

(19)



(11)

**EP 2 441 911 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:

**18.04.2012 Bulletin 2012/16**

(51) Int Cl.:

**E06B 9/13 (2006.01)**

**E06B 9/92 (2006.01)**

**E06B 9/88 (2006.01)**

**E06B 9/58 (2006.01)**

(21) Application number: **11184171.4**

(22) Date of filing: **06.10.2011**

(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**

(30) Priority: **13.10.2010 IT TV20100135**

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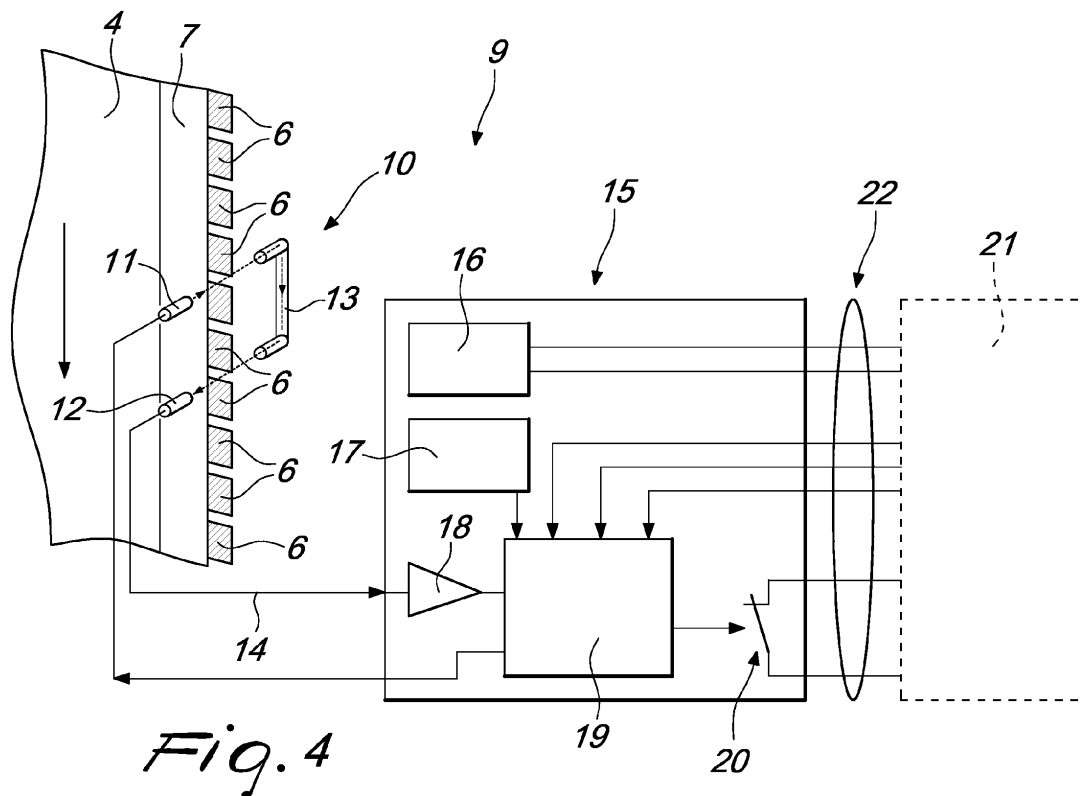
(54) **Device for detecting the speed of the curtain of a fast roll-up door**

(57) A device (9) for detecting the speed of the curtain of a fast roll-up door.

A plurality of teeth (6), which are identical and mutually equidistant with a selected spacing, protrudes lat-

erally to a curtain (4).

The device comprises means (10) adapted to detect, during the motion of the curtain (4), the time sequence of the teeth (6) and to control the movement of the curtain (4).



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## Description

**[0001]** The present application relates to a device for detecting the speed of the curtain of a fast roll-up door.

**[0002]** Nowadays this type of door is basically constituted by vertical posts, self-supporting or otherwise, and a horizontal beam, containing a take-up roller to which a gear motor is connected.

**[0003]** The closing element of the door is implemented with a curtain (usually a polyester fabric spread on both sides with PVC, polyvinylchloride) that is wound around the roller and slides laterally within special guides fixed to the posts.

**[0004]** In this known type of fast roll-up door, in order to achieve the reopening following an impact on the lower edge, electronic, electromechanical, pneumatic or opto-electronic devices are used.

**[0005]** The devices of the known type are based on sensitive elements that are accommodated in the lower edge of the door.

**[0006]** In general, these lower edges, precisely in order to permit the operation of the sensitive elements, must necessarily have a certain level of rigidity because, if they did not, even minimal stresses present in normal operation (for example minimal pressures or wind) would cause unwanted reopening.

