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(72) Inventor: **Van de Graaf, Peter**
5975 NS Sevenum (NL)

(74) Representative: **Baeten, Ernest et al**
Algemeen Octrooi- en Merkenbureau
P.O. Box 645
5600 AP Eindhoven (NL)

(71) Applicant: **Bergimex B.V.**
5657 EA Eindhoven (NL)

(54) **Insect repellent closing device**

(57) The present invention relates to an insect repellent closing device for a doorway, comprising at least one door element essentially made of a mesh-like material, which, in use, is pivotally mounted in a doorway defined

by a door frame, wherein a drive mechanism is provided for swinging said at least one door element open, as well as an electronic control unit for controlling the electrical drive mechanism.

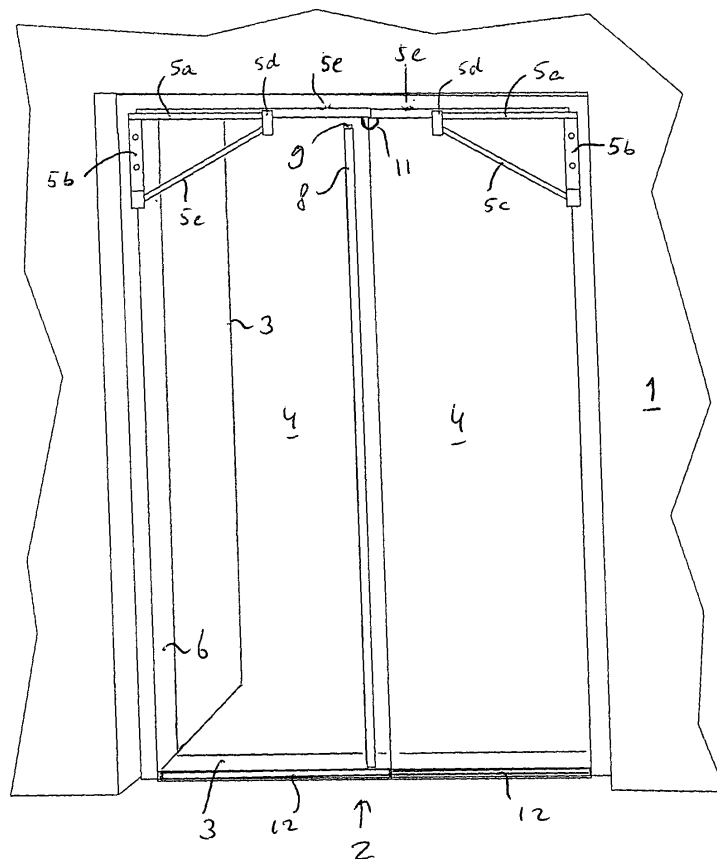


Fig 1

Description

[0001] The present invention relates to an insect repellent closing device for a doorway, comprising at least one door element essentially made of a mesh-like material, which, in use, is pivotally mounted in a doorway defined by a door frame.

[0002] A known screen door is installed in the door frame of an exterior door of a house, for example during the summer, which opens to a garden. The screen door, which hangs in the doorway as a second door, makes it possible to open the exterior door, which is permanently mounted to the door frame, so as to let fresh air into the house, whilst the screen door is closed so as to keep out unwanted insects.

[0003] A drawback of the known screen door is that although it allows an air flow through a doorway closed by the screen door, it interferes with the free passage of persons therethrough. Because the known screen door frequently separates people present outside the house from a stock of food and/or beverages which are preferably stored inside the house, out of reach of insects, possibly in a refrigerator, persons frequently pass through the doorway that is closed by the screen door, and that in many cases while the person in question has his or her hands full with food, beverages, tableware or the like.

[0004] Accordingly it is an object of the present invention to provide an insect repellent closing device as referred to in the introduction which does not interfere with the passage of persons or which at least constitutes less of an obstacle to a person passing through the doorway than does the known screen door. This object is accomplished by the present invention in that a drive mechanism is provided for swinging said at least one door element open, as well as an electronic control unit for controlling the electrical drive mechanism. This enables a person who approaches the doorway to activate the control unit so as to open said at least one door element. Thus, a person passing the doorway need not push or, even more objectionable, pull said at least one door element open himself or herself, so that the object of the present invention is accomplished. Furthermore, a control unit for the drive mechanism may be provided at a location remote from the doorway, so that a door will already be open when the person in question reaches the doorway. Although the drive mechanism is preferably an electrical drive mechanism, it is also possible to use another type of drive mechanism, for example a pneumatic drive mechanism.

