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Description

[0001] The invention relates to a door leaf for swing doors, having at least one door leaf, a motorized drive for the door leaf and a safety assembly, wherein a sensor, disposed on the door leaf, is provided. The invention also relates to a method for securing a door leaf of a swing door during opening and closing.

[0002] The European laid-open publication EP 1 832 866 A2 discloses a door sensor system including at least one light scanner device to detect an object in or near the door. The light scanner device uses an infrared laser diode emitting short laser pulses. The laser pulses are deflected on a rotating mirror. If an object is located in the region to be monitored, part of the light pulse is reflected back. The back-reflected light is detected by a receiver and produces a detection signal. The light scanner device can be arranged in the vicinity of the upper center of a door leaf. A region in front of the door leaf located ahead in the direction of movement is monitored then.

[0003] The European laid-open publication EP 2 226 452 A1 discloses a door monitoring sensor configured in the form a triangulation sensor. The receiver unit and the sender unit of the sensor are disposed separate from each other in an upper region of a swing leaf of a door.

[0004] The German patent publication DE 101 29 230 C1 describes a sensor arrangement for monitoring a room zone of at least one leaf of a door driven by a motor. If a revolving door driven by a motor is to be monitored, said door is provided with a sensor strip and a receiver strip on the bottom side that is opposite the floor surface. The sender strip has a plurality of juxtaposed light senders, and the receiver strip has a plurality of juxtaposed light receivers. The sender strip and the receiver strip are attached one on top of the other, and the light senders emit rays of light which extend not in parallel to the floor surface, but away from the floor surface at a small angle. Each light sender emits a bundled directed ray and the light reflected by a possibly present object is evaluated by the light receivers. In order to cover the complete width of the door, numerous light senders and light receivers a provided adjacent to each other, in the example illustrated, there are 16 light senders and 16 light receivers provided.

[0005] The US laid-open publication US 2004/0233414 A1 discloses a laser scanner which is disposed above a surface to be monitored and the presence of an object on the surface to be monitored is detected. The laser scanner is provided, for example,

for use in helicopters for ground monitoring or also on ships for monitoring the surface of the sea.

[0006] The European laid-open publication EP 2 108 775 A2 describes a motor-driven revolving door which is provided with a monitoring device. The monitoring device has a plurality of sensors arranged juxtaposed on each leaf of the revolving door in the vicinity of the upper end, which sensors monitor the region in front of the respective door leaf. In addition, further sensors are provided on the two edges of the door openings towards which the door leaves extend.

[0007] The European laid-open publication EP 2 648 022 A1 describes a door leaf with a motor drive and a safety arrangement including a sensor which is in the form of a laser scanner. The sensor is arranged on a rotation axis of the door leaf and configured for generating and monitoring a light curtain. The light curtain is produced in parallel to a floor surface and parallel to a side of the door leaf located in front in the direction of movement of the door leaf.

[0008] The invention is intended to provide improved securing of a swing door having a motorized drive, so that the motorized drive may be rapidly switched off or reversed when obstacles arise in the movement range of the swing door.

[0009] According to the invention, to this end a door leaf for swing doors, having the features of Claim 1, and a method having the features of Claim 8 are provided.

[0010] According to the invention, a door leaf for swing doors, having at least one door leaf with a safety assembly and a motorized drive for the door leaf, is provided, wherein at least one sensor, disposed on the door leaf, for generating and monitoring a light curtain is provided, wherein the light curtain is disposed so as to be parallel with a floor surface and below the door leaf and, as required, additionally in parallel to a side of the door leaf that in a direction of movement of the door leaf is at the front.

[0011] Surprisingly, reliable detection of obstacles may be achieved by providing a light curtain at a short distance from a side of the door leaf that in the direction of movement of the door leaf is at the front. The light curtain is set up at a distance of a few centimetres from the front side of the door leaf. In reference to the lateral edges and the lower edge of the door leaf, the light curtain likewise ends a few centimetres from the lateral edges or from the lower edge of the door leaf, respectively. For example, it has been found to be advantageous for the light curtain to be set up 2 cm

in front of the front side of the door leaf and also in each case to end 2 cm in front of the lateral edges of or of the lower edge of the door leaf, respectively. Surprisingly, it is sufficient here for one light curtain to be employed for detecting obstacles, since modern drives even for very large door leaves, in particular electric drives, may be stopped or reversed very rapidly, respectively, so that adequate safety is ensured even when obstacles are detected at a very short distance from the door leaf, namely by the light curtain. The invention is based on the insight that a light curtain which per se is employed in a spatially fixed manner for securing danger spots, may be particularly advantageously and easily employed also for securing moving door leaves of swing doors, if and when the light curtain is entrained with the door leaf and is thus conjointly moved with the door leaf at a short distance from the front side of the door leaf when the door leaf moves.

[0012] According to the invention, the light curtain is generated so as to be parallel with the floor surface. There is usually adequate space between the lower side of a door leaf and the floor surface above which the door leaf is moved to and fro for the disposition of a sensor for generating and monitoring a light curtain. The light curtain which is generated by means of such a sensor then runs parallel with the floor surface, the dimensions of the light curtain being adjustable in a substantially arbitrary manner by means of suitable sensors. The light curtain, like the sensor disposed on the lower side of the door leaf, is conjointly moved with the door leaf such that a predetermined range in front of the door leaf in the direction of movement of the door leaf may always be monitored in a manner which is substantially independent of the position of the door leaf. If it is provided that the door leaf in the closed state is also sealed in relation to the floor surface, deployable sealing strips may be provided on the lower side of the door leaf. Before the door leaf commences movement, the sealing strips have to be lifted off the floor surface again anyway, so that the light curtain may be generated and movement of the door leaf may be secured by means of the sensors.

[0013] According to the invention, the sensor is configured as a laser scanner. Laser scanners specifically have proven particularly advantageous for securing swing doors. One laser beam or a plurality of laser beams is/are deflected in one plane here, so as to project a light curtain.

[0014] In one refinement of the invention, the sensor is configured as an infrared-laser scanner.

[0015] In this way, a light curtain which is invisible to the human eye may be provided.

[0016] In one refinement of the invention, an acquisition range of the further sensor is adjustable in two directions which are parallel with the front side of the door leaf.