**[0007]** The aim of the present invention is to solve the above-mentioned technical problems, eliminating the drawbacks in the cited known art, by providing a device that, applied to a fast roll-up door provided with a curtain, makes it possible to identify abrupt slowdowns in the closing step of the curtain, which are due for example to impacts of the lower edge on an obstacle and as a consequence generate a reopening/arrest manoeuvre of the curtain.

**[0008]** Within this aim, an object of the invention is to provide a device applied to a roll-up door the curtain of which is free from rigid elements which could undergo permanent deformations/breakages.

**[0009]** Another object is to provide a device applied to a roll-up door that makes it possible to achieve the reopening by impact on the lower edge of the curtain in the absence of one or more sensitive elements arranged on a rigid lower edge of the curtain.

**[0010]** Another object is to provide a device that is structurally simple, low-cost, and can be made with the usual known systems.

**[0011]** This aim and these and other objects which will become more evident hereinafter, are achieved by a device for detecting the speed of the curtain, which can slide in a vertical direction within a guide of a fast roll-up door, characterized in that a plurality of mutually equidistant teeth protrude transversely and laterally to said curtain, said device comprising means adapted to detect, during the motion of said curtain, the time sequence of said teeth and to control the movement of said curtain.

**[0012]** Further characteristics and advantages of the invention will become better apparent from the detailed

description of a particular, but not exclusive, embodiment, which is illustrated for the purposes of non-limiting example in the accompanying drawings wherein:

5 Figure 1 is a partially sectional view of a fast roll-up door;

Figure 2 is a detail of the guide of the door shown in Figure 1;

10 Figure 3 is a partially cutaway detail showing the sliding of the teeth in the guide;

Figure 4 is a schematic view of the device;

Figure 5 is a sectional view of a particular solution for the device.

15 **[0013]** In the embodiments hereinbelow, individual characteristics shown in relation to specific examples may in reality be interchanged with other, different characteristics, existing in other embodiments.

20 **[0014]** Moreover, it should be noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

25 **[0015]** With reference to the figures, the reference numeral 1 designates a fast roll-up door constituted basically by two vertical posts 2a, 2b, self-supporting or otherwise, and by a horizontal beam 3, containing a take-up roller (not shown) to which a gear motor is connected for its movement (not shown).

30 **[0016]** The closing element of the door is implemented with a curtain 4, usually constituted by a polyester fabric spread on both sides with PVC that is wound around the roller and slides laterally within special guides 5 fixed to the posts 2a, 2b.

35 **[0017]** A plurality of teeth 6, which are identical and mutually equidistant with a selected spacing, protrudes laterally to the curtain 4.

**[0018]** In the particular embodiment these teeth 6 are obtained by injection moulding on a ribbon 7, preferably made of textile material.

40 **[0019]** For moulding the teeth 6, advantageously the technology used to obtain zip fasteners can be utilized.

**[0020]** The ribbon 7 is connected preferably at both the vertical sides of the curtain 4, preferably by means of welding or stitching.

45 **[0021]** The teeth 6 are arranged laterally to and outside the ribbon 7, and all are arranged in parallel with each other and can be accommodated at an adapted seat 8 provided axially at each guide 5.

50 **[0022]** The shape of the teeth 6 and of the seat 8 are such that the teeth can slide freely and axially inside the guide 5, and it is also possible for them to exit temporarily and transversely from the guide 5 when for example a force that exceeds preset values, due substantially to accidental impacts that are made to bear on the curtain 4 for example by personnel or by a trolley or by a vehicle, is applied on the curtain 4.

55 **[0023]** Thus the teeth 6 are provided, at the ends, with curved shapes adapted to allow their temporary extrac-

tion and their subsequent reinsertion into the guide 5, the reinsertion occurring by way of known means arranged at or in proximity to the upper end of the guides 5.

**[0024]** The shape of the teeth 6 and of the guides 5 is in any case such as to keep, during the normal use of the door, the teeth 6 inside the seat 8 and thus inside the guides 5, this condition being maintained for preset values of forces that are applied on the curtain 4 such as, for example, a pressure exerted by the wind.

**[0025]** This shape must also allow the teeth 6 to exit transversely to the guide 5 when the thrust on the curtain 4 exceeds preset values, in order to prevent the curtain from being subjected to permanent damage for example in the event of accidental impacts thereon.

**[0026]** The reference numeral 9 generally designates the device for detecting the speed of the curtain, this device exploiting the shape of the teeth 6 provided on the lateral edge of the curtain 4 due to the fact that the teeth provide a sequence of solids and spaces at a constant spacing.

**[0027]** In the particular embodiment, the device 9 comprises optoelectronic means 10 adapted to count the sequence, over time, of the solids and spaces formed by the teeth during the vertical movement of the curtain 4, these optoelectronic means thus being capable of detecting the instantaneous speed of the curtain.

**[0028]** By establishing beforehand the speed values of the curtain which are associated with its normal operation, any anomalies with respect to that operation can be determined so that the device can generate determined actions, as will be specified below.