[0005] The known, manually operated screen door has been known for decades. Accordingly, many alternatives to the known screen door have been conceived, the object being to make it easier to pass the doorway. Said alternatives comprise flexible strips of plastic material or screen mesh lamellae hanging side by side, partially overlapping each other, strings of beads and slide doors that open when someone pushes against the door, etc. The first group has the drawback that they do not reliably

close the door against insects in the closed position. Sliding doors still need to be manually operated and require the person to stand still in front of the door.

[0006] In a preferred embodiment of the present invention, a sensor arranged for detecting a person approaching said at least one door element is provided, which sensor transmits an appropriate signal to the drive mechanism when such a detection is made. The effect accomplished by the sensor is that a person who is approaching the door opening need not carry out an additional operation to activate the control mechanism for opening said at least one door element. Upon receipt of the signal of the sensor, the control mechanism activates the drive mechanism for automatically opening said at least one door element when a person is approaching. An advantage of a device according to the present invention is that one sensor will suffice for both directions of approach of the doorway. This is possible because, depending on the type of sensor that is used, the sensor, when used in combination with a mesh-like material, is capable of detecting through said mesh-like material that a person is approaching the doorway from the side of said at least one door element that is located opposite the sensor.

[0007] The operation of the sensor and the control mechanism of the drive mechanism may for example be realised by means of an infrared heat sensor, which detects whether the heat image in the sensor field changes sufficiently to assume that a person or a fairly large object is approaching the screen door. The sensor will then send a signal to the drive mechanism. A motion sensor or a presence sensor, among other sensors, may furthermore be suitably used as sensors for the device.

[0008] Preferably, the sensor is deactivated, or the control unit is at least prevented from activating the drive mechanism in response to a signal from the sensor when said at least one door element is moving towards the position in which it closes the doorway. In this way the drive mechanism is prevented from being activated, for example if a motion sensor is used, in response to the closing movement of said at least one door element.

[0009] Preferably, said at least one door element moves to the position in which it closes the doorway after the sensor has not made a detection for a predetermined period of time. Said closing can take place in that the drive mechanism no longer exerts a force on said at least one door element and a mechanical force of opposite sense acts on said at least one door element. Such a force may be provided by a spring or by a weight, or in another manner which is known per se. Alternatively, the drive mechanism may be arranged for driving said at least one door element to the position in which it closes the doorway.

[0010] In a preferred embodiment said at least one door element comprises a spring door mechanism. In the past this type of mechanism has proven to be a reliably functioning mechanism for such applications, and it can easily be driven by an electrical drive mechanism.

[0011] To provide an adequately functioning closing

mechanism, which is relatively easy to drive, it is preferable if two door elements are provided, the respective pivot axes of which extend at least substantially parallel to each other, whilst in use the edges of the door elements remote from the pivot axes in question pivot towards each other upon closing and away from each other upon opening.

[0012] It is preferable in that regard if the two edges remote from the respective pivot axes at least partially overlap in the closed position of the closing device. This reduces the risk of the door elements swinging past each other or of a gap somehow forming between the two door elements, as a result of which undesirable vermin might pass the doorway yet.

[0013] To avoid the risk of the two door elements coming into contact with each other with their end face edges, i.e. the edges remote from the pivot axes, and obstructing each other's closing movement, it is preferable if the two door elements are driven in such a manner by the drive mechanism that they swing to one after the other. Thus, one door element can swing to first, the second door element will swing to a fraction of a second to a few seconds later. In that case the pivoting movement of the first door element need not be completed before the pivoting movement of the second door element is started. Important is that the edges of the door elements only meet in the completely closed position of the two door elements. Also the pivoting movement to the open position can take place with a certain delay in a comparable manner, in which case it is desirable that the door element to be opened first be removed sufficiently far from the door element to be subsequently opened to prevent the two door elements from colliding.

[0014] If said at least one door element is provided with a magnetic material at or at least near the edge remote from the pivot axis, an adequate closure of said edge can be realised with an edge cooperating therewith, which is provided with a metal. Depending on whether a 1-door device or a 2-door device is used, said other edge may be a door post or an edge of a second door element. Said metal and said magnetic material may also be provided in a mechanically reversed arrangement, of course. A proper closure of the edge(s) prevents insects from passing the closed doorway through an open seam yet. To prevent oxidation of the magnetic material, the magnetic material may be electroplated.

[0015] The magnetic material preferably comprises at least one magnetic strip. By means of said magnetic strip, a substantially continuous closure of any seam that may exist can be realised.

[0016] In order to realise an adequate closure near the bottom edge of the door element as well, for example by means of a threshold, it is preferable if said at least one door element is provided with a weight element at the bottom edge. Said weight element pulls the mesh material of the door element taut downwards.

