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(54) **DOOR ASSEMBLY**

(57) Door assembly comprising a sliding door (10) and a safety device (11) for selectively closing an entry aperture (102) of an internal chamber (101) of a machine

(100), and machine (100) for processing objects comprising such door assembly.

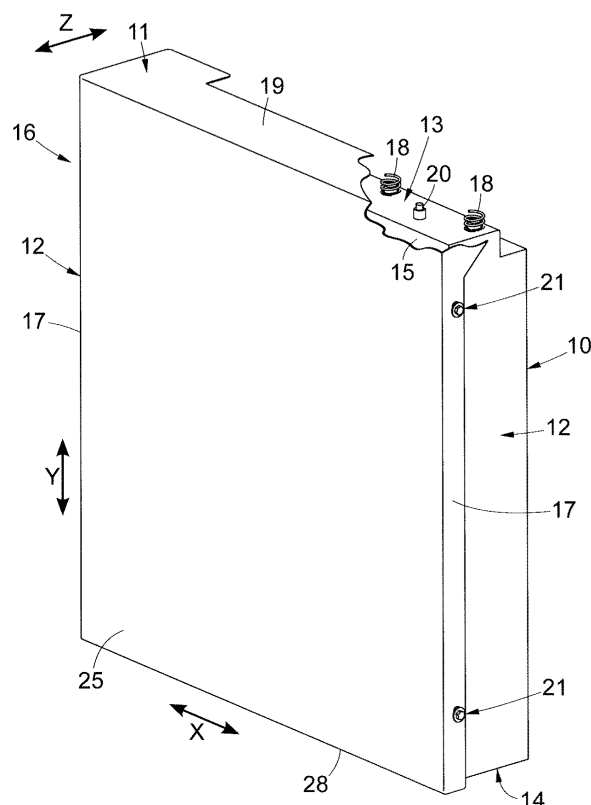


fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a door assembly comprising a sliding door and a safety device, also called anti-crushing device. Favorably, this door assembly is used to selectively close an entry aperture to an internal chamber of a machine for processing objects.

BACKGROUND OF THE INVENTION

[0002] Machines for processing objects are known, for example pre-washing, washing, thermo-disinfection, sterilization, sanitization, drying machines or suchlike, having an internal chamber accessible from an entry aperture, selectively closed by a door.

[0003] In particular, sliding doors are known, able to slide away from the entry aperture to open it, and close to the entry aperture to close it. An example of a sliding door is a so-called vertical door or guillotine door.

[0004] Safety devices are also known, also known as anti-crushing devices, associated with the sliding doors, aimed at preventing, avoiding and/or limiting any damage from crushing to an object that is accidentally on the closing path of the door itself. For example, bumpers, or safety sensitive bumpers, also called "sensitive edges", are known, generally installed in correspondence with the edge of the door that is free when the door is open and that is abutting when the door is closed. These bumpers generally provide at least one compressible element and a compression sensor capable of detecting the compression of the compressible element and triggering, in response, an interruption or inversion of the door's motion.

[0005] A disadvantage of known safety devices is their inability to detect interferences with the door's motion that do not occur in correspondence with the edge of the door where they are installed.

[0006] There is therefore the need to perfect a safety, or anti-crushing, device for a vertically sliding door that can overcome at least one of the disadvantages of the state of the art.

[0007] To do this, it is necessary to solve the technical problem of detecting possible interferences with the movement at least of closure of the door in correspondence with any edge whatsoever of the door itself.

[0008] In particular, one purpose of the present invention is to provide a door assembly that can detect possible interferences with the movement at least of closure of the door in correspondence with any edge whatsoever of the door itself, even edges other than the edge in which the compression sensor is installed.

[0009] Another purpose of the present invention is to provide a door assembly that is mechanically simple and economical, as well as reliable from a safety point of view.

[0010] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings

of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0011] The present invention is set forth and characterized in the independent claims. The dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

[0012] In accordance with the above purposes and to resolve the technical problem disclosed above in a new and original way, also achieving considerable advantages compared to the state of the prior art, a door assembly comprises a sliding door for selectively closing an internal chamber of a machine for processing objects.