[0017] In this way, the light curtain may be delimited laterally, towards the top and towards the bottom and, on account thereof, secure the front side of the door leaf or a desired portion of the front side of the door leaf, respectively. Such an adjustment of the acquisition range of the sensor in the case of a laser scanner is performed, for example, in that the laser scanner operates on the basis of a running-time measurement of the light and, in order for the acquisition range to be adjusted, the expected light running time is adjusted according to the angle of deflection of the laser beam.

[0018] In one refinement of the invention, an acquisition range of the sensor is adjustable depending on an opening angle of the door leaf.

[0019] In this way, variable geometrical conditions may be considered during opening or closing a door leaf of a swing door. For example, a gap between the two door leaves of a double-leaf swing door will at one point become so tight that no human limbs may fit into the gap any more when the two leaves are folded together. Moreover, acquisition of obstacles has to be switched off by default in order to be able to fold the two door leaves together in the first place. By varying the acquisition range of the sensor so as to depend on the pivot angle, varying spatial conditions during opening or closing may be considered. It is particularly advantageous here that the acquisition range of the sensor is readily programmable and, on account thereof, the sensor may be easily tuned to changed spatial conditions.

[0020] In one refinement of the invention, the further sensor during operation protrudes from the front side of the door leaf.

[0021] In this way, the light curtain may be reliably projected at a short distance from and parallel with the front side of the door leaf.

[0022] In one refinement of the invention, at least one actuator is provided in order to move the further sensor, proceeding from a rest position which is disposed so as to be flush with or within the door leaf, to an operating position which protrudes from the front side of the door leaf.

[0023] For reasons of design it may be provided that the sensor is deployed from the surface of the door leaf just shortly prior to commencement of the movement of the door leaf and then projects the light curtain. For example, only the sensors in the front side of the door leaf may be deployed during opening of a door leaf, while only the sensors which are disposed on the rear side of the door leaf are then deployed during closing of the door leaf. In the case where a door leaf completely bears in a parallel manner on a wall of a building or on another door leaf, the sensors may then be retracted into the interior of the door leaf in a timely manner.

[0024] In one refinement of the invention, switch rails which generate a switch signal when approaching an obstacle or contacting an obstacle are provided at least on the lateral edges of the door leaf.

[0025] Such switch rails or safety contact rails are advantageous for safety in crushing zones and shearing zones. For example, if and when very thick door leaves are folded out by 180° a gap which steadily decreases in size and which has to be safeguarded against crushing human limbs arises between the narrow sides of the door leaves. Further sensors, for example optical sensors, may likewise be employed, for example for securing blind spots. For example, additional light curtains may be employed so as to be parallel with the floor surface in order to ensure that there is no person lying on the floor or standing thereon in the region of the door. Sensors for such light curtains are advantageously disposed on the support. It may be convenient for such light curtains which run parallel with the floor surface to be activated only temporarily during opening or closing, for example just prior to the final closing of the door.

[0026] According to the invention, the sensor during operation protrudes from the lower side of the door leaf. In this way, a light curtain which is disposed in the intermediate space between the lower side of the door leaf and the floor surface may be generated, said light curtain then running parallel with the floor surface. According to the invention it is provided that prior to generating the light curtain the sensor is deployed from the lower side of the door leaf. For example, the sensor may be disposed between deployable sealing strips on the front edge and on the rear edge of the door leaf. Only when the door is static in the closed state are the sealing strips deployed so far as to bear on the floor surface. Before the door leaf commences moving, the sealing strips are lifted off the floor surface and the sensor which is disposed between the sealing strips may generate the light curtain.

[0027] In a method according to the invention for securing a door leaf of a swing door during opening and closing, a light curtain which is parallel with a side of the door leaf which in a direction of movement is at the front, and/or parallel with a floor surface, is generated, and movement of the door leaf is stopped and/or reversed when an obstacle is detected in the range of the light curtain. The light curtain, or a plurality of light curtains, respectively, is/are generated by means of a laser scanner.

[0028] In one refinement of the invention, the light curtain is conjointly moved with the door leaf during opening and closing.

[0029] According to the invention, the sensors for generating and monitoring the light curtain are disposed in the door leaf itself. On account thereof, the light curtain is conjointly moved by default during opening and closing of the door leaf. On account thereof, the light curtain is automatically always disposed where it is also required, namely in front of the door leaf in the direction of movement.

[0030] According to the invention, the deployment of sensors for generating and monitoring the light curtain prior to commencement of movement of the door leaf is provided.

[0031] In this way, the sensors may be disposed so as to be protected from contamination and damage when the door is not moved. It is only when the sensors are required for generating and monitoring the light curtain that they are moved from a protected rest position to a deployed operating position. Further features and advantages are derived from the claims and from the description of preferred embodiments of the invention, in conjunction with the appended drawings.

[0032] In the drawings:

Fig. 1 shows a schematic front view of a door leaf of a swing door not claimed, having a safety assembly;

Fig. 2 shows a side view of the door leaf of Fig. 1;

Fig. 3 shows a schematic portion-wise side view of the door leaf of Fig. 3, with a retracted sensor;

Fig. 4 shows an illustration of the door leaf corresponding to Fig. 3, with a deployed sensor;

Figs. 5, 6, and 7 show various intermediate positions when opening a swing door not according to the invention;

Figs. 8, 9, and 10 show various intermediate positions when closing a swing door not according to the invention;

Fig. 11 shows a schematic front view of an embodiment according to the invention of a door leaf of a swing door having a safety assembly;

Fig. 12 shows a side view of the door leaf of Fig. 11;

Fig. 13 shows a portion-wise view of the door leaf of Fig. 12; and

Fig. 14 shows a schematic illustration of an embodiment of a swing door according to the invention, from above, in the fully closed position.

[0033] The illustration of Fig. 1 shows a swing door 10 not according to the invention, having a door leaf 12 which is pivotably disposed on a stationary support 14. The illustration of Fig. 1 is schematic, and the stationary support 14 may be part of a building, for example, or be formed by a wall of a building. The support 14 and the door leaf 12 are interconnected by means of two hinges 16 which are also only schematically illustrated and which may also be configured in the form of so-called parallelogram hinges, so as to also enable parallel folding of very thick door leaves against a building wall. Moreover, a motorized drive 18 for moving the door leaf 12, which drive is indicated in a merely schematic manner by dashed lines, is provided within the door leaf 12 or on the support 14.