[0017] In a preferred embodiment of the present invention, the weight element comprises a cavity and a filling

hole for said cavity. Thus, a relatively low weight of the weight element can be maintained during transport, whilst the weight element can be filled with water or sand, for example, through the filling hole, which may be closable, when the closing device is being installed.

[0018] The closing device may be supplied in assembled condition, but it can also quite suitably be sold as a do-it-yourself package of parts for assembling a closing device according to the invention. In particular because doorways do not have standard dimensions, a door element of mesh material can be simply cut to size so as to adapt the dimensions to fit a specific doorway. Furthermore, other parts for the closing device may be designed so that they can be placed in an orientation as desired by a user.

[0019] The present invention further relates to a doorway provided with a door which is arranged for obstructing the passage of an air flow through the doorway, at least in the closed position thereof, whilst the doorway further comprises a closing device according to the first aspect of the present invention. The closing device according to the first aspect of the present invention is generally used in a doorway in which a "regular" door is installed. Said "regular" door need not be removed for installing an insect repellent closing device that closes the doorway.

[0020] If the door element comprises a swing door, it is preferable if the door and the door element are pivotable in opposite directions relative to each other from the doorway, from a position in which the doorway is closed to a position in which the doorway is released. In this way the doors are prevented from coming into contact with each other and possibly damaging each other. Moreover, the door and the door element cannot interfere with each other's freedom of movement.

[0021] The present invention will be described in more detail below with reference to drawings of an exemplary embodiment of a closing device according to the present invention, in which:

Figure 1 is a perspective front view of a preferred embodiment of a closing device according to the present invention;

Figures 2a and 2b are top plan views of a detail of the suspension of the closing device of figure 1;

Figures 3a-3f are schematic top plan views, showing various positions of use of doors of the closing device;

Figure 4 shows parts of a do-it-yourself assembly kit for a closing device according to the present invention.

[0022] With reference now to figure 1, there is shown a wall 1 comprising a doorway 2 with a threshold 13 and an open door 3. Two screen doors 4 of insect mesh hang on posts 6 of the doorway 2 via compound pivot arms 5, which are driven by a motor 7 accommodated in a vertical part of each of the arms. One screen door 4 is provided

with a magnetic strip 8, the other screen door is provided with a 2 mm wide aluminium strip 9. The screen doors are hinged to the door posts 6. Both screen doors 4 are provided with a weight 12. A motion sensor 11 is disposed at the top of the doorway 2.

[0023] The suspension of a screen door is shown in more detail in figures 2a and 2b. A mounting element 14 is fixed to a door frame 6 in a corner defined by two door posts 6a, 6b. The mounting element 14 has two straight surfaces, which are oriented perpendicular to each other and which abut the two door posts 6a, 6b. A third surface is curved, so that said surface abuts the outer circumference of the cylindrical arm part 5b. The cylindrical arm part 5b can thus pivot along the curved surface of the mounting element 14. The arm 5a, which is connected to the cylindrical arm part 5b, is attached to the arm 5e, which carries the screen fabric (not shown in figures 2a and 2b), via the arm part 5d and fastening element 15. This suspension provides an adequate closure, at least in the closed position of the closing device, between the screen mesh on the one hand and the door post 6b on the other hand. When the closing device is being closed, the screen mesh nestles against the door post 6b, as it were.

[0024] Figures 3a-3f schematically show in top plan view four different positions of use of the closing device of figure 1.

[0025] The closing device according to the preferred embodiment that is shown in figures functions as follows. In figure 1, the screen doors 4 are shown in the closed position. The screen doors 4 are hinged in the doorway 2 via compound pivot arms 5. They are held together by a magnetic strip 8, which is attached to the distal edge of one screen door 4, and an aluminium strip 9, which is attached to the distal edge of the other screen door 4. The two distal edges of the screen doors 4 and the respective strips 8 and 9 overlap, so that no insects can pass between the screen doors 4. To prevent insects from passing between a lower edge of a screen door 4 and the threshold 13, weights 12 are attached to the bottom edge of the screen doors 4. Said weights 12 are hollow and have a closable filling opening (not shown), so that they can be filled with a desired mass of water or sand by the user. The weights 12 can be removed by pivoting them open and can be attached to a screen door 4 by pivoting two parts together, causing the mesh of the screen door 4 to be trapped between the two parts. In this way an adequate closure of the doorway 2 against the entry of insects is realised.