[0013] Such a machine can, for example, be any object processing machine whatsoever having an internal chamber accessible from an entry aperture, for example a pre-washing, washing, thermo-disinfection, sanitization, sterilization, drying machine or suchlike.

[0014] The objects can be, for example, objects that require, for their use, to undergo one or more of the treatments indicated above. By way of example, the objects can be surgical or medical instruments or devices in general, or laboratory instruments or devices.

[0015] In accordance with one aspect of the present invention, the door assembly is also provided with a safety device, which acts as anti-crushing device, comprising:

- a cover with a box-like shape mating with the door, made in a single piece and conformed to enclose, at least laterally and at the upper part, the door, the cover being laterally connected to the door itself so as to be able to slide with respect thereto in an opening/closing direction of the door;
- at least one compressible element placed on a head edge of the door and configured to connect and keep spaced apart from each other the head edge and a mating head wall of the cover;
- at least one pressure switch disposed on the door's head edge and configured to be activated by a defined movement of the cover's head wall closer to the door's head edge due to a defined compression of the at least one compressible element, consequently generating a signal to trigger a stop or inversion of the door's movement.

[0016] In this way, by means of the door assembly described here it is possible to detect any interferences with the door's movement in correspondence with any edge of the door itself, whether or not the edge is provided with at least one pressure switch, preventing crushing risks. Creating the cover in a single piece means that an interference at any point of the cover causes a movement of the entire cover, and the possibility of sliding with respect to the door in the opening/closing direction converts or transforms the movement of the cover into a

movement of the cover's head wall closer to the door's head edge, which can activate the at least one pressure switch.

[0017] The present invention also concerns a machine for processing objects which comprises a door assembly in accordance with the present disclosure.

DESCRIPTION OF THE DRAWINGS

[0018] These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a three-dimensional representation of a machine provided with a door assembly according to some embodiments described here;
- fig. 2 is a partly sectioned three-dimensional representation of a door assembly according to some embodiments described here;
- fig. 3 is a rear view of a door assembly according to some embodiments described here;
- figs. 4a-b are details of the door assembly of fig. 2, showing a non-stressed condition and a condition of interference, respectively, of the safety device;
- fig. 5 is a representation in separate parts of a possible assembly for the sliding coupling between a door and a corresponding safety device of a door assembly according to some embodiments described here.

[0019] We must clarify that the phraseology and terminology used in the present description, as well as the figures in the attached drawings also in relation as to how described, have the sole function of better illustrating and explaining the present invention, their purpose being to provide a non-limiting example of the invention itself, since the scope of protection is defined by the claims.

[0020] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can be conveniently combined or incorporated into other embodiments without further clarifications.

DESCRIPTION OF SOME EMBODIMENTS

[0021] The attached drawings are used to describe a door assembly comprising a sliding door 10 and a safety device 11, also called anti-crushing device.

[0022] The door assembly is described by way of example in the case of a sliding door 10 being installed on a washing and/or thermo-disinfection machine 100, without this excluding its installation on a different type of machine, for example a pre-washing, sanitization, sterilization, drying machine or similar object processing

machine, having an internal chamber 101 accessible from an entry aperture 102.

[0023] The sliding door 10 is configured to selectively close the entry aperture 102 and therefore the internal chamber 101.

[0024] By "sliding door" we mean a door that can selectively assume an open position, in which it does not engage the respective entry aperture 102, and a closed position, in which it does engage the respective entry aperture 102, wherein the passage from the open position to the closed position and vice versa occurs through the door sliding, always moving essentially in a same plane. An example of a sliding door is a so-called vertical door or guillotine door.

[0025] For example, the door 10 described here can be a vertical sliding door configured to pass from the open to the closed position with an upward vertical motion and, vice versa, from the closed to the open position with a downward vertical motion. Alternative embodiments can instead provide a downward closing direction and an opposite upward opening direction.

[0026] In some embodiments, the machine 100 generally comprises a frame that defines the internal chamber 101, for example a processing chamber, which can be a washing and/or thermo-disinfection process, or other processes as exemplified above. Access to the internal chamber 101 is allowed through the entry aperture 102, which is provided with the sliding door 10.

[0027] In some embodiments, the machine 100 can further comprise an external paneling 107 for covering the frame.

