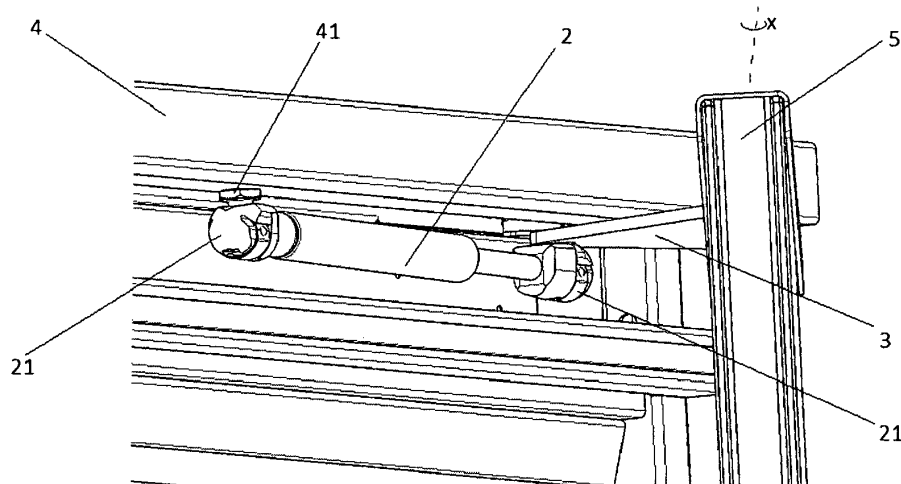


Fig. 7

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Description

[0001] The subject of the invention is a self-closing hinge, used especially in doors of refrigerated racks, as well as a door assembly with a self-closing hinge.

[0002] Devices for damping the closing of doors, such as gas springs, are known from the prior art. The EP1619409B1 patent description revealed a gas spring with end position damping. The gas spring includes a first piston mounted on the piston rod and a sealing ring fitted in a circumferential groove. The second piston is fitted to the end of the piston rod and contains a second sealing ring facing the opposite direction.

[0003] In the prior art, the use of a gas spring in damping the closing of door leaves is also known. The European patent EP3366164B1 revealed a refrigerated rack with one or more self-closing doors, comprising support frame which defines a loading space and at least one door for closing the loading space. A door with a vertical axis of rotation is hinged to the frame and can rotate to move between a closed position and a fixed maximum opening position. The rack includes an automatic door closing system with a hydro-pneumatic piston. The piston is hinged to the door in the position offset from the axis of rotation by means of a lever extension integrated into the door. The two hinge points of the piston are arranged with respect to the axis of rotation so that the hydro-pneumatic piston exerts a force that always generates a momentum to close the door around the axis of rotation and so that to obtain a perpendicular distance between the axis of dynamic action of the piston and the axis of rotation which decreases as the angular degree of opening of the door increases.

[0004] In prior art solutions involving the use of gas springs hinged to the door frame, a certain force is required to open the door. Due to the quite frequent application of relatively high force to open the door, the door leaf opens at too high a speed which in turn causes the hinge elements or the door leaf frame to break off.

[0005] Therefore, it has become necessary to provide a change in the design of the hinge or a change in the connection of the gas spring to the door frame that would eliminate the problems associated with frequent failures of this type of closures.

[0006] The essence of the invention is a self-closing hinge intended especially for refrigerated racks and containing a gas spring characterized in that it consists of a hinge in the shape of a flat polygon on one apex of which there is a pin perpendicular to the surface of the hinge and on the other apex there is a ball pin on which a ball socket of one end of the gas spring is movably mounted and on the opposite side to the second apex of the hinge, there is at least one mounting hole for mounting the hinge on the door leaf, furthermore the other end of the gas spring is designed to be fixed via a ball socket on the ball pin located on the door frame.

[0007] Preferably, a gas spring with end position damping is used.

[0008] Preferably, the gas spring bushing has a longitudinal groove on its inner surface of decreasing depth.