[0026] Disposed at the top of the doorway 2 is an infrared heat sensor 11, which detects a person approaching the doorway 2. Because the sensor 11 responds to heat, and heat can pass through the screen door, the sensor 11 is capable of detecting an approaching person through the screen doors 4 without the screen doors 4 interfering with the operation of the sensor 11. Upon detecting an approaching person, the sensor 11 activates the motors. Based on the situation in figure 3a, the left-

hand motor will be activated first to open the left-hand screen door 4l (the terms left-hand and right-hand are based on the orientation shown in figures 3a-3f). An initial force will have to be overcome in order to overcome the mutual magnetic attractive force of the magnetic strip 8 and the aluminium strip 9. Once the left-hand screen door 4l has swung open partially (figure 3b), the right-hand motor will be activated and the right-hand screen door 4r will swing open as well. This condition is shown in figure 3c. Eventually the two screen doors 4r and 4l will reach the position shown in figure 4d, in which the doorway 2 is fully open. The screen doors 4r, 4l will remain open until the sensor 11 registers that no persons are present within the detection range of the sensor 11. Following that, the motors are activated to close the two screen doors 4. The right-hand motor is activated first to close the right-hand screen door 4r (see figure 3e). After some time the left-hand motor is activated as well to close the left-hand screen door 4l (see figure 3f). This ensures that the screen doors 4r and 4l cannot obstruct one another while closing as a result of their distal side edges coming into contact with each other. Furthermore, this ensures a correct orientation of the magnetic strip 8 and the aluminium strip 9. This is important in particular if two magnetic strips should be used, because the magnets would repel each other in case of an incorrect orientation of the legs relative to each other, as a result of which the screen doors 4r and 4l would not close properly.

[0027] The cooperation between the sensor 11 and the control unit takes place as follows:

The infrared heat sensor 11 is mounted to an arm 5e of a screen door. When a person approaches the doorway 2, the sensor 11 will detect a heat image and determines, by comparing it with a reference value, whether the change in the heat image is sufficiently significant to assume that a person causes this image. If that is the case, a signal will be delivered to the controller. The controller will subsequently activate a rotary motor in the cylindrical arm 5b, as a result of which the arm 5 in question will pivot away from the doorway 2. Some time after the controller will activate the second motor, causing the second arm to pivot away from the doorway. The person can now freely walk through the doorway.

[0028] If the sensor does not detect a heat image corresponding to the presence of a person for a predetermined period of time, the rotary motor in the second arm will be activated in the opposite sense. After some time, the rotary motor of the other arm will be activated. Once the arms have completed their movement, the doorway is closed by the closing device.

[0029] Figure 4 shows the parts included in a package of parts according to the present invention. The package enables a do-it-yourselfer to assemble an insect repellent closing device according to the present invention that fits a specific doorway. The screen mesh 4 is relatively large

and can be cut to size as desired, so that it will properly fit the doorway in question. The weights 12 are each configured as two weight elements that can pivot towards and away from each other, which weight elements can be moved into contact with the lower edge of the screen mesh in the open position and subsequently be snapped to. As a result, the weight 12 will clamp itself down on the lower edge of the screen mesh 4. The mounting elements 14 are provided with through holes 18, via which they can be fixed to a door post. The cylindrical arm part 5b has through holes 9, which can be aligned with the holes 18 of the mounting elements 14 for joining the mounting element 14 and an arm 5 together and fixing them to a door post. The metal strip 9 can be attached to the screen mesh by means of bolts 20 having a wide head, which can be passed through holes 21, which are in turn aligned with holes 20 provided with internal screw thread, into which the bolts 20 can be screwed. The cylindrical arm parts 5b accommodate rotary motors, which are fed and controlled by means of wires 16, 17 and a plug contact 15a, 15b. The control unit is disposed in the control box 23.

[0030] Although only one exemplary embodiment of the device according to the invention is shown and described in the figures and the above description, a great many variants, which may or may not be obvious to a person skilled in the art, are possible within the scope of the invention, which is defined in the appended claims. Thus, one screen door may be provided in the doorway, for example, which screen door abuts against the door post in the closed position thereof. The door posts and the screen door may be magnetically attracted by one another, as is the case with the two screen doors of the preferred embodiment described herein. Furthermore, the screen doors need not overlap, but they may also abut against each other in the closed position, in which case a magnetic attractive force ensures that the two screen doors are properly closed. Furthermore it is possible to use different types of sensors, for example a motion sensor and/or a presence sensor. If a motion sensor is used, it may be necessary to incorporate an algorithm in the control unit, which algorithm prevents the motion sensor from transmitting a signal to the controller to open the closing device when the screen door is being closed. After all, the closing of the screen door may be interpreted as motion, so that the closing of the screen door might lead to an incorrectly adjusted mechanism sending a command to the controller to open the doors in response to said movement.