[0028] The door 10 can have a shape essentially mating with the shape of the entry aperture 102, so as to be able to fully engage it, selectively closing the internal chamber 101 when it is in the closed position.

[0029] The door 10 can comprise two opposing sliding edges 12, adjacent to corresponding first sides 104 of the entry aperture 102.

[0030] Each first side 104 of the entry aperture 102 and the corresponding sliding edge 12 of the door 10 are configured to allow the vertical sliding of the door 10 along the first sides 104.

[0031] As a non-limiting example, each first side 104 can comprise a guide mating with a slider associated with the respective sliding edge 12.

[0032] The door 10 can also comprise a head edge 13 (figs. 1-4) and an opposing tail edge 14 (figs. 2-3).

[0033] The head edge 13 is configured to abut against a corresponding second side 105 of the entry aperture 102 when the door 10 is in the closed position.

[0034] The door 10 is configured so that the tail edge 14 is adjacent to a third side 106 of the entry aperture 102 which is opposite the second side 105 when the door 10 is in the closed position.

[0035] According to embodiments described using fig. 1, the sliding edges 12 and the first sides 104 extend in an opening/closing direction Y of the door 10, while the head 13 and tail 14 edges and the second and third side 105,

106 extend in a direction X orthogonal to the opening/closing direction Y and to an entry direction Z for passing through the entry aperture 102.

[0036] In the open position, the entry aperture 102 is not engaged by the door 10. For example, if the door 10 is opened downward, in the open position the door 10 can be essentially entirely under the third side 106, for example with the head edge 13 adjacent to the third side 106.

[0037] The safety device 11 can comprise a cover 16 for at least partly covering the door 10. The cover 16 can be a casing with a box-like shape mating with the door 10. Also, the cover 16 can be conformed to enclose, at least laterally and at the upper part, the door 10.

[0038] For example, the cover 16 can comprise two lateral walls 17 configured to at least partly cover the sliding edges 12, and a head wall 19 configured to cover the head edge 13.

[0039] The cover 16 can also comprise a front wall 25, configured to cover a front face 15 of the door 10, facing toward the outside of the machine 100.

[0040] The cover 16 can also comprise a tail wall 28 configured to at least partly cover the tail edge 14.

[0041] Preferably, the head wall 19 can have an extension configured to enclose the head edge 13.

[0042] Preferably, each lateral wall 17 can have an extension configured to enclose at least one portion contiguous to the front face 15 of the respective sliding edge 12.

[0043] Preferably, the tail wall 28 can have an extension configured to enclose at least one portion contiguous to the front face 15 of the tail edge 14.

[0044] The cover 16 can be essentially in a single piece, that is, monolithic, such as, for example, a paneling, for example metallic, suitably folded and/or welded to create, essentially in a single piece, the casing mating with the shape of the door 10.

[0045] The safety device 11 can comprise at least one compressible element 18, placed on the head edge 13 of the door 10 and configured to connect and keep spaced apart from each other the head edge 13 and the mating head wall 19 of the cover 16.

[0046] The at least one compressible element 18 can be configured to sustain the head wall 19 of the cover 16 above the head edge 13 of the door 10, in such a way that the head wall 19 is not directly resting on the head edge 13 when the compressible element 18 is in a resting condition, that is, is not compressed (fig. 4a).

[0047] The at least one compressible element 18 can be, for example, a spring, in particular a mechanical spring, or an element of elastically compressible material such as an expanded resin or rubber. The safety device 11 can comprise at least two compressible elements 18, for example four, each consisting of a spring for example. An even number of compressible elements 18 can also be provided, disposed on the head edge 13 in a manner that is axially symmetrical with respect to an axis of symmetry of the door 10 which is parallel to the open-

ing/closing direction Y.

[0048] Advantageously, the at least one compressible element 18 allows to at least partly cushion any collisions of an object or obstacle on the head edge 13.

[0049] The safety device 11 can comprise at least one pressure switch 20, placed on the head edge 13 of the door 10.

[0050] The at least one pressure switch 20 can be for example a microswitch, or a piezoelectric sensor, or a similar switch or sensor, configured to generate a compression response and supply a corresponding signal.

[0051] The safety device 11 can, for example, comprise two pressure switches 20, for example in the form of microswitches.