**[0029]** Thus, the optoelectronic means 10 comprise a pulsed infrared emitter 11 and a photodiode 12 which are arranged on the same outer side wall 41a of the guide, at a suitable distance between them.

**[0030]** On the other side, on the outer side wall 41b of the guide 5, a first light guide 13 is provided, which is transparent to infrared and based on the principle of total internal reflection.

**[0031]** The positioning of the emitter 11, of the photodiode 12, and of the first light guide 13 is such that the passage of the teeth 6 and of the associated empty spaces that divide them will cause periodic interruptions in the path of the infrared light from the emitter to the receiver constituted by the photodiode 12.

**[0032]** The outgoing signal 14 from the photodiode 12 is sent to an electronic processing means 15 which will perform at least one measurement of the speed of the curtain 4.

**[0033]** The electronic processing means 15 is comprised of a power supply circuit 16 that supplies the necessary voltages for the operation of the various components that make up the system, an adjustment assembly 17 that makes it possible to modify the sensitivity to the obstacle, a circuit 18 adapted to boost and process the signal 14 coming from the optoelectronic means 10, and a digital microcontroller 19 adapted to perform the calculation of the speed of the curtain 4 and to detect the

effects on speed produced by an obstacle.

**[0034]** Lastly, the electronic processing means 15 comprises an output device 20 that opens its contact when an obstacle is detected or in the event of anomalies in operation.

**[0035]** The electronic processing means 15 is connected to a control unit 21 of the door 1 by means of a series of interface signals 22.

**[0036]** Figure 5 shows a preferential scheme for the optoelectronic means 10 for detecting the passage of the teeth 6. The emitter 11 of infrared light is inserted within an adapted first blackout bushing 23 which is interlocked at an adapted circular seat 24 provided axially with a first biconvex lens 25 provided at the wall of a container 26, which is made of plastic material and transparent to infrared light, associated with the side wall of the guide 5.

**[0037]** The emitter 11 produces a pulsed infrared light beam which is concentrated by the first biconvex lens 25 toward a second, transparent light guide 27 inserted at an adapted first hole 40a provided on the outer side wall 41a of the guide 5.

**[0038]** The infrared light beam exiting from the second light guide 27 passes through the space constituted by the seat 8 for the teeth 6 and is thus periodically interrupted by the passage of the teeth 6 during the vertical movement of the curtain 4.

**[0039]** The light beam thus arrives at the first light guide 13 which is C-shaped and comprised of three straight sections adapted to form the three sides of a rectangle and associated at the two ends at adapted second and third holes 40b, 40c, provided on the other side wall 41b of the guide 5. One of these ends is arranged in axial alignment with the second light guide 27 and the other in axial alignment with a third light guide 28 which is arranged in front of the photodiode 12 at an adapted fourth hole 40d provided on the outer side wall 41a of the guide 5.

**[0040]** The light beam thus passes twice through the seat 8 where the teeth 6 slide.

**[0041]** Here also, the photodiode 12 is positioned at a second bushing 29 positioned at an adapted circular seat 30 directed toward the container 26, a second biconvex lens 31 being provided within it.

**[0042]** The photodiode 12 will generate a pulsed current as output during the moment when the infrared light beam passes through an empty space between two teeth 6 of the curtain 4, and a zero current during the moments when the infrared light beam is interrupted by the presence of one of the teeth 6.

**[0043]** Thus the operation ensures that, thanks to the presence of a sequence of teeth at a constant spacing on the lateral edge of the curtain, the device, which can be positioned indifferently on one side only or on both sides of the door, detects the speed of the curtain and manages it, by means of specific software, so as to cause the reopening, in the event of abrupt slowdowns, for example associated with the impact of the lower edge of the curtain on an obstacle or more generally with a sud-

den interruption of the movement of the curtain, due for example to gusts of wind.

[0044] The device is in fact capable of identifying the position of the curtain and thus of managing different speeds as a function of the position of the curtain.

[0045] In practice it has been found that the invention fully achieves the above-mentioned aim and objects since it makes it possible to identify abrupt slowdowns in the closing step of the curtain, due for example to impacts of the lower edge on an obstacle, and to consequently cause a reopening/stopping manoeuvre of the curtain.

[0046] Moreover the invention makes it possible to utilize a curtain without rigid elements which could be subjected to permanent deformations/breakages.

[0047] The invention also makes it possible to achieve the reopening by impact on the lower edge of the curtain in the absence of one or more sensitive elements arranged on a rigid lower edge of the curtain.

[0048] Obviously the materials used as well as the dimensions constituting the individual components of the invention can be more pertinent to specific requirements.

[0049] The various means for effecting certain different functions shall not in any way coexist only in the illustrated embodiment, but may be present per se in many embodiments, even if they are not illustrated.

[0050] The characteristics indicated as advantageous, advisable or similar may also be lacking or be substituted by equivalent characteristics.

