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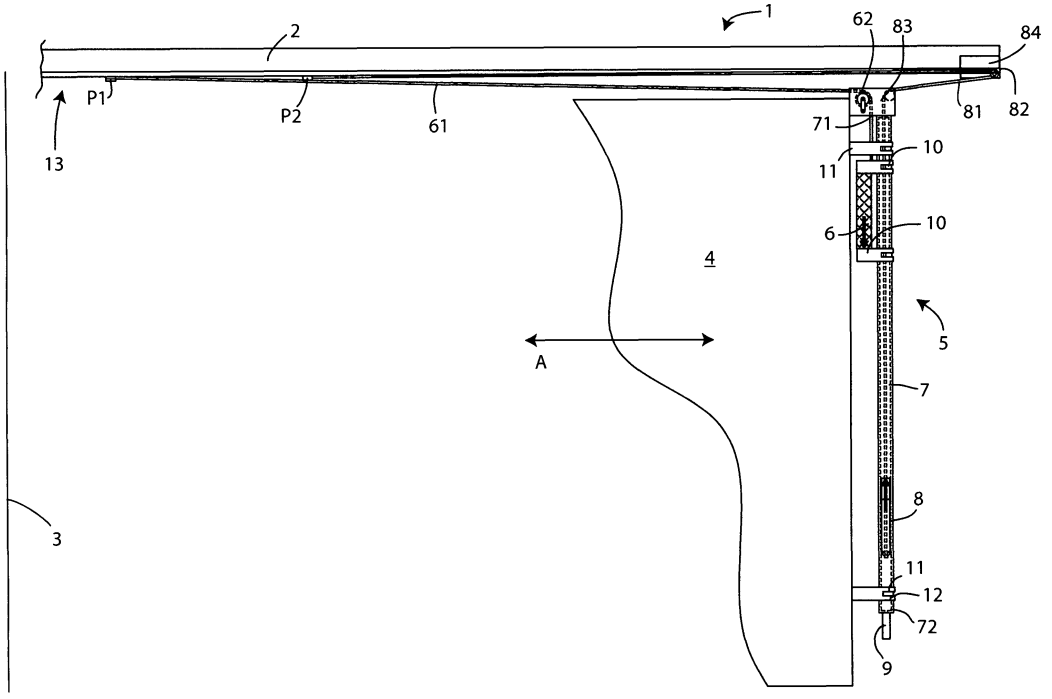
(54) Device for closing and dampening movement of a sliding door and relevant method of installation of the same

(57) The present invention relates to a device (5) for closing and dampening a sliding door (1), said sliding door (1) comprising a traverse (2), an abutment upright (3) and at least a wing (4) having a front lateral edge and a rear lateral edge, said wing (4) being slidingly coupled with said traverse (2) and having an opening position and a closure position, in correspondence of which said front lateral edge is close to said abutment upright (3), said closure and dampening device (5) being **characterized in that** it comprises wing (4) closure means (6, 61, 62), interacting with said wing (4) so has to exert a force suitable to make it passing from said opening position to said closure position; and means for dampening the closure stroke of said wing (4).

The present invention also relates to a method of installation of said device (5) and to a kit of a device (5) for closing and dampening.



EP 2 189 603 A1

Description

[0001] The present invention relates to a device for closing and dampening movement of a sliding door and relevant method of installation of same.

[0002] More specifically, the invention concerns a device for closure and dampening a door of the above kind, particularly studied and realised in order to ensure closure without shots, regardless the position it is.

[0003] As it is well known, sliding doors are widely diffuse, particularly disappearing sliding doors, mainly comprised of a wing, a counterframe and sliding means.

[0004] Typically, counterframe comprises a box, replacing a portion of the wall on which said sliding door is installed and within which the wing can be introduced when it is open. Said box also comprises a sliding traverse, and an upright for abutment of said wing.

[0005] Sliding means are suitable to guide door wing from an open position, wherein said wing is fully or partially inserted within said box, and a closed position, wherein said wing is withdrawn from inside the box, thus closing the passage of said door.

[0006] The above mentioned sliding means are usually comprised of carriages, sliding coupled with an upper track fixed to said sliding traverse, and possibly a further lower guide track, suitable to permit a guided movement of the wing.

[0007] Recently, the need arose of providing sliding doors with systems or devices dampening their motion, thus preventing that door wing when closing can hit against the abutment upright, causing a tiresome noise.

[0008] Solutions are already available on the market aiming solving these problems, but they have some drawbacks.