[0009] The essence of the invention is also a door assembly, especially of a refrigerated rack, with a self-closing hinge, comprising a door leaf movably fixed to the door frame through a lower hinge and a self-closing hinge, which hinges, through pins fixing them to the door leaf, determine the vertical axis of rotation of the door leaf, characterized in that the self-closing hinge is in the form of a flat polygon having a pin perpendicular to the surface of the hinge and connecting the door leaf to the door frame on one apex, the second apex projecting beyond the surface of the door leaf is movably connected to the ball socket of one end of the gas spring via the ball pin located on the second apex of the hinge and the other end of the gas spring is movably attached via the ball socket to the ball pin located on the door frame, whereas the side opposite the second apex of the hinge includes at least one mounting hole for mounting the hinge to the door leaf, the gas spring being in a fully expanded condition when the door leaf is closed and the door leaf is fully open.

[0010] Preferably, the lower hinge is in the form of a flat element with at least one mounting hole and a pin perpendicular to the surface of the lower hinge.

[0011] Preferably, a gas spring with end position damping is used.

[0012] Preferably, the gas spring bushing has a longitudinal groove on its inner surface of decreasing depth.

[0013] In the prior art, gas springs have been previously used to dampen the closure of door leaves. However, the problem of damage to the door leaf or door frame caused by the door moving too fast when it is opened to its maximum extent has not been resolved. By combining the gas spring with a polygonal hinge where one end of the spring is connected to one apex of the hinge, which hinge protrudes beyond the plane of the door leaf, a state of expansion of the gas spring is obtained not only when the door leaf is closed but also when it is in its maximum open position. The geometry of the hinge allows to take full advantage of the damping properties of the gas spring.

[0014] The gas spring is connected to the hinge via a ball pin. The ball socket is located at the ends of the gas spring. The socket is fitted on the ball pin of the hinge and secured with a cotter pin. This connection allows the gas spring to be mounted not perpendicular to the axis of the ball pin. This connection also allows the gas spring to rotate freely around the ball pin. The gas spring is also connected to the door frame via a ball pin. Both connections of the gas spring (to the hinge and the frame) are articulated joint.

[0015] Thanks to the damping of the expansion of the gas spring and the appropriate geometry of the hinge, the aim of the invention - which was to dampen the closing of the door leaf but also to dampen the moment when the door leaf reaches its maximum opening - was achieved. Damping the opening of the door leaf in the

final phase allows to eliminate the jerking effect and overloads resulting from too high speed of opening the door leaf, which in turn reduces the failure rate of the door leaves, the door frame and the hinge. The door leaf is opened by pulling it, while closing the door leaf requires only a light push of it, which causes the door leaf to close automatically.

[0016] The polygonal shape of the hinge, preferably used as the upper hinge in a door assembly, makes it possible to achieve, both with the door closed and with its maximum opening, a complete expansion of the gas spring, which, in turn, results in a damping of the closure of the door leaf and a damping of its opening speed at the final stage of achieving the maximum opening.

[0017] The simple design of the elements of the self-closing hinge according to the invention significantly reduces its failure rate and, in case of possible damage, enables quick replacement of individual elements.

[0018] The object according to the invention is shown in the drawing, in which the respective figures represent:

- Fig. 1 Self-adapting hinge according to the invention;
- Fig. 2 Door assembly with a hinge according to the invention in the closed position;
- Fig. 3 Door assembly with a hinge according to the invention in the opened position;
- Fig. 4 Door assembly with a hinge according to the invention in the maximum open position;
- Fig. 5 Lower hinge in perspective view;
- Fig. 6 Ball pins of the door frame and hinge;
- Fig. 7 Self-closing hinge according to the invention mounted on the door leaf and frame;

[0019] Fig. 1 shows a self-closing hinge 1 according to the invention comprising a gas spring 2 movably connected at one of its ends to the hinge 3 via a ball pin 33 located on the hinge 3, on which ball pin 33 the ball seat 21 of the spring 2 is fitted. The hinge 3 is in the form of a flat polygon, one apex of which contains a pin 31 perpendicular to the surface of the hinge 3, the other apex is movably connected to the gas spring 2 via a ball pin 33 while the opposite side to the other apex contains mounting holes 32 for mounting the hinge 3 on the door leaf.