[0034] The door leaf 12 is provided with at least one laser scanner 20 which projects a light curtain 22. The light curtain 22 is projected at a small distance of about 2 cm in front of a side of the door leaf 12 that in the direction of movement is in front, see also Fig. 2. The laser scanner 20 here generates the light curtain 22 only immediately prior to commencement of movement of the door leaf 12. A direction of movement is indicated by an arrow 24 in the illustration of Fig. 2. Now, if an obstacle, for example a human hand, makes its way into the light curtain 22, this is detected by the laser scanner 20, and the laser scanner 20 thereupon emits a switch signal. This switch signal is transmitted via signal lines (not illustrated) to a controller of the motorized drives 18 and causes immediate stoppage of the motorized drives 18 or the reversal of their direction of movement.

[0035] The light curtain 22 covers a range below the laser scanner 20. The door leaf 12 in the illustrated example is very tall and has a height of about 2 to 3 m. It is thus sufficient for the laser scanner 20 to monitor a range below the laser scanner 20 for obstacles. The light curtain 22 here ends in each case a few centimetres, in particular 2 cm, in front of the lateral edges of the door leaf 12. The light curtain 22 likewise ends a few centimetres, in particular 2 cm, in front of a lower edge of the door leaf 12. On account of the fact that the light curtain ends a few centimetres in front of a lower edge of the door leaf 12, it is enabled that very flat obstacles which are lower in height than a human foot do not lead to the door leaf 12 being stopped and, on account thereof, that small rocks or flat objects, for example, may be pushed away when the door leaf 12 opens.

[0036] In order to prevent crushing of human limbs or of objects below a lower edge of the door leaf 12 depending on the spatial conditions, a lower edge of the door leaf 12 may moreover be provided with a safety contact rail.

[0037] In the embodiment illustrated, the left narrow side and the right narrow side of the door leaf 12 in Fig. 1 are in each case provided with one safety contact rail 26. Once the safety contact rails 26 acquire an obstacle, for example by being compressed, they emit a switch signal which is likewise transmitted to the controller of the motorized drives 18 and then stops or reverses movement of the motorized drives 18.

[0038] Further potential positions 28, 30 for the laser scanner 20 are illustrated in a dashed manner in the illustration of Fig. 1.

[0039] A further laser scanner 29 is provided on the support 14, specifically at the lower end of the support, where the latter transitions into the floor surface. This laser scanner 29 projects a light curtain 31 which runs parallel with the floor surface and extends below the door leaf 12. Such a light curtain 31 serves for covering blind spots, in particular just prior to the door leaf 12 being completely closed. It may be ensured by means of the light curtain 31 that no person is standing or lying in front of or behind the door leaf 12, see also Fig. 2. If this is the case, the door leaf 12 may be moved on, since it is ensured that there is no risk of persons being crushed. The laser scanner 29 is advantageously only temporarily activated during opening and closing of the door leaf 12, respectively, for example only when the door is already largely closed and has only yet to assume its final position. The risk of persons being crushed in gaps created between the support 14 and the door leaf 12, or between further door leaves, respectively, is particularly high just prior to complete closing.

The light curtain 31 can ensure that there is no risk here. On the other hand, a permanently active light curtain 31, generated by the laser scanner 29, may lead to an opening operation or closing operation of the door leaf 12, respectively, being interrupted too frequently, since the moving operation of the door leaf 12 will be interrupted by every person standing in front of or behind the door leaf 12.

[0040] As can be derived from Fig. 2, the laser scanner 20 protrudes beyond a side of the door leaf 12 which in the direction of movement 24 is in front. On account thereof, the laser scanner 20 can project the light curtain 22 so as to be exactly parallel with the front side of the door leaf 12.

[0041] The laser scanner 20 here, in the operating position illustrated in Fig. 2, may be fixedly disposed, but for reasons of design and when not required, it may also be displaced into a rest position which is disposed within the door leaf 12.

[0042] Fig. 3 shows the door leaf 12 in a portion-wise manner from the side. The laser scanner 20, by way of its front side, is now disposed so as to be flush with a front side of the door leaf 12.

[0043] The illustration of Fig. 4 shows an illustration which is comparable to that of Fig. 3, the laser scanner 20 now protruding beyond the front side of the door leaf 12 and being able to generate the light curtain 22 so as to be parallel with the front side of the door leaf 12. An actuator 32, which is configured for example as a linear motor or as a pneumatic or hydraulic cylinder, respectively, may serve for retracting and deploying the laser scanner 20, for example.

[0044] The illustration of Fig. 5 shows a swing door 34 not according to the invention, having a total of four door leaves 12a, 12b, 12c, and 12d. The door leaves 12a, 12d are referred to as first door leaves and are in each case pivotably disposed on a support 14 which in the embodiment illustrated is part of a building. A building opening, which in the completely closed state of the swing door 34 of Fig. 5 is blocked, is disposed between the left and right supports 14 in Fig. 5.

[0045] The door leaves 12b, 12c are referred to as second door leaves and are pivotably connected to a narrow side of the first door leaves 12a, 12d, this narrow side facing away from the supports 14.

[0046] The first door leaves 12a, 12d are in each case provided with one first laser scanner 20a which in the illustration of Fig. 5 is illustrated in the retracted and dashed

rest position. The second door leaves 12b, 12c, on their side which is on top in Fig. 5 and is at the front during opening, are in each case provided with one second laser scanner 20b. Since Fig. 5 shows the state immediately prior to commencement of an opening movement, the second laser scanners 20b are illustrated in their already deployed position and each project one light curtain which is parallel with the front side of the door leaves 12b, 12c.

[0047] The second door leaves 12b, 12c are in each case also provided with a third laser scanner 20c which is disposed on that side of the second door leaves 12b, 12c that is at the rear during opening. The third laser scanners 20c in the illustration of Fig. 5 are illustrated in a dashed manner in their rest position within the door leaves 12b or 12c, respectively.