[0009] One known solution provides a device comprising a return spring, the first end of which is coupled to a fixed point, while the second end is coupled to the sliding wing, and also comprising a braking device having a toothed wheel operating by friction.

[0010] Said solution has different operation problems.

[0011] In fact, if spring is not properly calibrated, it can happen that wing does not abuts against the upright, thus remaining slightly open.

[0012] Moreover, it is well known that said springs are subjected to wearing and must be replaced after a set time period.

[0013] Adjustment of this kind of devices is difficult. In fact, it is necessary providing springs having different return forces for different wings, on the basis of weight, material (e.g. wood or glass) and size.

[0014] Instead, braking device is strongly worn and must be frequently replaced. Furthermore, in case of an additional strong pushing action, said braking device does not ensure wing braking.

[0015] In view of the above, it is subject matter of the present invention, that of suggesting a closure device for sliding door wings able to slow down the run, so as to accompany door wing up to its closure, regardless the opening position (i.e. complete or partial) of the door wing.

[0016] It is also an object of the present invention that of providing a device for closing and dampening which is compact and that can be retrofitted on existing doors not provided with this kind of device.

[0017] It is further object of the present invention that of providing a device for closing and dampening that can be provided on counterframes.

[0018] It is therefore specific object of the present invention a device for closing and dampening a sliding door, said sliding door comprising a traverse, an abutment upright and at least a wing having a front lateral edge and a rear lateral edge, said wing being slidingly coupled with said traverse and having an opening position and a closure position, in correspondence of which said front lateral edge is close to said abutment upright, said closure and dampening device being **characterized in that** it comprises wing closure means, interacting with said wing so has to exert a force suitable to make it passing from said opening position to said closure position; and means for dampening the closure stroke of said wing.

[0019] Always according to the invention, said dampening means can be integral with said wing, or they can be independently provided with respect to the same wing.

[0020] Still according to the invention, said dampening means can comprise a cylinder, a piston, slidable within said cylinder, defining an upper chamber and a lower chamber of the cylinder, and connected with said wing by connection means, provided above said cylinder, and a one-way valve, provided on the end of said cylinder opposed to the end connecting said piston with said wing, permitting exit of air from lower chamber of said cylinder only during the descent stroke of the piston along the cylinder.

[0021] Advantageously, according to the invention, said cylinder can be substantially vertical and can be coupled with said rear lateral edge of said wing by coupling means, such as a pair of fixed supports.

[0022] Furthermore, according to the invention, said closure means can comprise a counterweight, slidingly coupled with said cylinder, and further motion transmission means, such as a first cable, having one end fixed to said counterweight and the other end fixed to said sliding traverse in a first fixing point and passing through transmission means, such as a pulley, so that when said wing passes from said opening position to said closure position and vice versa, said counterweight exerts a force causing the closure of said wing.

[0023] Always according to the invention, said first fixing point can be in an intermediate position between projections on sliding traverse of said front lateral edge and of said rear lateral edge of said wing, when the latter is in said closure position.

[0024] Still according to the invention, aid device can comprise a pair of supports suitable to sliding couple said counterweight with said cylinder.

[0025] Furthermore, according to the invention, said

connection means can be comprised of motion transmission means, such as a second cable, having one end fixed to said piston and another end fixed to said sliding traverse in a second fixing point, and passing through said transmission means.

[0026] Advantageously, according to the invention, said motion transmission means can comprise a transmission channel obtained within a transmission substantially provided at one end of said sliding traverse, and a pulley, provided in correspondence of a further end of said cylinder.

[0027] Always according to the invention, said door further comprises a counter frame having a box coupled with said sliding traverse, said wing fully or partially entering by said rear lateral edge within said box in said opening position.

[0028] Still according to the invention said device can comprise means, preferably a magnet, suitable to maintain said wing in an open position that can be fixed to said cylinder or to one of said fixed supports.

[0029] Further according to the invention, said magnet can be coupled to the metallic bottom of said box.

[0030] It is further object of the present invention a method for installing a device as defined in the above, comprising the following steps:

- dismounting wing and relevant sliding carriages from said sliding traverse;
- introducing transmission block, having said transmission channel, in said sliding traverse;
- pushing said transmission block until the rear end of said sliding traverse;
- fixing magnet to the second lower support;
- fixing said pair of fixed supports of said cylinder to the rear lateral edge of said wing;
- installing again said sliding carriages and said wing into said sliding traverse;
- placing said wing in an opening position, maintained in said position thanks to the coupling action of said magnet with the metallic bottom of said box;
- pulling said first cable until fully lifting said counterweight, putting it close to the second upper fixed support;
- fixing the free end of said first cable to said first fixing point;
- placing said wing, which is fully open or in partially closed, in position where it is wished starting slowing down during its closure stoke;
- pulling said second cable until putting under tension the same and fixing free end of the same cable in said second fixing point; and
- cutting excess of said cables.