[0020] Fig. 2, Fig. 3 and Fig. 4 show the door assembly of a refrigerated rack comprising the self-closing hinge 1 according to the invention. The door assembly consists of a door frame 4, in which the door leaf 5 is fitted via the lower hinge 6 and a self-closing hinge 1. The lower hinge 6 is in the form of a rectangular, flat element with a perpendicular pin 61 that connects the door leaf 5 and the door frame 4, and with mounting holes 62 for attaching the lower hinge 6 to the lower side of the door leaf 5. The pins of the lower hinge 6 and the self-closing hinge 1 define the vertical axis of rotation (x) around which the door leaf 5 can rotate to move between the closed position and the maximum open position. The movement of the door leaf 5 is carried out by means of a gas spring 2,

where one end thereof is movably fixed to the door frame 4 and the other end thereof is movably fixed to the hinge 3 via ball sockets 21 of the gas spring 2 seated respectively on a ball pin 41 of the door frame 4 and on a ball pin 33 of the hinge 3.

[0021] Fig. 2 shows the door assembly of a refrigerated rack in the closed position. In the closed position, the gas spring 2 is expanded and keeps the door leaf 5 closed, exerting force on the hinge 3. The hinge 3 is in the form of a flat polygon, one apex of which contains a pin 31 connecting the door frame 4 to the door leaf 5. The second apex, extending beyond the surface of the door leaf 5, is connected to the gas spring 2 by means of a ball socket 21 seated on the ball pin 33 located on the second apex of the hinge 3, while the side opposite the second apex of the hinge 3 comprises mounting holes 32 for mounting the hinge 3 on the upper side of the door leaf 5.

[0022] Fig. 6 shows a fragment of the door frame 4 with the ball pin 41 and a fragment of a door leaf 5 with the mounted hinge 3, on which the ball pin 33 is visible projecting beyond the surface of the door leaf 5. Fig. 7 shows a gas spring 2 which is mounted on the ball pins 33 and 41 via the ball seats 21.

[0023] During the opening of the door leaf 5, the gas spring 2 is compressed up to the equilibrium point from which the door leaf opens spontaneously to its maximum opening point. Fig. 3 shows the door leaf 5 in the open position in which the gas spring 2 is at the point of equilibrium.

[0024] In the final phase of opening, the door leaf 5 loses its opening speed using the properties of the gas spring 2, which means that after reaching its equilibrium point, the gas spring 5 expands to its maximum state of expansion. When the gas spring 2 expands during the opening phase of the door leaf 5, the door leaf 5 opens spontaneously and the rate of expansion is slowed down until complete expansion is reached and the door leaf 5 thus opens to its maximum extent. Slowing down the opening process of the door leaf 5 reduces the overload caused by the door leaf opening too quickly, as is the case with the prior art solutions.

[0025] When closing the door leaf, the process is analogous, i.e. the gas spring 2 is compressed to reach its equilibrium point (as shown in Fig. 3). When the gas spring 2 exceeds the equilibrium point, the door leaf 5 starts to close spontaneously and the gas spring 2 expands. In the final phase of closing the door leaf 5, there is a decrease in the closing speed due to the expansion of the gas spring 2 used.

[0026] The self-closing hinge according to the invention can be applied both to refrigerated racks but also to other door assemblies.

Claims

1. Self-closing hinge (1) especially designed for refrigerated racks and containing a gas spring (2), char-

acterized in that it consists of a hinge (3) in the shape of a flat polygon on one apex of which there is a pin (31) perpendicular to the surface of the hinge (3) and on the other apex there is a ball pin (33), on which a ball socket (21) of one end of the gas spring (2) is movably fixed, while on the opposite side to the second apex of the hinge (3) there is at least one mounting hole (32) intended for fixing the hinge (3) on the door leaf, furthermore the other end of the gas spring (2) is intended to be fixed via the ball socket (21) on the ball pin located on the door frame.