[0052] In some embodiments, each pressure switch 20 is interposed between two compressible elements 18.

[0053] Each pressure switch 20 can be configured to be activated by a defined movement of the head wall 19 of the cover 16 closer to the head edge 13 of the door 10, due to a defined compression of the at least one compressible element 18. Each pressure switch 20 can be configured to not interact with the head wall 19 of the cover 16 when each compressible element 18 is in a resting condition (fig. 4a). Each pressure switch 20 can be configured to be activated, for example compressed, by the head wall 19 of the cover 16 when it moves closer, for example by more than a predetermined threshold, to the head edge 13 of the door 10 (fig. 4b).

[0054] Advantageously, the safety device 11 can be configured, by means of an appropriate choice and/or configuration of each compressible element 18 and of each pressure switch 20, to detect movements of the head wall 19 closer to the door 10 by more than a predetermined threshold. For example, it can be provided that each pressure switch 20 can come into contact with the head wall 19 only when the at least one compressible element 18 (and possibly at least one or more compressible elements 18 in the vicinity of the pressure switch 20 itself) is compressed at least by a minimum amount, corresponding to a maximum allowed distance between the head wall 19 of the cover 16 and the head edge 13 of the door 10.

[0055] Each pressure switch 20 can be configured to generate, when activated, a signal to trigger the stop and/or inversion of the movement of the door 10.

[0056] The cover 16 can be laterally connected to the door 10 so that it can slide relative to the door 10 in the opening/closing direction Y.

[0057] The safety device 11 can comprise a plurality of sliding coupling assemblies 21 (figs. 2-5) configured to laterally connect the cover 16 with the door 10 in a sliding manner, in correspondence with the sliding edges 12.

[0058] The door 10 and the cover 16 can respectively comprise, for each sliding coupling assembly 21, an assembly hole 27 and a slot 26 (fig. 5) for the installation of the respective sliding coupling assembly 21. Each slot 26 is configured to at least partly face the respective assembly hole 27 when the cover 16 is assembled on

the door 10.

[0059] In correspondence with each sliding edge 12 there can be provided at least one sliding coupling assembly 21, preferably two opposite sliding coupling assemblies 21, each one in proximity to a respective end of the respective sliding edge 12. Each sliding coupling assembly 21 can comprise an elongated element 22 and a blocking member 24.

[0060] The assembly hole 27 can be configured to accommodate a respective blocking element 24.

[0061] In some embodiments, the blocking element 24 can be assembled integral with the door 10 in correspondence with the assembly hole 27.

[0062] The elongated element 22 can be configured to have an external end 22a housed on the external surface of the cover 16 and an opposite internal end 22b housed in the blocking element 24, while an elongated body of the elongated element 22 can pass through the slot 26 and the assembly hole 27.

[0063] The external end 22a can be provided with a head wider than the slot 26, and/or possibly with a narrowing element 22c of the slot 26, either being configured to rest on an external surface portion of the cover 16 which is contiguous to the slot 26 so as to prevent any motions of the elongated element 22 toward the door 10 perpendicular to the opening/closing direction Y.

[0064] The internal end 22b can be housed and blocked by the blocking element 24, in such a way that the elongated element 22 is integral with the blocking element 24 and, consequently, with the door 10.

[0065] The slot 26 can have an elongated shape in the opening/closing direction Y, so as to allow a motion of the elongated element 22 inside it in the opening/closing direction Y, consequently allowing the cover 16 to be able to slide with respect to the door 10 in the opening/closing direction Y.

[0066] The slot 26, the assembly hole 27 and the sliding coupling assembly 21 can be configured to allow the relative movement of the cover 16 with respect to the door 10 only in the opening/closing direction Y, and not in the orthogonal X and entry Z directions.

[0067] In some embodiments, the sliding coupling assembly 21 can include an intermediate element 23, placed in part between the door 10 and the cover 16 and in part projecting from the cover 16 by means of the slot 26, configured to house the elongated body of the elongated element 22.