Claims

1. An insect repellent closing device for a doorway, comprising at least one door element essentially made of a mesh-like material, which, in use, is pivotally mounted in a doorway defined by a door frame, **characterised in that** a drive mechanism is provided

ed for swinging said at least one door element open, as well as an electronic control unit for controlling the electrical drive mechanism.

2. A closing device according to claim 1, **characterised in that** a sensor arranged for detecting a person approaching said at least one door element is provided, which sensor transmits an appropriate signal to the drive mechanism when such a detection is made.
3. A closing device according to claim 2, **characterised in that** the sensor is deactivated when said at least one door element is moving towards the position in which it closes the doorway.
4. A closing device according to one or more of the preceding claims, **characterised in that** said at least one door element moves to the position in which it closes the doorway after the sensor has not made a detection for a predetermined period of time.
5. A closing device according to one or more of the preceding claims, **characterised in that** said at least one door element comprises a spring door mechanism.
6. A closing device according to one or more of the preceding claims, **characterised in that** two door elements are provided, the respective pivot axes of which extend at least substantially parallel to each other, whilst the edges of the door elements remote from the pivot axes in question pivot towards each other upon closing and away from each other upon opening.
7. A closing device according to claim 6, **characterised in that** the two edges remote from the respective pivot axes at least partially overlap in the closed position of the closing device.
8. A closing device according to claim 7, **characterised in that** the two door elements are driven in such a manner by the drive mechanism that they swing to one after the other.
9. A closing device according to one or more of the preceding claims, **characterised in that** said at least one door element is provided with a magnetic material at or at least near the edge remote from the pivot axis.
10. A closing device according to one or more of the preceding claims, **characterised in that** said magnetic material comprises at least one magnetic strip.
11. A closing device according to one or more of the preceding claims, **characterised in that** said at least one door element is provided with a weight el-

ement at the bottom edge.

12. A closing device according to claim 11, **characterised in that** the weight element comprises a cavity and a filling hole for said cavity. 5
13. A package of parts for assembling a closing device according to any one of the preceding claims.
14. A doorway provided with a door arranged for blocking an air flow through the doorway, at least in the closed condition of the door, **characterised in that** the doorway moreover comprises a closing device according to one or more of claims 1-13. 10 15
15. A doorway according to claim 14, **characterised in that** the door element comprises, a swing door and that the door and the door element can be pivoted in opposite directions relative to each other from the doorway, from a position in which the doorway is closed to a position in which the doorway is released. 20

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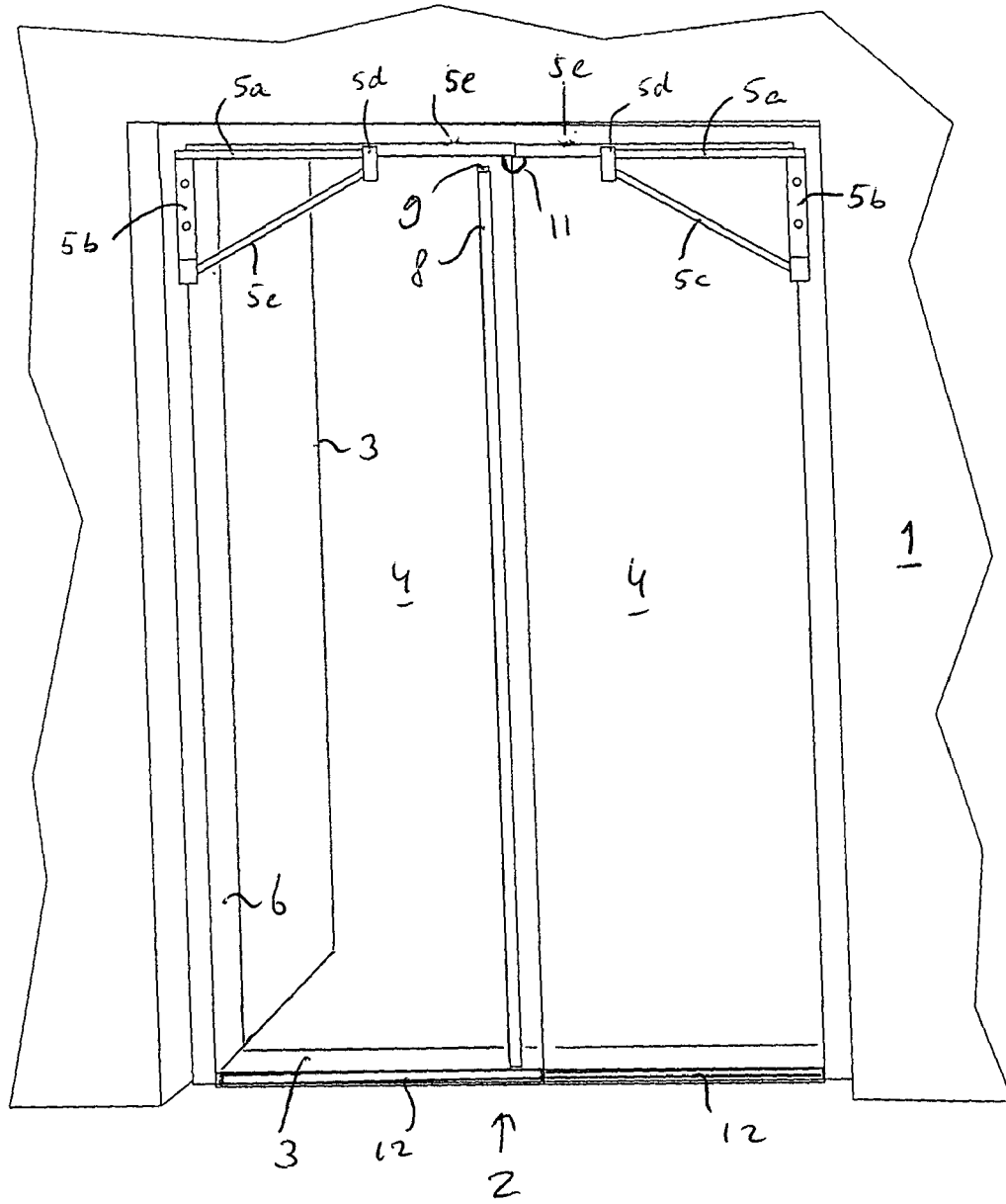