[0051] The disclosures in Italian Patent Application No. TV2010A000135 from which this application claims priority are incorporated herein by reference.

[0052] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

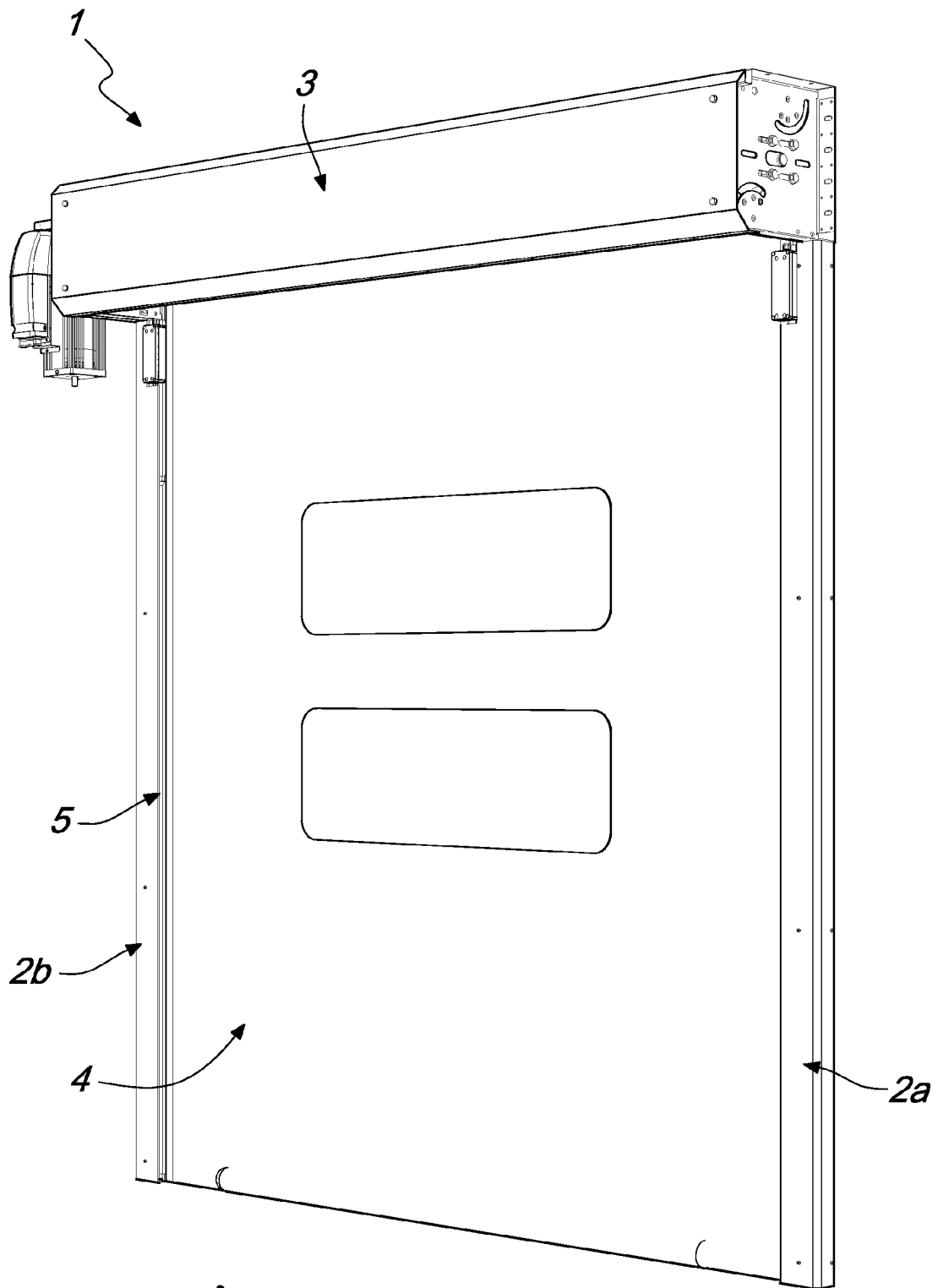
## Claims

1. A device (9) for detecting the speed of the curtain, which can slide in a vertical direction within a guide of a fast roll-up door, **characterized in that** a plurality of mutually equidistant teeth (6) protrude transversely and laterally to a curtain (4), said device comprising means (10) adapted to detect, during the motion of said curtain, the time sequence of said teeth (6) and to control the movement of said curtain (4).
2. The device according to claim 1, **characterized in that** said plurality of teeth slides freely and axially within said guide during normal use, said plurality of teeth being allowed to exit temporarily and transversely from said guide when a force that exceeds preset values, due substantially to accidental impacts on said curtain, is applied on said curtain.