[0048] In order for the swing door 34 to be opened, the second door leaves 12b, 12c, are initially folded by 180° to the outside, that is to say towards the supports 14. This folding movement is indicated by the curved arrows 36, 38 in Fig. 5. During such an opening movement of the second door leaves 12b, 12c, movement of the second door leaves 12b, 12c is secured by the light curtains projected by the second laser scanners 20b. Should an obstacle indeed make its way into the light curtains of those sides of the second door leaves 12b, 12c that in the directions of movement 36, 38 are in front, movement of the second door leaves 12b, 12c is immediately stopped.

[0049] Proceeding from the state of Fig. 5, the second door leaves 12b, 12c are pivoted by 180°, until they arrive at the position illustrated in Fig. 6. In this position the second door leaves 12b, 12c lie in each case parallel with the first door leaves 12a, 12d. The second laser scanners 20b here have to be retracted to the rest position immediately prior to the parallel folding of the second door leaves 12b, 12c against the first door leaves 12a, 12d. However, this may be performed at a point in time at which there is no risk of obstacles being disposed between the second door leaves 12b, 12c and the first door leaves 12a, 12d.

[0050] Proceeding from the state of Fig. 6, the pack composed of the first door leaf 12a and the second door leaf 12b is folded by 90°, in the direction toward the support 14, as indicated by means of a curved arrow 40. In the same way, the pack composed of the first door leaf 12d and the second door leaf 12c is folded by 90° toward the support 14, as indicated by means of a curved arrow 42. During such a movement of the door leaves 12a, 12b, 12c, 12d only the side of the first door leaves 12a, 12d located in front in the direction of movement 40, 42 need to be secured. As a result, the first laser scanners 20a are deployed prior to commencement of said

movement of the first door leaves 12a, 12d and project a light curtain in parallel to and in front of the first door leaves 12a, 12d during the movement.

[0051] Proceeding from the position of Fig. 6, the door leaves 12a, 12b, 12c, 12d then reach the completely opened position of Fig. 7. The first door leaf 12a now is parallel with the support 14, and the second door leaf 12b is disposed so as to be parallel with the first door leaf 12a. The laser scanners 20a, 20b, and 20c are all displaced to their rest position within the door leaves 12a, 12b.

[0052] In exactly the same way, the two door leaves 12d and 12c are now disposed so as to be parallel with the right support 14 in Fig. 7, and the laser scanners 20a, 20b, 20c are disposed in their retracted rest position. A building opening is now accessible in a substantially complete manner.

[0053] The illustrations of Figs. 8 to 10 show a closing operation of the swing door 34, proceeding from the completely opened position in Fig. 8. In order for the swing door 34 to be closed, the door leaves 12a, 12b which in the completely opened position are disposed so as to be mutually parallel are collectively pivoted away from the support 14 by 90°. This movement is indicated by means of a curved arrow 44. Before the pack consisting of the door leaves 12a, 12b begins to move, the third laser scanner 20c is deployed and, on account thereof, projects a light curtain in front of that side of the second door leaf 12b that in the direction of movement 44 is at the front.

[0054] In the same way, the third laser scanner 20c in the second door leaf 12c is deployed, projects a light curtain, and subsequently the pack consisting of the door leaves 12c, 12d is collectively pivoted away from the right support 14 in Fig. 8 by 90°. This movement is indicated by a curved arrow 46.

[0055] Proceeding from the state of Fig. 8, the door leaves 12a, 12b, 12c, 12d reach the partially closed position which is illustrated in Fig. 9. The two door leaves 12a, 12d are already located in their final position which they also assume in the case of a completely closed swing door 34. The second door leaves 12b, 12c, proceeding from the position which is illustrated in Fig. 9, still have to be pivoted away from the respective support 14 by 180°. The third laser scanners 20c remain active also during this pivot movement according to the curved arrows 48, 50, and secure movement of the second door leaves 12b, 12c.

[0056] Proceeding from the state of Fig. 9, the door leaves 12a, 12b, 12c, 12d reach the completely closed position of the swing door 34, which is illustrated in Fig. 10. In this completely closed position all door leaves 12a, 12b, 12c, and 12d are disposed so as to be mutually parallel and completely close a building opening between the two supports 14. The laser scanners 20a, 20b, and 20c are all now located in their retracted rest position. In order for the door to be opened, the second laser scanners 20b, 20c are deployed and activated, and the opening operation is performed by means of the sequence of movements of Figs. 5 to 7, as has already been explained.

[0057] It may be seen with reference to Figs. 5 to 10 that in the case of a swing door 34 having a total of four leaves, six laser scanners 20a, 20b, 20c are sufficient in order to secure movement of the door leaves 12a, 12b, 12c, 12d. Three laser scanners 20a, 20b, 20c suffice per side of the swing door 34, that is to say for each side which is composed of in each case one first door leaf 12a and one second door leaf 12b, or of one first door leaf 12d and one second door leaf 12c, respectively. A first laser scanner 20a here has to secure a side of the first door leaves 12a, 12d that during opening is at the front. A second laser scanner 20b has to secure a side of the second door leaves 12b, 12c that during opening is at the front. A third laser scanner 20c has to secure a side of the second door leaves 12b, 12c that during closing is at the front.

[0058] The contours of two additional light curtains 31a, 31b are drawn in Fig. 10, see also Fig. 1. These two light curtains 31a, 31b run parallel with a floor surface and below a lower edge of the door leaves 12a, 12b, 12c, 12d. The light curtains 31a, 31b are in each case generated by laser scanners 29 (not illustrated in Fig. 10), see Fig. 1, which are disposed on the supports 14, specifically at the lower end of the supports 14, where the latter bear on the floor surface. The light curtains 31a, 31b are generated only very shortly prior to reaching the completely closed position which is illustrated in Fig. 10, so as to ensure just prior to the complete closing of the door that no persons are located in front of or behind the door leaves 12a, 12b, 12c, 12d. This is done to ensure that no persons are crushed in the gaps which exist between the door leaves 12a, 12b, 12c, 12d and the supports 14 and which are heavily constricted when the door is completely closed. The region of these gaps is indeed advantageously covered by switch rails, but providing light curtains 31a, 31b which run parallel with the floor surface can provide additional safety here. The light curtains 31a, 31b are deliberately not switched on during the complete closing operation, so as to be able to nevertheless trigger the closing operation or the opening operation, respectively, even when persons are located in the range of movement of the door.