Fig 1

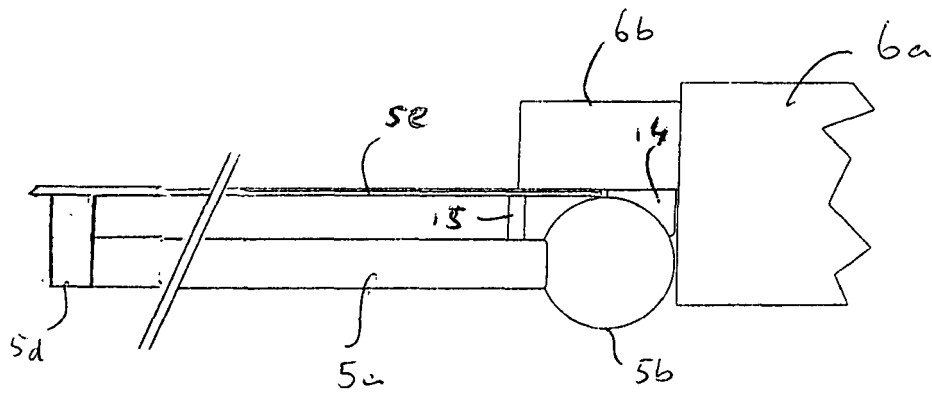


Fig. 2a

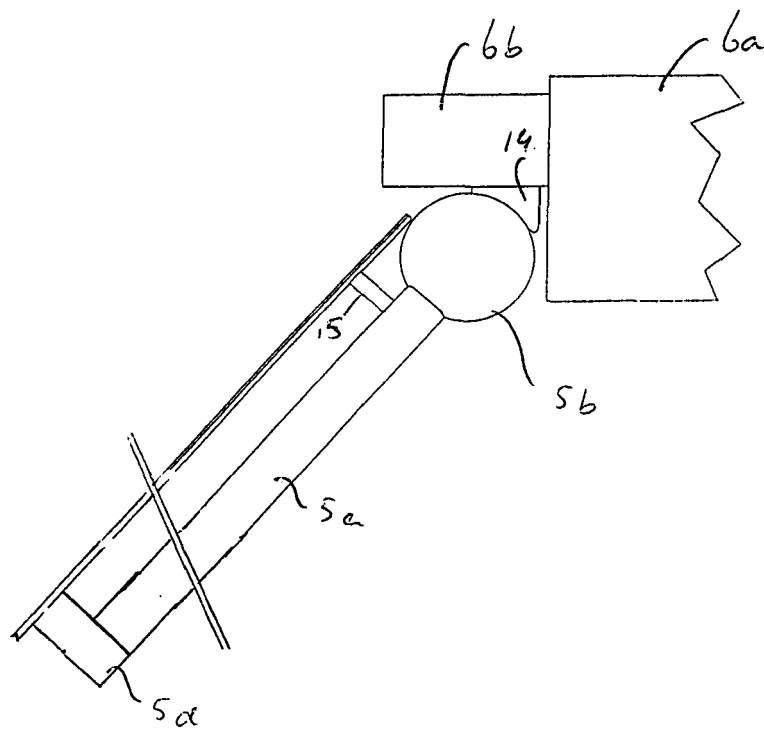


Fig. 2b

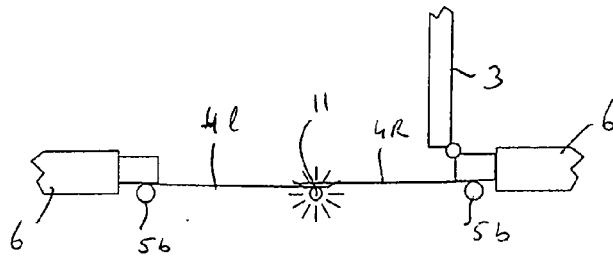


Fig. 3a

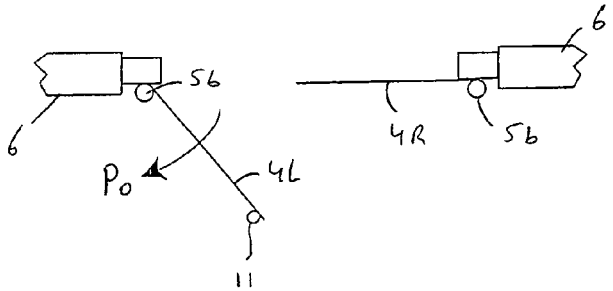


Fig. 3b