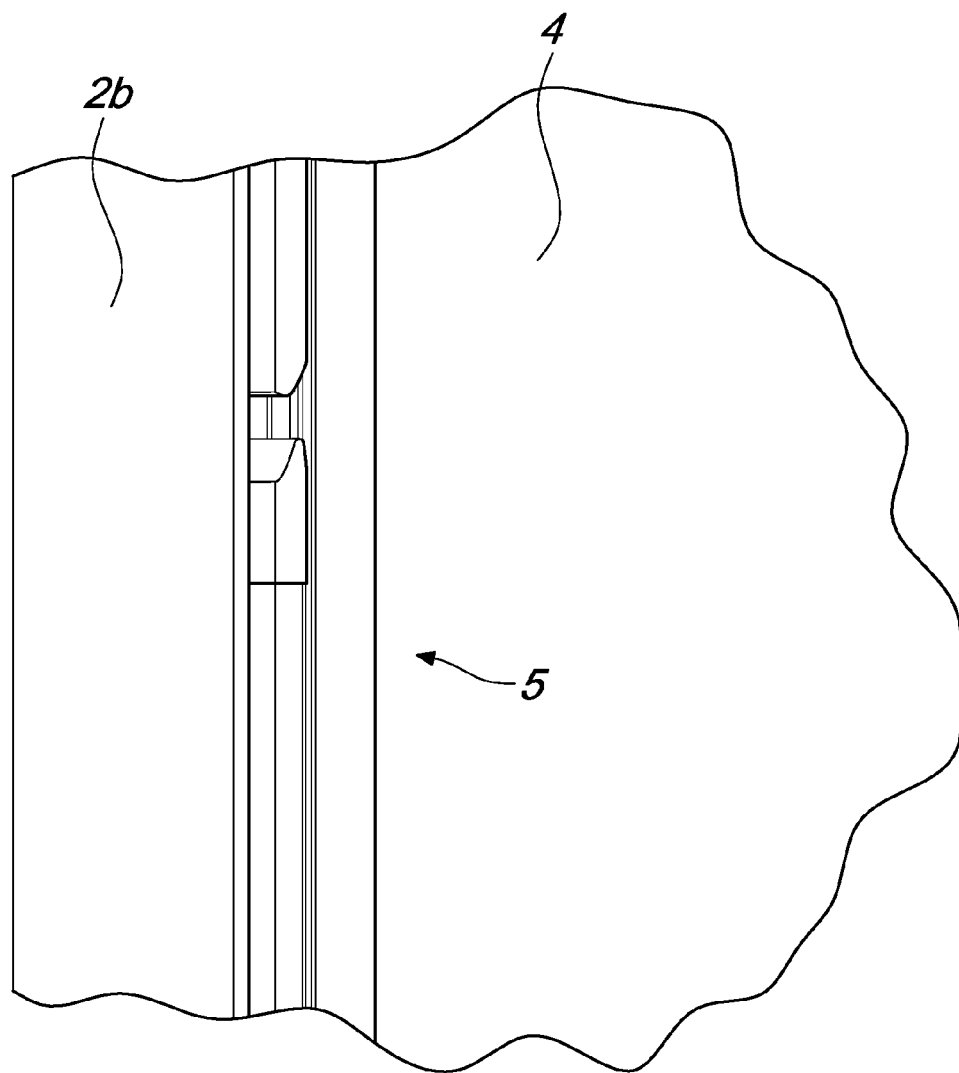
3. The device according to claims 1 and 2, **characterized in that** said plurality of teeth (6) are obtained by injection molding on a ribbon (7) which is associated to one or both of the vertical sides of said curtain (4).
4. The device according to claims 1 and 3, **characterized in that** said teeth (6) have, at their ends, curved shapes which are adapted to allow their temporary extraction and their subsequent reinsertion in said guide (5), said reinsertion occurring by means which are arranged at or proximate to the upper end of said guides (5), the shape of said teeth (6) and of said guides (6) being such as to keep, during normal use of the door, said teeth (6) within said seat (8) and within said guides (5), this condition being maintained for preset values of forces that are exerted on said curtain (4) and at the same time being adapted to allow said teeth (6) also to exit transversely to said guide (5) when the thrust on said curtain (4) exceeds preset values.
5. The device according to one or more of the preceding claims, **characterized in that** said means (10) adapted to detect the time sequence of said teeth and to control the movement of said curtain comprises an optoelectronic means (10) which is adapted to count the sequence over time of the fills and voids defined by said teeth (6) during the vertical movement of said curtain (4) and to determine/control, once the speed values of said curtain that can be associated with its normal operation have been established beforehand, any anomalies with respect to said operation and to generate specific actions aimed at modifying the movement of said curtain.
6. The device according to claim 5, **characterized in that** said optoelectronic means (10) comprises a pulsed infrared emitter (11) and a photodiode (12), which are arranged at the same outer side wall (41a) of at least one of said guides (5), at a mutual distance.
7. The device according to claim 6, **characterized in that** on the opposite side, on the outer side wall (41b) of said guide (5), a first light guide (13) is associated which is transparent to infrared and is based on the principle of total internal reflection so as to redirect the beam of light from said emitter (11) to said photodiode (12).
8. The device according to one or more of the preceding claims, **characterized in that** the signal (14) that exits from said photodiode (12) is sent to an electronic processing means (15), which performs at least one measurement of the speed of said curtain (4), said electronic processing means (15) being composed of a power supply circuit (16), which delivers the voltages required for the operation of the