[0059] As a result, very reliable securing of the movement of a motor-operated swing door may be reliably implemented with low effort by way of the safety assembly and the swing door 34.

[0060] The illustration of Fig. 11 schematically shows a swing door 10 having a door leaf 12 according to an embodiment of the invention which is constructed in a very similar manner to the swing door 10 of Fig. 1. Therefore only the points of difference in relation to the swing door 10 of Fig. 1 will be explained.

[0061] In the swing door 10 of Fig. 1, a light curtain 31 is generated by means of a laser scanner 29 which is disposed at the lower end of the support 14. In the swing door 10 of Fig. 11, a laser scanner 50 is disposed on a lower side of the door leaf 12 and is configured so as to be deployable from the lower side of the door leaf 12. In the embodiment of Fig. 11, the laser scanner 50 generates the light curtain 31 which extends between a lower side of the door leaf 12 and a floor surface 52, so as to be parallel to the floor surface 52. The light curtain here, in terms of its dimensions, may be adjusted so as to be substantially arbitrary. It can be seen in the illustration of Fig. 11 that the light curtain 31, proceeding from the light scanner 50, extends across the entire lower side of the door leaf 12 and ends only shortly after the left end of the door leaf 12 in Fig. 11. In the other direction, the light curtain 31, proceeding from the light scanner 50, extends some length in the direction of the support 14.

[0062] The illustration of Fig. 12 shows the door leaf 12 of Fig. 11 in a side view. It can be seen that the light curtain 31, proceeding from the laser scanner 50, extends in the direction of movement 24 and counter thereto, so as to cover the complete lower side of the door leaf 12. In the direction of movement 24, the light curtain 31 extends some length beyond the front side of the door leaf 12, so as to acquire, for example, objects lying on the floor surface 52 adequately far ahead of the front side of the door leaf 12 and, on account thereof, to avoid a collision between the door leaf 12 and such objects.

[0063] The illustration of Fig. 13 shows the door leaf 12 of Fig. 12 in a portion-wise manner in the region of its lower side. The laser scanner or sensor 50, respectively, which, proceeding from a dashed position within the door leaf 12, has been deployed in the direction of the floor surface 52, so as to generate the light curtain 31, can be seen. The direction of movement 24 in the illustration of Fig. 13 is illustrated so as to be directed to the left.

[0064] The door leaf 12 has deployable sealing strips 54 which are illustrated in the state of Fig. 13 within the door leaf 12, and are thus merely indicated in a dashed manner. When the door leaf 12 is stationary, preferably in the completely closed position of the swing door, the sealing strips 54 may be deployed from the lower side of the door leaf 12 in the direction of the floor surface. This deployed position is likewise indicated in a dashed manner in Fig. 13. The laser scanner 50 is disposed between the two deployable sealing strips 54. If the door leaf 12 is to be moved, the sealing strips 54 have to be initially lifted off the floor surface 54 and to be retracted into the door leaf 12. The laser scanner 50 may be simultaneously deployed from the lower side of the door leaf 12, and the light curtain 31 is generated and monitored even before the door leaf 12 begins to move.

[0065] The illustration of Fig. 14 shows an embodiment according to the invention of a swing door 34 in the completely closed position. The swing door 34 largely corresponds to the swing door illustrated in Fig. 5, and only the points of difference in relation to the swing door 34 of Fig. 5 will be explained. For the sake of completeness it should be noted that for reasons of clarity the laser scanners 20A, 20B, 20C of Fig. 5 are not illustrated in Fig. 14. However, these laser scanners 20A, 20B, 20C may also be present in the embodiment of the swing door 34 which is illustrated in Fig. 14.

[0066] Only four laser scanners 50A, 50B are illustrated in Fig. 14, in each case one laser scanner 50A, 50B being provided in each door leaf 12A, 12B, 12C, 12D. Each of the laser scanners 50A, 50B is disposed between a lower side of the respective door leaf 12A, 12B, 12C, 12D, and the floor surface 52, see Fig. 13, and is deployable from the lower side of the door leaves 12A, 12B, 12C, 12D. The laser scanners 50A, 50B in each case generate one light curtain 31A, 31B. The light curtains 31A, 31B in the embodiment illustrated are in each case rectangular, but in terms of their geometrical shape may be adjusted in a substantially arbitrary manner.

[0067] The state of Fig. 14 shows the completely closed state. Proceeding from the state of Fig. 14, the door leaf 12B is initially pivoted in the direction of the curved arrow 38, and the door leaf 12C is pivoted in the direction of the curved arrow 36. The light curtains 31A, 31B between the door leaves 12A, 12B, 12C, 12D, in the case of the door leaves 12B, 12C cover that region that in the direction of movement is substantially at the front. In the case of the door leaves 12A, 12D that region is covered in which the door leaf 12B or the door leaf 12C, respectively, comes to lie.

[0068] It can be seen that the light curtains 31A, 31B in each case cover the complete lower side of the door leaves 12A, 12B, 12C, 12D, and counter to the direction of

movement also extend somewhat beyond the lower side of the door leaves 12A, 12B, 12C, 12D. The light curtains 31A, 31B may also be mutually overlapping; as has been explained, the geometrical dimensions of the light curtains 31A, 31B may be adjusted in a substantially arbitrary manner, so as to be adapted to the respectively present application.

[0069] Proceeding from the state of Fig. 14, a further intermediate state is reached, see Fig. 6. The respective outer door leaves 12A, 12D, together with the folded-in door leaves 12B or 12C, respectively, are folded away in a downward direction, see Figs. 6, 7. For this further movement, the light curtains 31A are converted such that they then cover the region of the door leaves 12A, 12D that in the direction of movement is at the front. In Fig. 14, this would then be the region below the door leaves 12A, 12D.

[0070] The arrangement of the laser scanners 50A, 50B on a lower side of the door leaves 12A, 12B, 12C, 12D, so as to be deployable from the respective lower side, enables an arrangement which is very resistant to contamination and damage to be achieved.