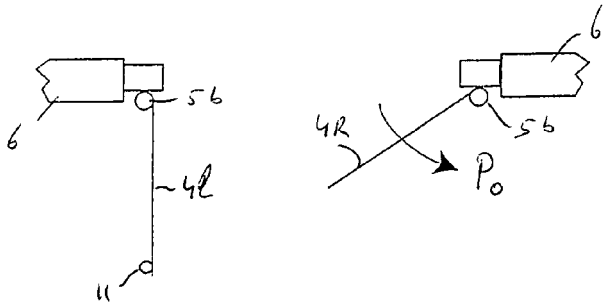


Fig. 3c

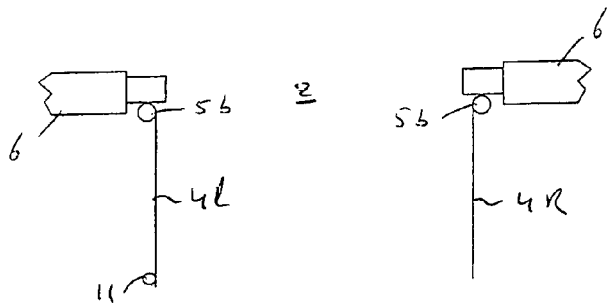


Fig. 3d

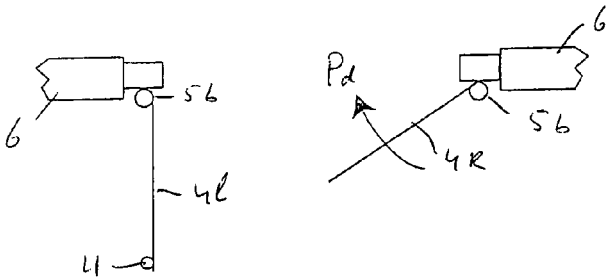


Fig. 3e

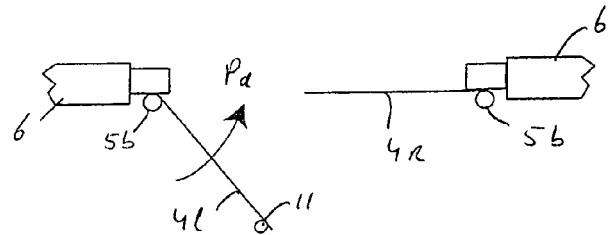


Fig. 3f.