various components that form the system, an adjustment assembly (17), which makes it possible to modify the sensitivity to the obstacle, a circuit (18), which is adapted to boost and process the signal (14) that arrives from the optoelectronic means (10), a digital microcontroller (19), which is adapted to calculate the speed of said curtain (4) and to detect the effects on speed caused by an obstacle, and an output device (20), which opens its contact when an obstacle is detected or in the event of anomalies in operation, said electronic processing means (15) being connected to a control unit (21) of said door (1) by means of a series of interface signals (22).

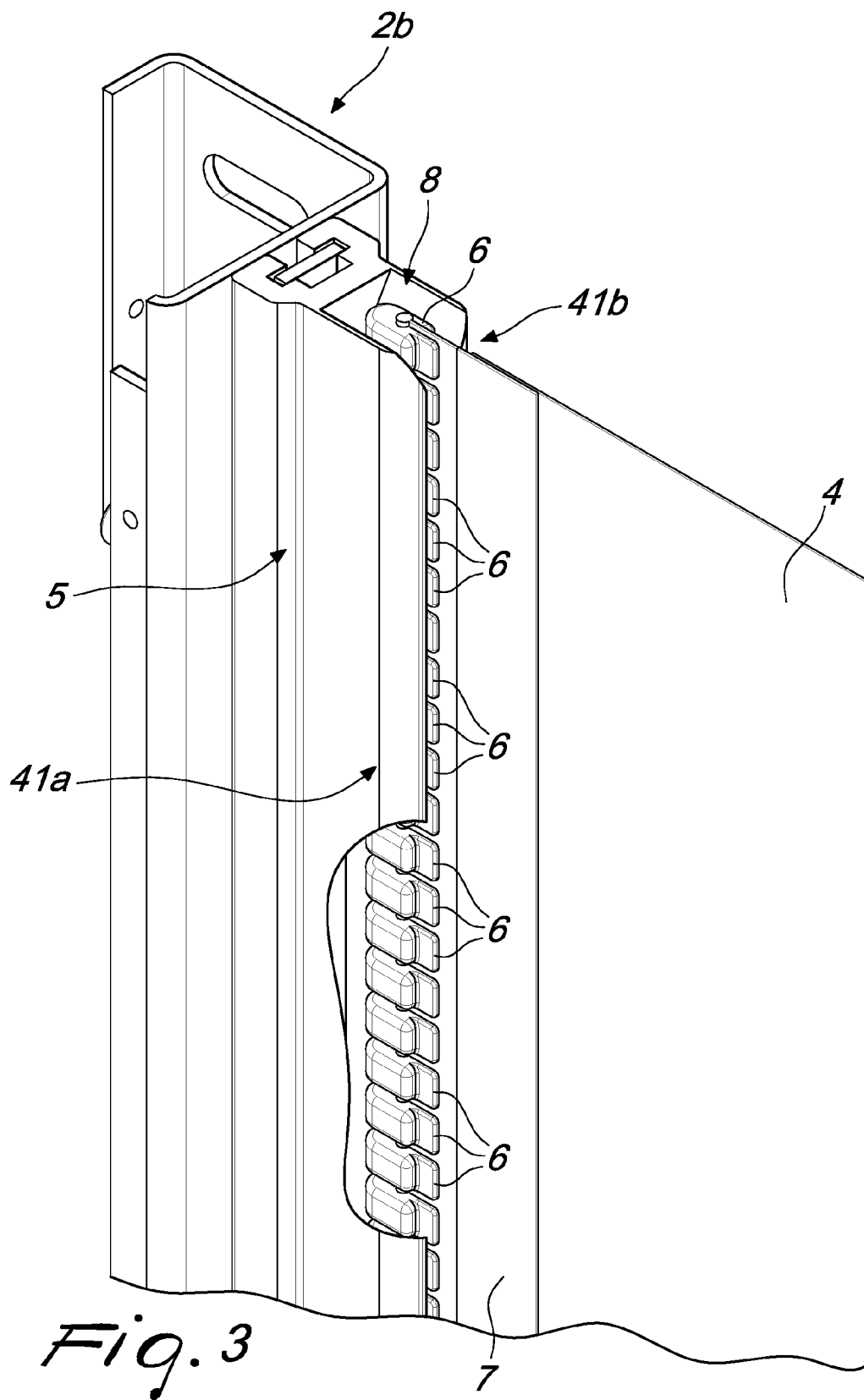
9. The device according to one or more of the preceding claims, **characterized in that** said emitter (11) of infrared light and said photodiode (12) are inserted within first and second blackout bushing (23, 29) which are interlocked at an adapted circular seat (24, 30), said bushings being provided respectively and axially with a first biconvex lens and a second biconvex lens (25, 31), which are provided at the wall of a container (26), made of a plastic material that is transparent to infrared light, associated with a side wall of said guide (5).
10. The device according to claims 1 and 9, **characterized in that** said emitter (11) generates a pulsed infrared light beam, which is concentrated by said first biconvex lens (25) toward a second transparent light guide (27), which is inserted at an adapted first hole (40a) provided on the outer side wall (41a) of said guide (5), said infrared light beam that exits from said second light guide (27) passing through the space constituted by said seat (8) for said teeth (6) and being interrupted periodically by the passage of said teeth (6) during the vertical motion of said curtain (4), said beam of light subsequently reaching said first light guide (13), which is C-shaped and composed of three straight sections adapted to form the three sides of a rectangle, and is associated at the two ends at adapted second and third holes (40b, 40c) provided in the other side wall (41b) of said guide (5), said ends being arranged respectively in axial alignment with said second light guide (27) and in axial alignment with a third light guide (28), which is arranged in front of said photodiode (12) at an adapted fourth hole (40d) provided in the outer side wall (41a) of said guide (5).