2. Self-closing hinge (1) according to claim 1, **characterised in that** the gas spring (2) is a spring with end position damping. 15

3. Self-closing hinge (1) according to claim 1, **characterised in that** the gas spring bushing (2) has a longitudinal groove of decreasing depth on its inner surface. 20

4. Door assembly, especially of a refrigerated rack, with a self-closing hinge (1) comprising a door leaf (5) movably fixed to the door frame (4) through a lower hinge (6) and a self-closing hinge (1), which hinges via pins (31, 61) attaching them to the door leaf (5) define the vertical axis of rotation of the door leaf (5), **characterized in that** the self-closing hinge (1) is in the form of a flat polygon, one of the vertices of which has a pin (31) perpendicular to the surface of the hinge (3) and connecting the door leaf (5) with the door frame (4), the other apex, projecting beyond the surface of the door leaf (5) is movably connected to the ball socket (21) of one end of the gas spring (2) via the ball pin (33) located on the second apex of the hinge (3), and the other end of the gas spring (2) is movably attached via the ball socket (21) to the ball pin (41) located on the door frame (4), while the side opposite the second apex of the hinge (3) comprises at least one mounting hole (32) for fastening the hinge (3) to the door leaf (5), the gas spring (2) being in a fully expanded state when the door leaf (5) is closed and the door leaf (5) is fully opened. 25
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5. Door assembly according to claim 4, **characterised in that** the lower hinge (6) is in the form of a flat element with at least one mounting hole (62) and a pin (61) perpendicular to the surface of the lower hinge (6). 45
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6. Door assembly according to claim 4, **characterised in that** the gas spring (2) contains an end position damper.

7. Door assembly according to claim 4, **characterised in that** the gas spring bushing (2) has on its inner surface a longitudinal groove of decreasing depth. 55