[0031] Always according to the invention, said sliding traverse can be provided with a slot wherein it is possible introducing said transmission block.

[0032] It is still further object of the present invention a kit for a device for closing and dampening as defined in the above, comprising a cylinder provided with fixed supports that can be fixed to the edge of said wing and with a valve on one end; a piston sliding within said cylinder; a cable, having one end fixed to said piston and another end that can be fixed to said sliding traverse, passing through transmission means, such as a pulley, and a transmission channel;- a counterweight sliding coupled with said cylinder; and a cable, having one end fixed to said counterweight, and another end that can be fixed to said sliding traverse, and passing through transmission means, such as a pulley.

[0033] Always according to the invention said kit can comprise a magnet.

[0034] The present invention will be now described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figure of the enclosed drawing, showing a longitudinal section view of a counterframe with a sliding door with the device for closing and dampening according to the invention.

[0035] Making reference to the enclosed figure, it is possible observing a door, generically indicated by reference number 1, comprising a counterframe, provided with a bow, a sliding traverse 2 and an abutting upright 3.

[0036] Door 1 also comprises a wing 4, sliding coupled with said sliding transverse 2 by carriages (not shown), said carriages sliding along a track (not shown as well), not making part of the invention.

[0037] Door 1 comprises a closing and dampening device, generically indicated by reference number 5, in order to permit closure of wing 4 regardless its position, permitting to the same reaching abutment upright 3 with a slow down motion, accompanying its motion.

[0038] Closing and dampening device 5 comprises a counterweight 6, sliding vertically when said wing passes from the open to the closed position and vice versa, suitable to cause push determining wing closure 4.

[0039] As it can be observed from figure, counterweight 6 moves vertically, but it is obliged to horizontally move integrally with said wing (direction indicated in the figure by arrow A).

[0040] Said counterweight 6 is connected at the first end of a first cable 61. Second end of said first cable 61 is fixed to said sliding traverse 2, in a first intermediate point of the same indicated by reference P1. First cable 61 further passes through a pulley 62 fixed to the wing 4.

[0041] In the present embodiment, point P1 is preferably positioned in an intermediate position between the projections on sliding traverse 2 of the lateral edges of the wing 4 when the latter is in the closed position, i.e. when front edge is close to the abutment upright 3.

[0042] Device 5 also comprises a dampening cylinder 7, substantially vertical, parallel with respect to the rear edge of wing 4, with a piston 8, housed within said dampening cylinder 7 and sliding within the same. Dampening cylinder 7 acts as brake of the wing 4 motion, always permitting in any case to the wing 4 to close, regardless the intermediate open position of the wing, thus opposing

to the gravity force on counterweight 6.

[0043] Said dampening cylinder 7 has a first upper end 71 open and a second lower end 72 closed by a one-way valve 9, suitable to prevent sucking air during lifting movement of the piston 8, the operation of which will be described in greater detail in the following.

[0044] Counterweight 6 is sliding coupled with said dampening cylinder 7 by suitably shaped first supports 10.

[0045] Said dampening cylinder 7 is also fixed to said wing 4 by a pair of second fixed supports 11.

[0046] Said piston 8 is coupled in point P2 with a second cable 81, fixed to the sliding traverse 2, and transmitted by a pulley 83 and a channel 82. Said channel 82 is provided within a transmission block 84 fixed to the rear end of the same sliding traverse 2.

[0047] Finally, closing and dampening device 5 also comprises a magnet 12, fixed to the second lower support 12, suitable to keep wig 4 in an open position, acting on a fixed metallic element that in the present case can be the same box on the door 1.

[0048] Dampening cylinder 7 is preferably comprised of aluminium, while supports 10 and 11 are preferably comprised of plastics, so as to permit a further reduction of the total weight of device 5.

[0049] Preferably, said cables 61 and 81 are not elastic cables, thus avoiding possible tearings.

[0050] In a further embodiment, dampening cylinder 7 can be provided in different positions, e.g. along the sliding traverse 2 or on the bottom of the box.

[0051] Furthermore, other closure means can be used instead of counterweight 6. Among these alternative solutions, it is possible thinking using a spring that can apply a constant force on closure wing 4.