PATENTKRAV

1. Portfløj (12, 12a, 12b, 12c, 12d) for svingporte (10), med mindst en portfløj (12, 12a, 12b, 12c, 12d) med en sikkerhedsanordning og et motoriseret drev (18) for portfløjen (12, 12a, 12b, 12c, 12d), hvorved der er tilvejebragt mindst en sensor, som er placeret på portfløjen (12, 12a, 12b, 12c, 12d), og hvorved sensoren er tilvejebragt med henblik på frembringelse og overvågning af et lysgardin (22, 31a, 31b), hvilket lysgardin (22, 31a, 31b) er anbragt parallelt med en gulvoverflade og neden under portfløjen (12, 12a, 12b, 12c, 12d), hvorved sensoren under driften rager frem fra portfløjens (12, 12a, 12b, 12c, 12d) underside, **kendetegnet ved, at** sensoren er udformet som laserscanner (50), og laserscanneren (50) er udformet, så den kan deployeres fra portfløjen (12, 12a, 12b, 12c, 12d) før påbegyndelse af portfløjens bevægelse, og hvorved der efter behov er tilvejebragt en yderligere sensor til frembringelse og overvågning af et lysgardin, der er anbragt parallelt med en side af portfløjen (20), og som befinder sig foran i portfløjens (12, 12a, 12b, 12c, 12d) bevægelsesretning.

2. Portfløj (12, 12a, 12b, 12c, 12d) ifølge krav 1, **kendetegnet ved, at** sensoren er konfigureret som en infrarød laserscanner (20).

3. Portfløj (12, 12a, 12b, 12c, 12d) ifølge et af de foregående krav, **kendetegnet ved, at** et detekteringsområde for den yderligere sensor kan indstilles i to retninger parallelt med portfløjens (12, 12a, 12b, 12c, 12d) forside.

4. Portfløj (12, 12a, 12b, 12c, 12d) ifølge mindst et af de foregående krav, **kendetegnet ved, at** et detekteringsområde for sensoren kan indstilles i afhængighed af en svingvinkel for portfløjen (12, 12a, 12b, 12c, 12d).

5. Portfløj (12, 12a, 12b, 12c, 12d) ifølge et af de foregående krav, **kendetegnet ved, at** den yderligere sensor under driften rager frem fra den forrest beliggende side af portfløjen (12, 12a, 12b, 12c, 12d).

6. Portfløj (12, 12a, 12b, 12c, 12d) ifølge krav 5, **kendetegnet ved, at** der er tilvejebragt mindst en aktuator (32) med henblik på at bevæge den yderligere

sensor fra en flugtende eller inden i portfløjen (12, 12a, 12b, 12c, 12d) arrangeret hvilestilling og til en ud fra den fremad vendende side af portfløjen (12, 12a, 12b, 12c, 12d) ragende driftsstilling.

7. Portfløj (12, 12a, 12b, 12c, 12d) ifølge mindst et af de foregående krav, **kendetegnet ved, at** der mindst på portfløjens (12, 12a, 12b, 12c, 12d) sidekanter er tilvejebragt kontaktlister, som frembringer et koblingssignal, når en hindring nærmer sig eller ved berøring af en hindring.

8. Fremgangsmåde til sikring af en portfløj (12, 12a, 12b, 12c, 12d) ifølge mindst et af de foregående krav under åbning og lukning, **kendetegnet ved** frembringelse af et lysgardin (22, 31a, 31b) parallelt med en gulvoverflade og neden under portfløjen (12, 12a, 12b, 12c, 12d), samt desuden efter behov parallelt med en i bevægelsesretningen foran liggende side af portfløjen (12, 12a, 12b, 12c, 12d) såvel som frembringelse af lysgardinet (22, 31a, 31b) ved hjælp af en laserscanner (20, 50) og standsning af en bevægelse af portfløjen (12, 12a, 12b, 12c, 12d) ved detektering af en hindring i lysgardinets (22, 31a, 31b) område ved flytning af sensorer til frembringelse og overvågning af lysgardinet (22, 31a, 31b) før en påbegyndelse af portfløjens (12, 12a, 12b, 12c, 12d) bevægelse under åbning og lukning, hvorved laserscanneren (50) er udformet med henblik på deployering fra portfløjens (12, 12a, 12b, 12c, 12d) underside og under drift rager frem fra portfløjens (12, 12a, 12b, 12c, 12d) underside.

9. Fremgangsmåde ifølge krav 8, **kendetegnet ved** medfølgende bevægelse af lysgardinet (22, 31a, 31b) sammen med portfløjen (12, 12a, 12b, 12c, 12d) under åbning og lukning.