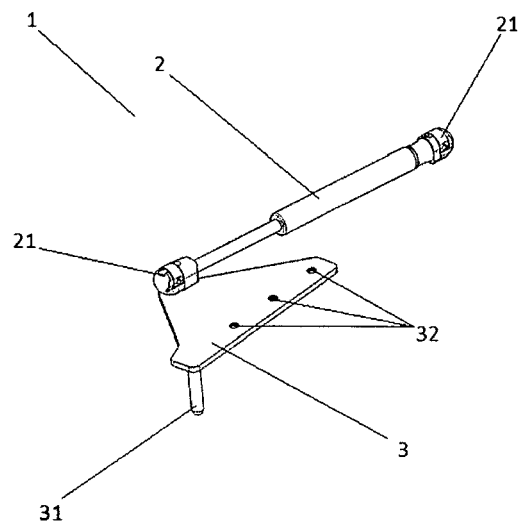


Fig. 1

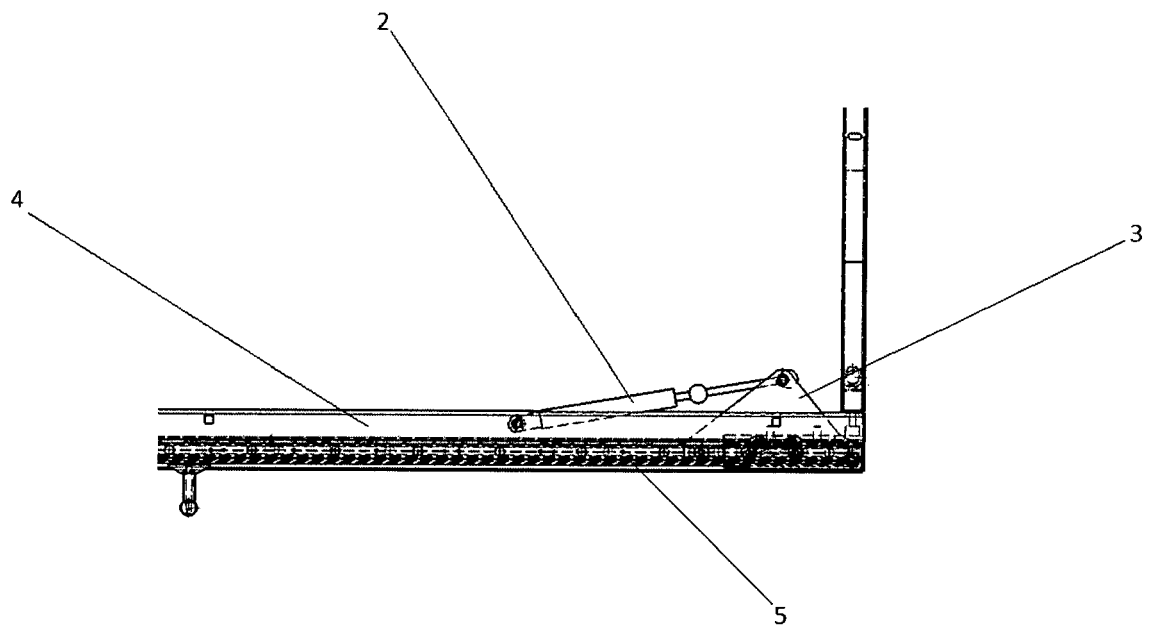


Fig. 2

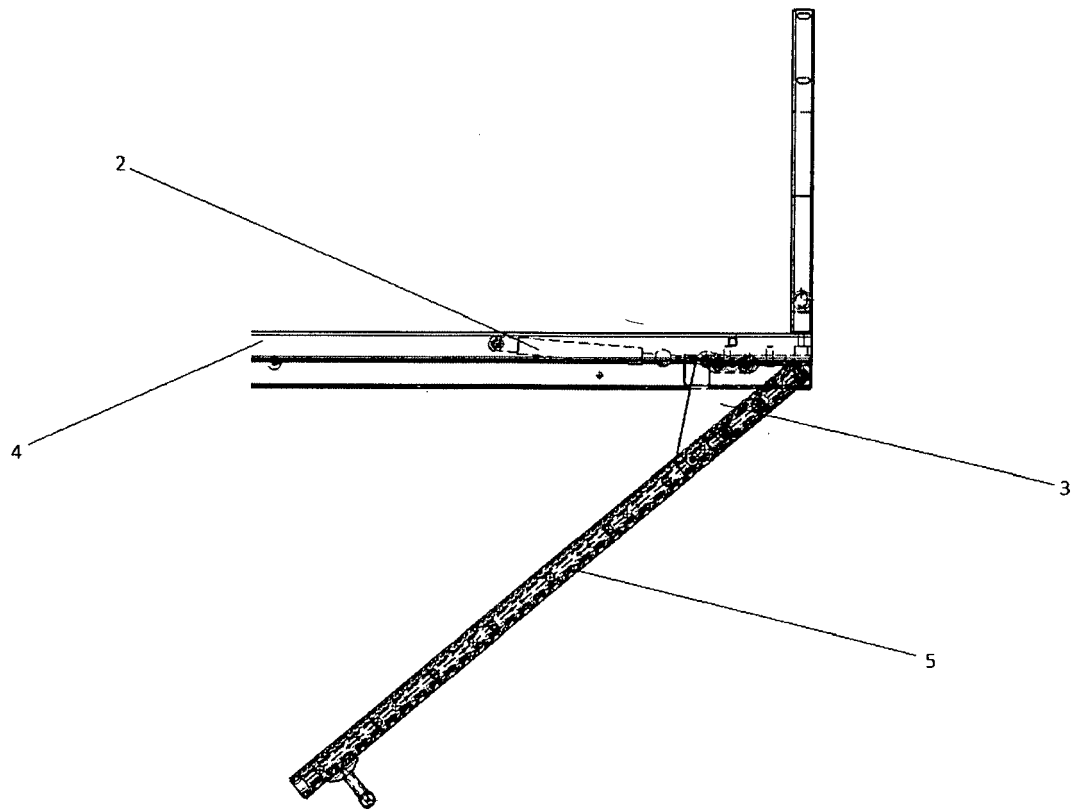


Fig. 3

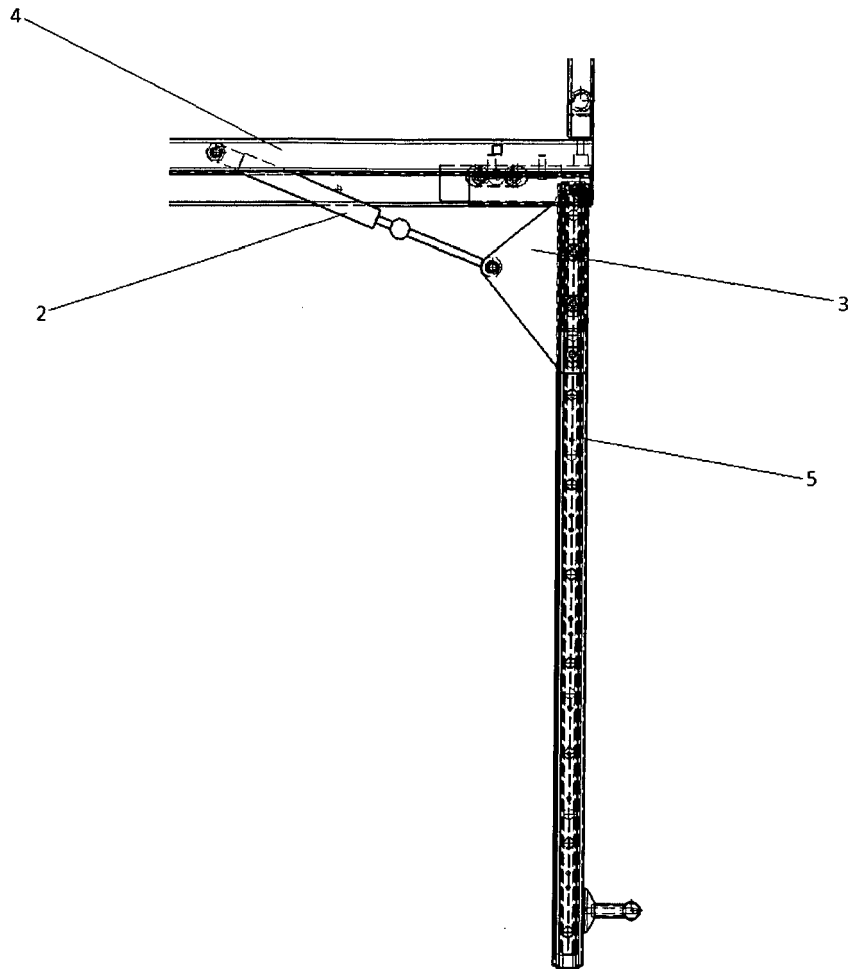


Fig. 4

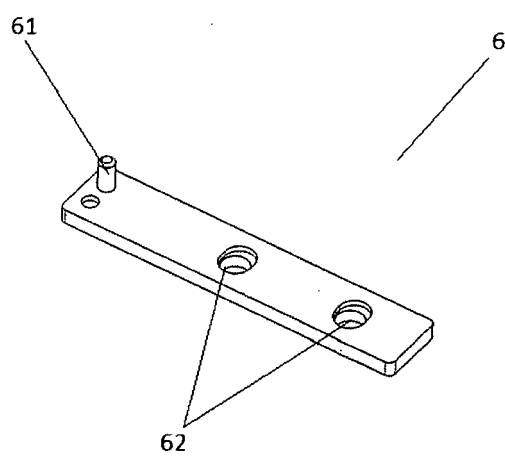


Fig. 5

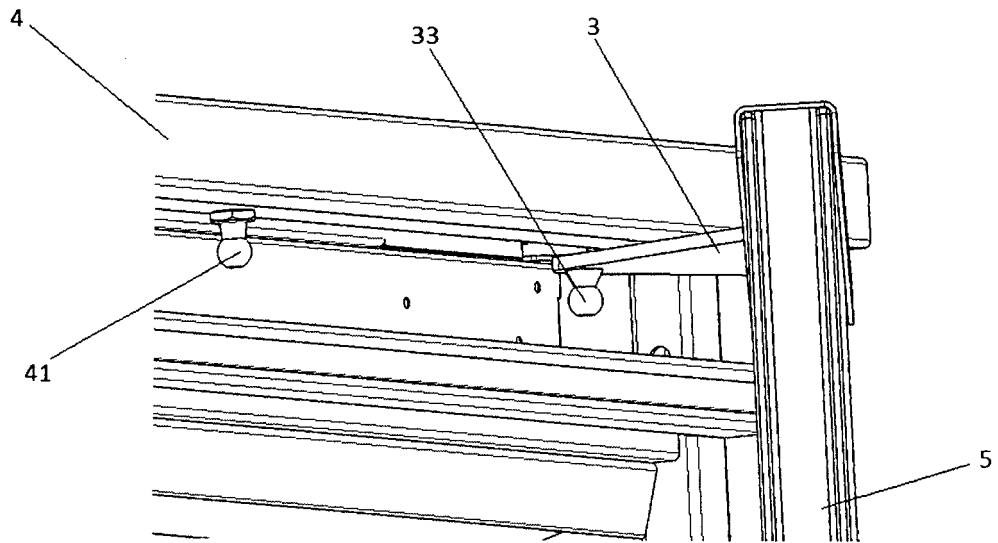


Fig. 6

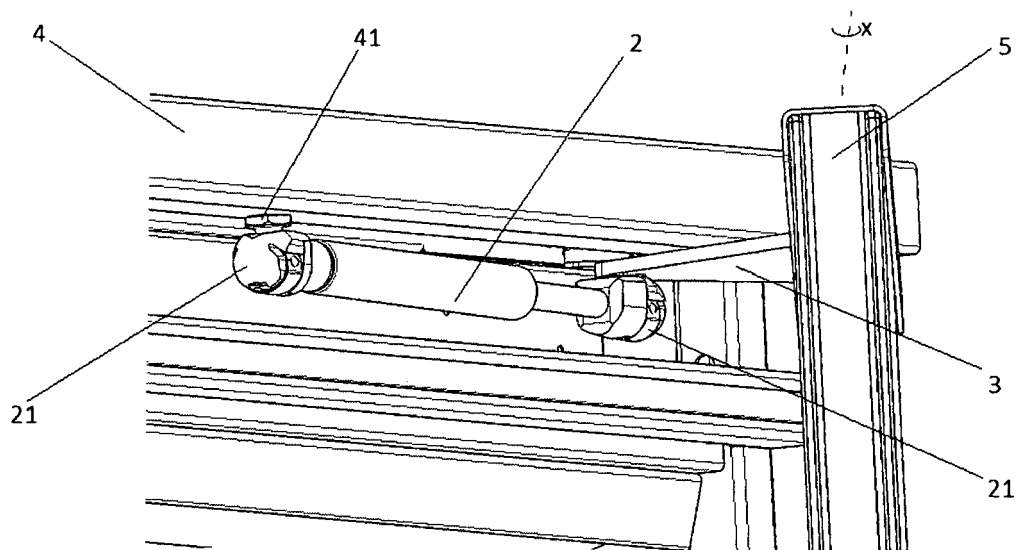


Fig. 7



EUROPEAN SEARCH REPORT

Application Number
EP 21 46 0028

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Y	* paragraphs [0008], [0016] - [0023]; figures 1-5 *	3-7	E05F1/12 E05F1/14
Y,D	EP 3 366 164 B1 (EPTA SPA [IT]) 4 September 2019 (2019-09-04) * paragraphs [0015] - [0087]; figures 1-10 *	3-7	ADD. E05D5/04
			TECHNICAL FIELDS SEARCHED (IPC)
			E05D E05F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 October 2021	Examiner Rémondot, Xavier
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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19-10-2021

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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