[0068] In some embodiments, an installation position of the sliding coupling assembly is configured adjustable in the entry direction. The assembly hole 27 can have an elongated shape in the entry direction Z, so that the installation position of the sliding coupling assembly 21 can be adjusted in the entry direction Z, that is, it can be chosen more or less close to the front face 15. This allows to adjust the hollow space between the cover 16 and the front face 15 of the door 10, allowing to install the cover 16 flush with the external paneling 107 of the machine 100. This reduces the empty spaces between the door 10 and

the machine 100 and, therefore, the chances that an object, or something else, such as an operator's hand, will interfere with the moving door 10, thus acting as an anti-crushing or anti-pinching device.

[0069] When an object or other, for example an operator's hand, interferes with the moving door 10 in correspondence with the head edge 13, the consequent movement of the head wall 19 of the cover 16 closer to the head edge 13 is detected by the pressure switch 20, which generates a respective signal that can trigger the stop and/or inversion of the movement of the door 10, avoiding crushing.

[0070] When an object or other, for example an operator's hand, interferes with the moving door 10 in correspondence with one of the sliding edges 12 or with the tail edge 14, the interference causes a movement of the entire cover 16, since it is made in a single piece. The cover 16 can move only in the opening/closing direction Y, thanks to the sliding coupling with the door 10 described above. Therefore, also in this case the interference of an object causes a movement of the head wall 19 of the cover 16 closer to the head edge 13, which can be detected by the pressure switch 20, so as to generate a signal to trigger the stop and/or inversion of the movement of the door 10, avoiding crushing.

[0071] It is clear that modifications and/or additions of parts may be made to the door assembly as described heretofore, without thereby departing from the field and scope of the present invention, as defined by the claims.

[0072] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art will be able to achieve other equivalent forms of a door assembly, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

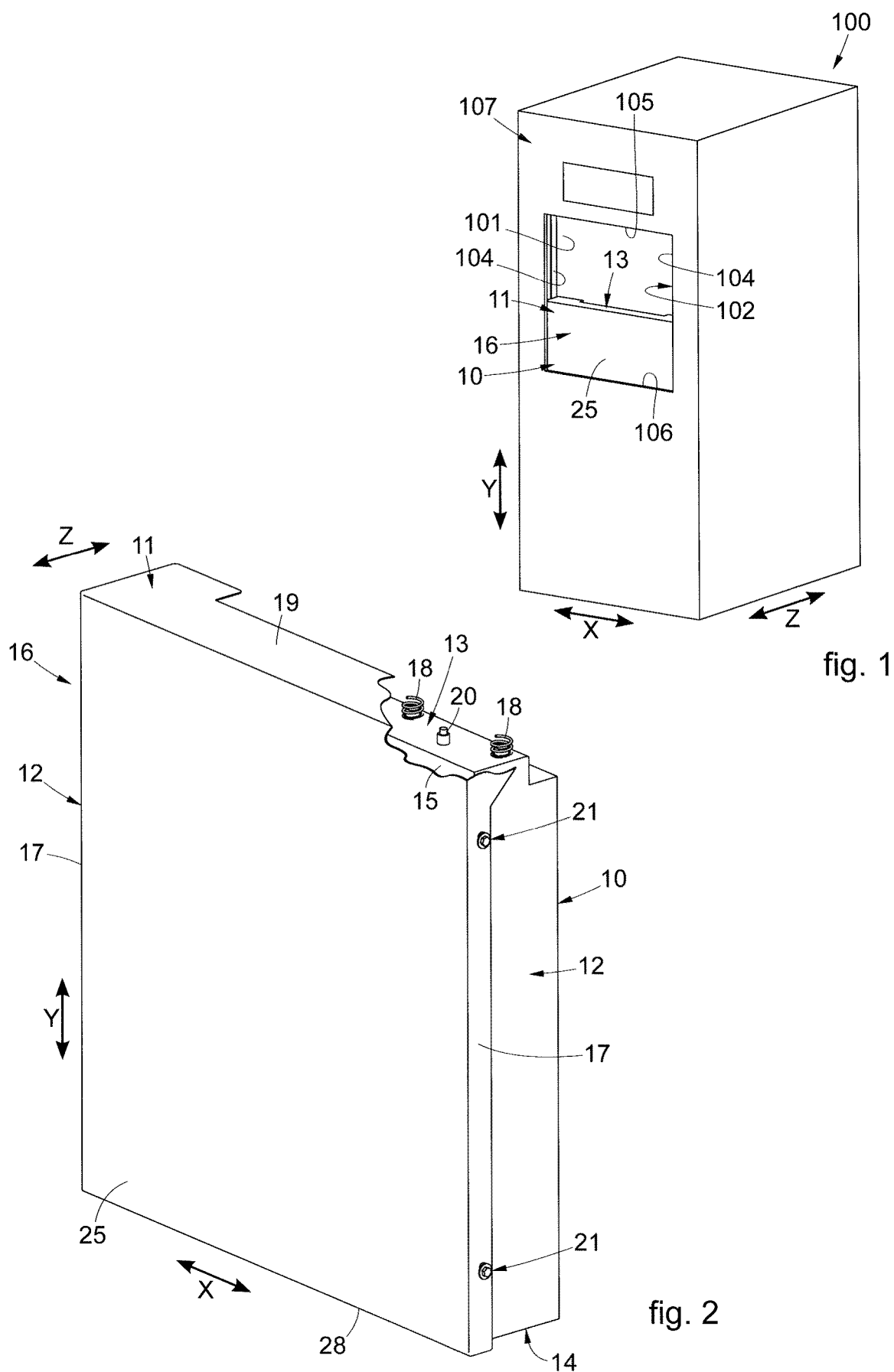
[0073] In the following claims, the sole purpose of the references in brackets is to facilitate their reading and they must not be considered as restrictive factors with regard to the field of protection defined by the claims.