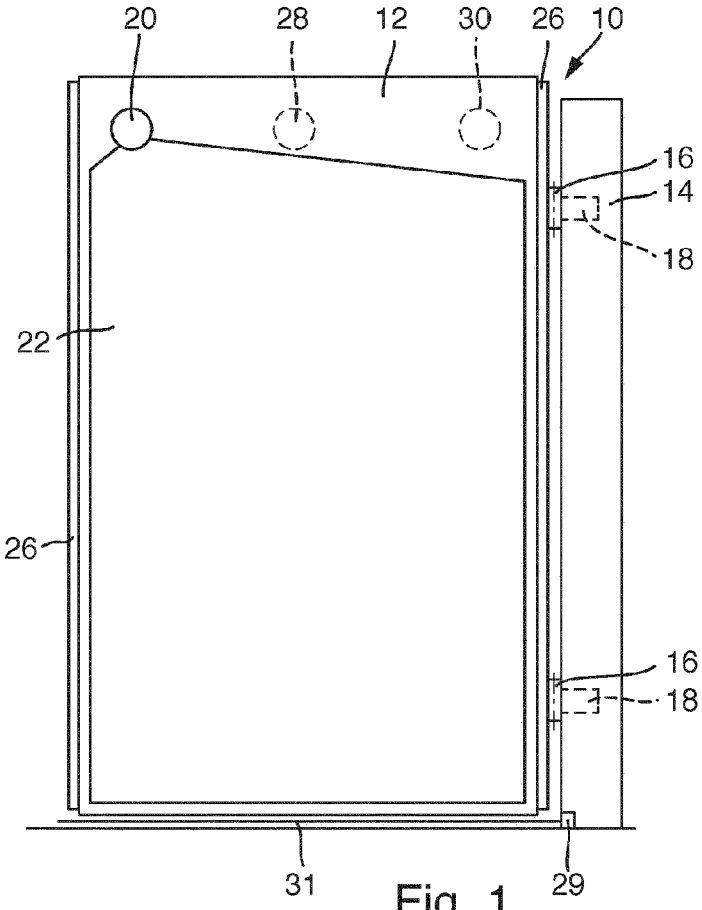


Fig. 1

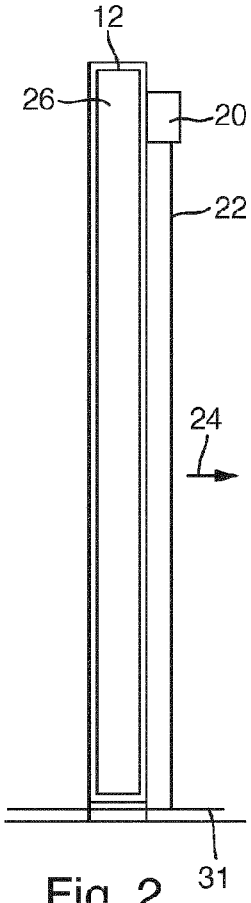


Fig. 2

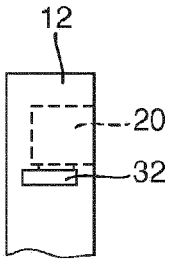


Fig. 3

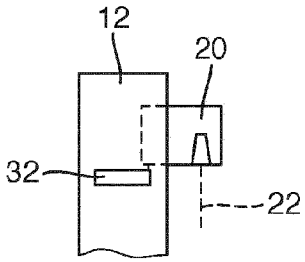


Fig. 4

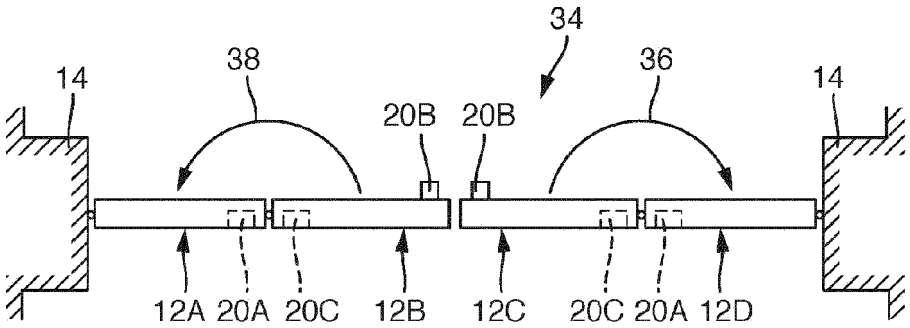
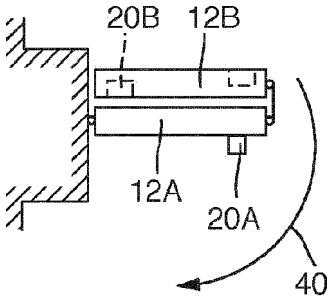


Fig. 5



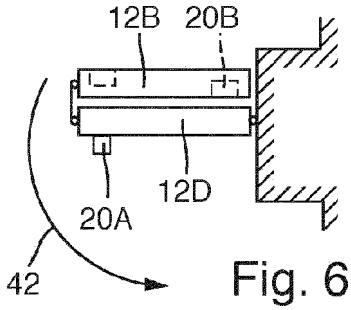
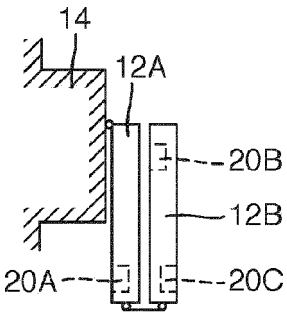