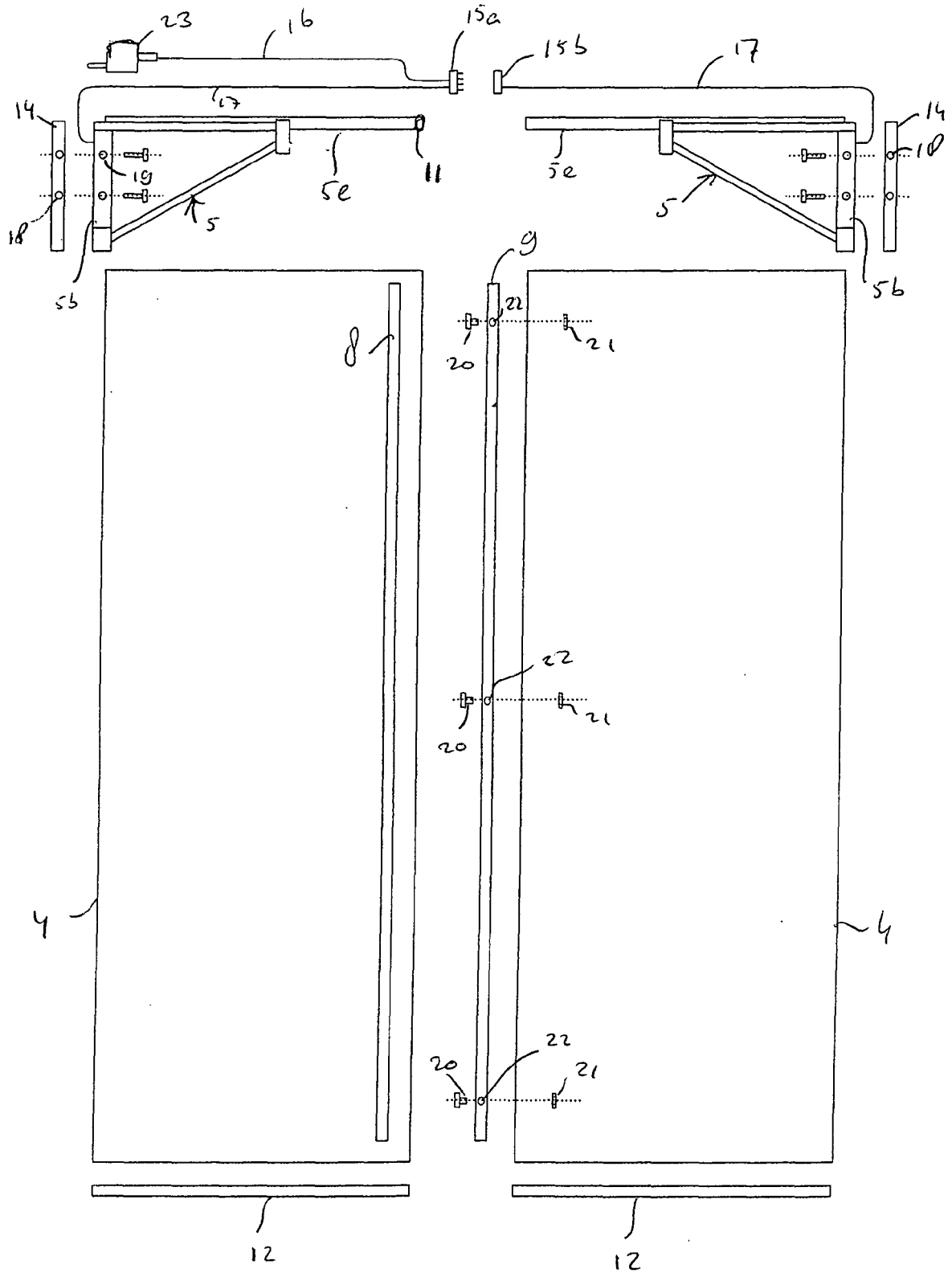


Fig 4

**PARTIAL EUROPEAN SEARCH REPORT**

Application Number

which under Rule 63 of the European Patent Convention EP 09 00 1589 shall be considered, for the purposes of subsequent proceedings, as the European search report

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 6 131 639 A (MCMILLEN LINDA R [US] ET AL) 17 October 2000 (2000-10-17) * the whole document *	1-12, 14-15	INV. E06B9/52 E05F15/12 E05F15/20
Y	US 2003/167693 A1 (MAININI CHRISTOPHER E [US]) 11 September 2003 (2003-09-11) * the whole document *	1-12, 14-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E06B E05F
INCOMPLETE SEARCH			
<p>The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.</p> <p>Claims searched completely :</p> <p>Claims searched incompletely :</p> <p>Claims not searched :</p> <p>Reason for the limitation of the search:</p> <p>see sheet C</p>			
Place of search		Date of completion of the search	Examiner
The Hague		6 July 2009	Geivaerts, Dirk
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03.82 (P04E07)



**INCOMPLETE SEARCH
SHEET C**

Application Number

EP 09 00 1589

Claim(s) completely searchable:
1-12, 14-15

Claim(s) not searched:
13

Reason for the limitation of the search:

The scope of claim 13 does not contain technical features, as such claim 13 is indefinite in scope.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 00 1589

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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06-07-2009

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6131639	A	17-10-2000	NONE	

US 2003167693	A1	11-09-2003	NONE	

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