Claims

1. Door assembly comprising a sliding door (10) for selectively closing an internal chamber (101) of a machine (100) for processing objects, **characterized in that** said door assembly is also provided with a safety device (11) which acts as anti-crushing and comprises:

- a cover (16) with a box-like shape mating with said door (10) made in a single piece and conformed to enclose, at least laterally and at the upper part, said door (10) to which it is laterally connected, so as to be able to slide with respect to it in an opening/closing direction (Y) of said door (10);
- at least one compressible element (18) placed

- on a head edge (13) of said door (10) and configured to connect and keep spaced apart from each other said head edge (13) and a mating head wall (19) of said cover (16);
 - at least one pressure switch (20) disposed on said head edge (13) and configured to be activated by a defined movement of said head wall (19) closer to said head edge (13) due to a defined compression of said at least one compressible element (18), thus generating a signal to trigger a stop or inversion of the movement of said door (10).
2. Door assembly as in claim 1, **characterized in that** said safety device (11) comprises a plurality of sliding coupling assemblies (21) configured to laterally connect said cover (16) with said door (10) in a sliding manner, in correspondence with two opposing sliding edges (12) of said door (10) extending in said opening/closing direction (Y).
 3. Door assembly as in claim 2, **characterized in that** a position of installation of said sliding coupling assembly (21) is configured adjustable in a direction (Z) of entry into said internal chamber (101).
 4. Door assembly as in claim 2 or 3, **characterized in that** said door (10) and cover (16) respectively comprise, for the installation of each of said sliding coupling assemblies (21), an assembly hole (27) and a slot (26) at least partly facing each other when the cover (16) is assembled on the door (10), said slot (26) having an elongated shape in said opening/closing direction (Y) and said assembly hole (27) having an elongated shape in said entry direction (Z).
 5. Door assembly as in any claim hereinbefore, **characterized in that** said cover (16) comprises two lateral walls (17) and a front wall (25), said head (19) and front (25) walls having respective extensions configured to enclose, respectively, said head edge (13) and a front face (15) of said door (10) facing toward the exterior of said machine (100), each of said lateral walls (17) having an extension configured to enclose at least one portion contiguous to said front face (15) of the respective sliding edge (12).
 6. Door assembly as in any claim hereinbefore, **characterized in that** said door (10) is a vertically sliding door.
 7. Door assembly as in any claim hereinbefore, **characterized in that** said door (10) comprises an even number of compressible elements (18) disposed on said head edge (13) in a manner that is axially symmetrical with respect to an axis of symmetry of said door (10) parallel to said opening/closing direction (Y).
 8. Door assembly as in any claim hereinbefore, **characterized in that** said at least one, or each, pressure switch (20) is interposed between two compressible elements (18).
 9. Door assembly as in any claim hereinbefore, **characterized in that** said at least one pressure switch (20) is a microswitch.
 10. Machine (100) for processing objects comprising a door assembly as in any claim hereinbefore.