Fig. 6



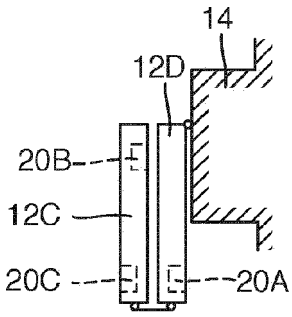


Fig. 7

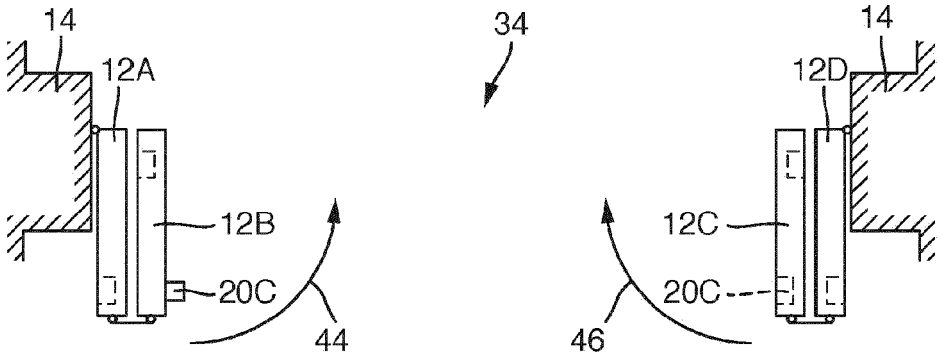


Fig. 8

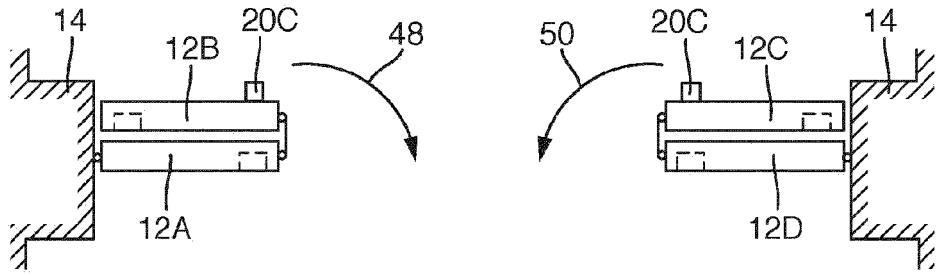


Fig. 9

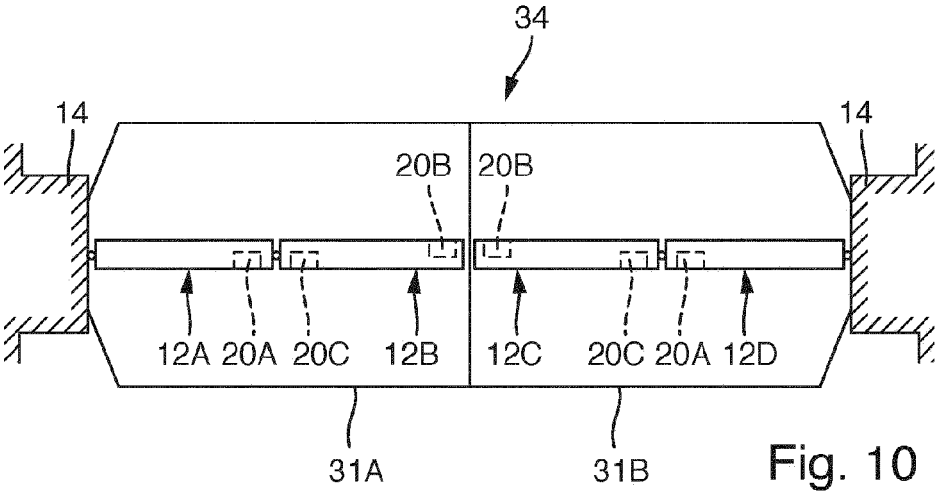


Fig. 10

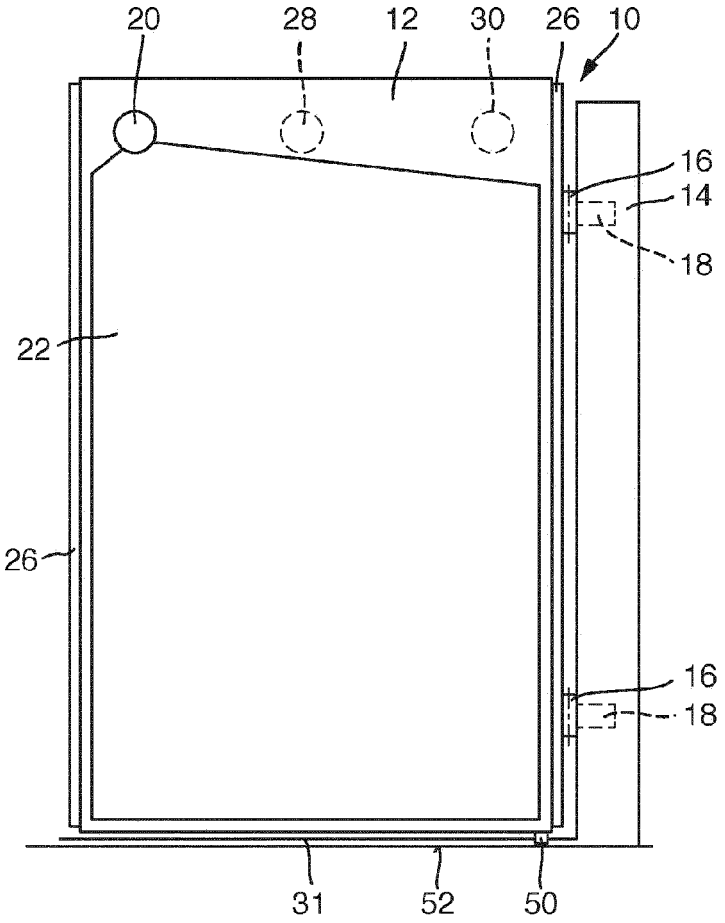


Fig. 11

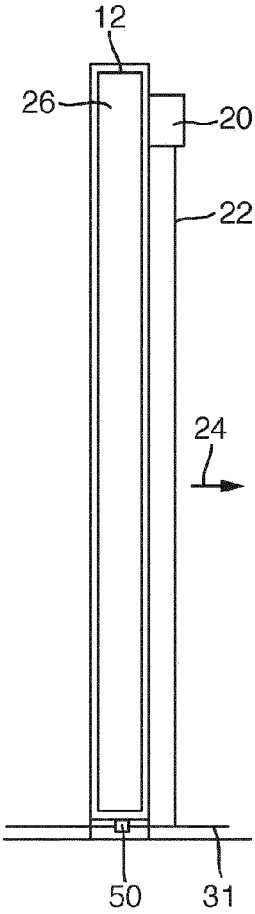


Fig. 12

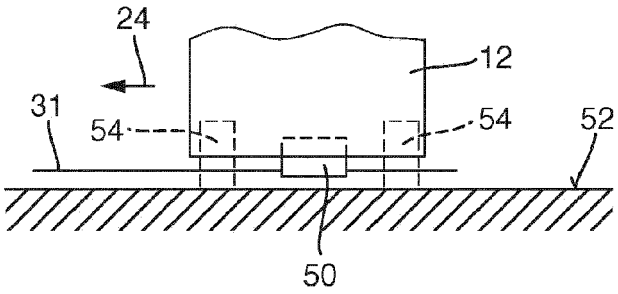


Fig. 13

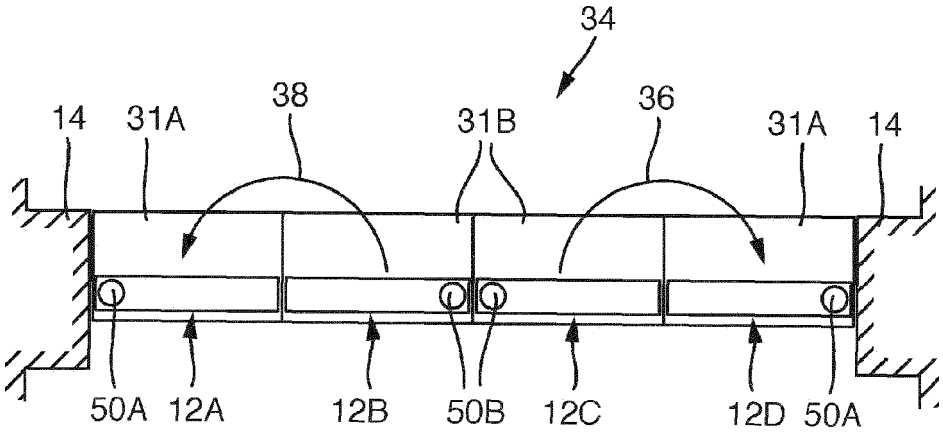


Fig. 14