*Fig. 1*



*Fig. 2*



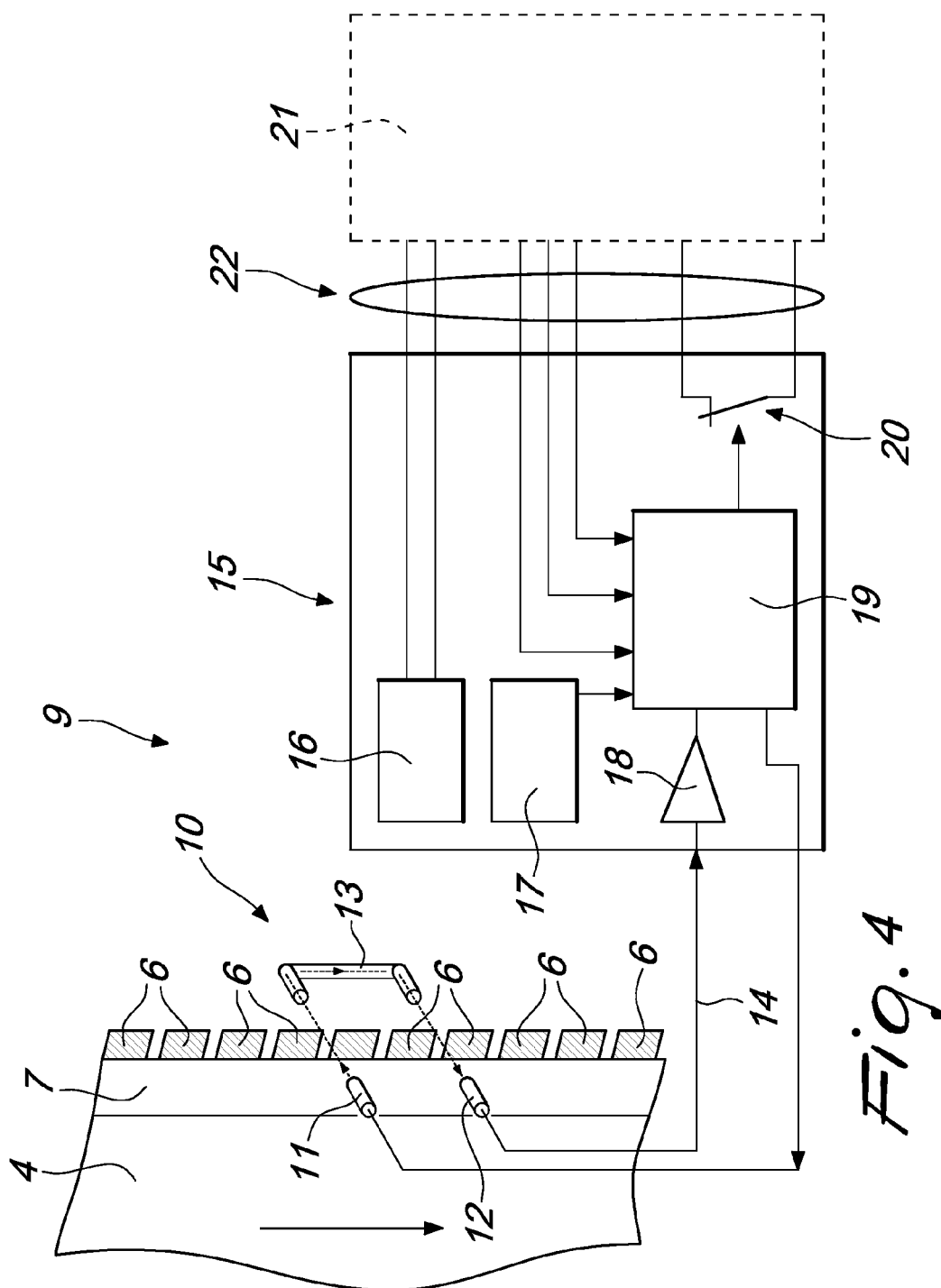


Fig. 4

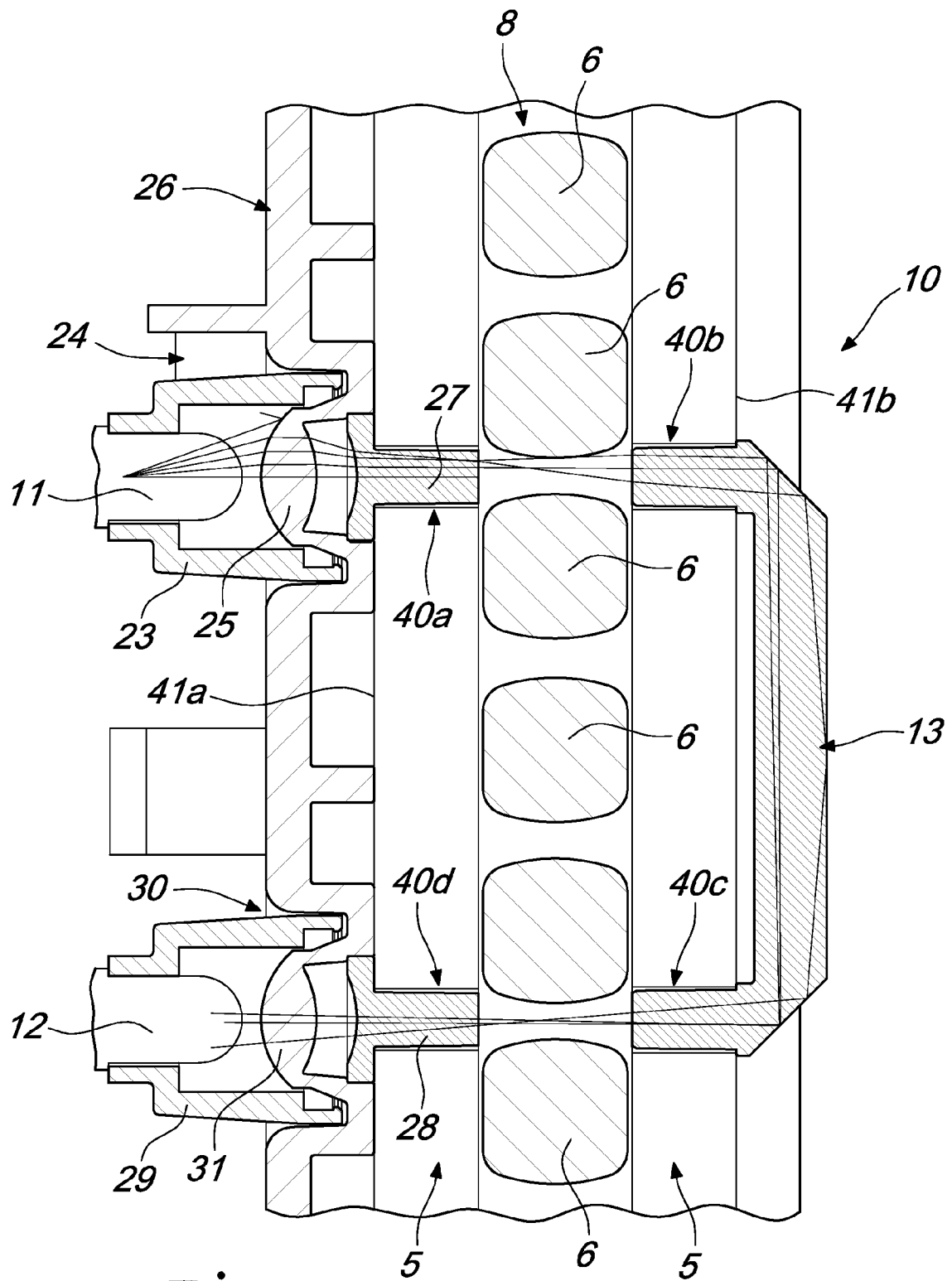


Fig. 5



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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |                                                     |                                                      |
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| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                                                                              | Relevant to claim                                   | CLASSIFICATION OF THE APPLICATION (IPC)              |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                            |                                                     | E06B                                                 |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                     |                                                      |
| Place of search<br>The Hague                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                            | Date of completion of the search<br>20 January 2012 | Examiner<br>Cornu, Olivier                           |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                                                                                                                                            |                                                     |                                                      |

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