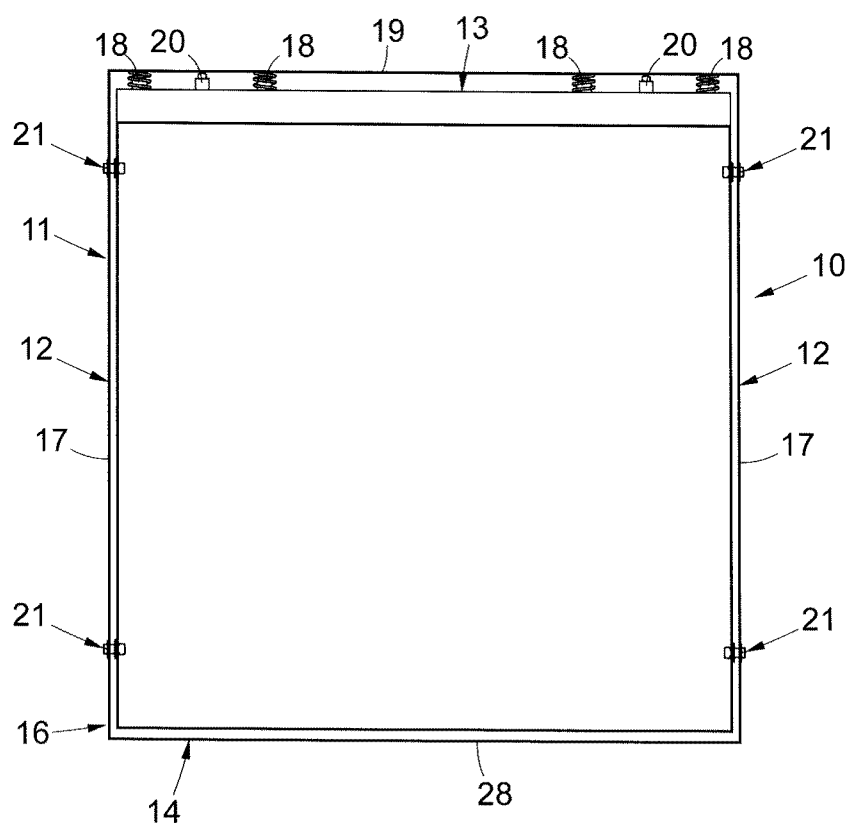


fig. 3

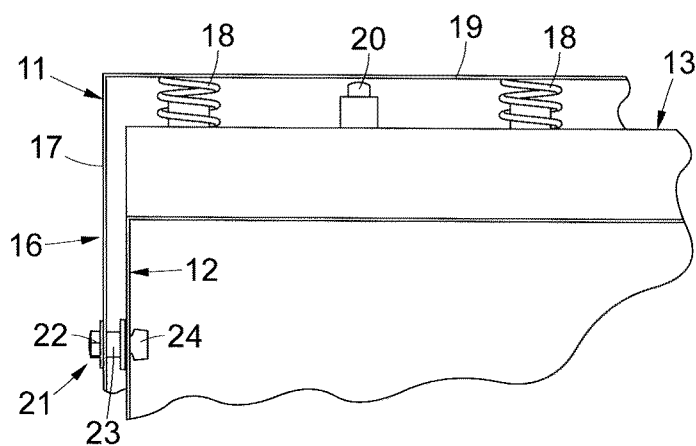


fig. 4a

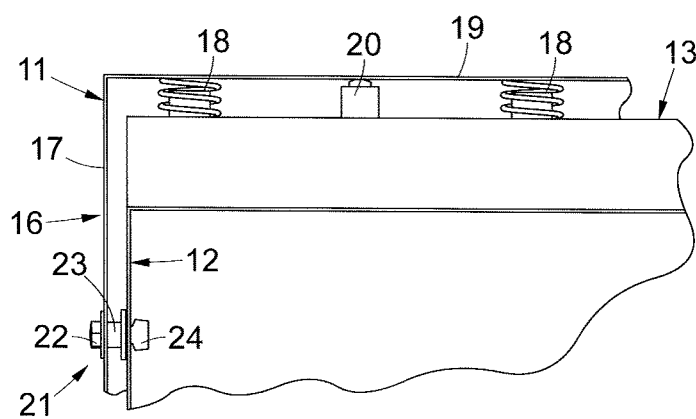


fig. 4b

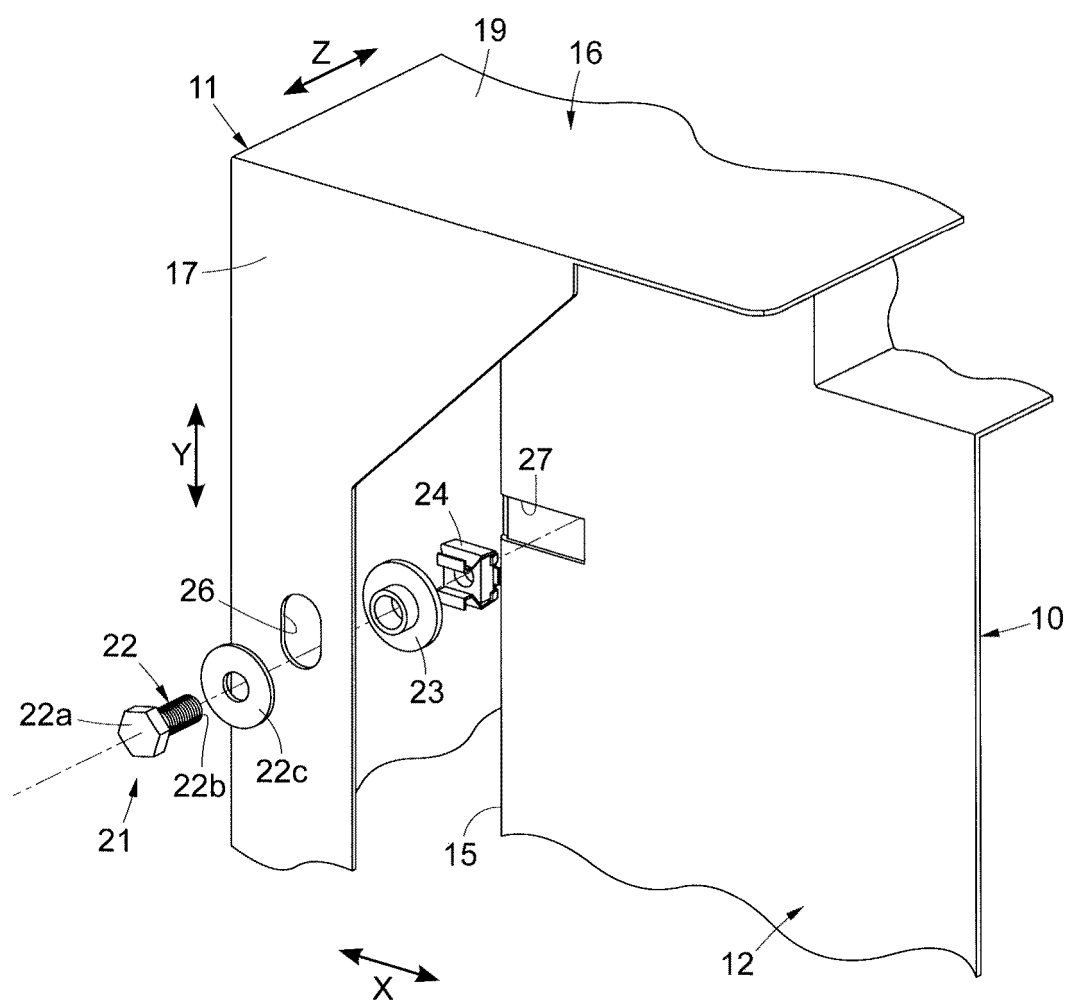


fig. 5



EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	KR 2019 0095844 A (MIRAE TECH INC [KR]) 16 August 2019 (2019-08-16) * paragraph [0038] - paragraph [0059]; figures 1,3,4 *	1-10	INV. E05F15/48
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			TECHNICAL FIELDS SEARCHED (IPC)
			E05F E05G
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		10 April 2025	Berote, Marc
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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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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