[0052] Closing and dampening device 5 operates as follows. When wing 4 is in an opening position, counterweight 6 is positioned above, close the second fixed support 11, thus in a maximum potential energy condition. Instead, piston 8 is close the second end 72 of said dampening piston 7.

[0053] In case wing 4 is abutting against upright, magnet 12 will maintain the same adhering to the rear side of metallic box, preventing its closure.

[0054] Even exerting a minimum traction in order to overcome wing maintaining wing 4 by magnet 13, said wing 4 will be free to close. In this situation, and for all other open situations, even of partial opening, of wing 4, counterweight 6 ill exert its action, giving to wing 4 a push necessary and sufficient to start closure motion.

[0055] At the same time, piston 8 will start its run upward, thus creating a vacuum within lower portion of dampening cylinder 7, included between piston 8 and valve 9, which is in a closure condition.

[0056] Therefore, air flows along dampening cylinder 7 passing only between the same dampening cylinder 7 and piston 8. In view of the strict tolerance between outer diameter of piston 8 and inner diameter of dampening cylinder, a small amount of air will pass, thus slowing down piston stroke 8 and consequently wing stroke 4 up to impact against closure abutment upright 3.

[0057] Suitably adjusting length of second cable 81, it is possible adjusting part where wing 4 is slowed down with respect to the whole lumen of door 1, thus retarding or not intervention of piston 8. In other words, it is possible adjusting wing 4 wherein piston 8 starts sliding within dampening cylinder 7. Before, wing 4 will be free to slide until when second cable 81 is tightened and starts dragging piston 8, thus lifting the same.

[0058] During the opening of the door 1, piston 8 is free to descend by gravity along its seat, thanks to the fact that valve 9, being open, permits ejection of air contained within lower part of dampening cylinder 7, during the ascending stroke of the same piston 8.

[0059] It must be taken into consideration that counterweight 6 and piston 8 have such a weight to permit closure of the door regardless the position of the wing 4, a suitable for every kind (weight) of commercial door.

[0060] Device 5 according to the invention can be both installed in new doors, and retrofitted in existing doors 1 and counterframes not providing such a kind of device.

[0061] Particularly, installation operations of a device according to the invention will be described, taking into consideration the case of a sliding door 1 comprising a box (not shown), already installed, destined to replace by its volume a portion of the wall, and a wing 4 sliding coupled with the sliding traverse.

[0062] In such a case, in order to install a device 5 within door 1, the following steps are carried out:

- dismounting wing 4 and relevant sliding carriages from said sliding traverse 2;
- introducing transmission block 84, having said transmission channel 82, in said sliding traverse 2;
- pushing said transmission block 84 until the rear end of said sliding traverse 2;
- fixing magnet 12 to the second lower support;
- fixing said pair of fixed supports 11 of said cylinder 7 to the rear lateral edge of said wing 4;
- installing again said sliding carriages and said wing 4 into said sliding traverse 2;
- placing said wing 4 in an opening position, maintained in said position thanks to the coupling action of said magnet 12 with the metallic bottom of said box;
- pulling said first cable 61 until fully lifting said counterweight 6, putting it close to the second upper fixed support 11;
- fixing the free end of said first cable 61 to said first fixing point P1;
- placing said wing 4, which is fully open or in partially closed, in position where it is wished starting slowing down during its closure stoke;
- pulling said second cable 81 until putting under tension the same and fixing free end of the same cable in said second fixing point P2; and
- cutting excess of said cables 61 and 81.

[0063] It is noted that device 5 for dampening the movement according to the invention is always covered by counterweight, being rear edge of the wing hidden by box.

[0064] Solution according to the present invention has the advantage of permitting closure of a door wing regardless its position.

[0065] A further advantage of the present invention is that said device can be also easily installed in already existing doors not provided with such a closure system.

[0066] It is still an advantage of the present invention that of permitting an adjustment of the position and of the wing dampening force during the closure movement.

[0067] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

Claims

1. Device (5) for closing and dampening a sliding door (1), said sliding door (1) comprising a traverse (2), an abutment upright (3) and at least a wing (4) having a front lateral edge and a rear lateral edge, said wing (4) being slidingly coupled with said traverse (2) and having an opening position and a closure position, in correspondence of which said front lateral edge is close to said abutment upright (3),
said closure and dampening device (5) being **characterized in that** it comprises:

   wing (4) closure means (6, 61, 62), interacting with said wing (4) so has to exert a force suitable to make it passing from said opening position to said closure position; and
   means for dampening the closure stroke of said wing (4).

2. Device (5) according to claim 1, **characterized in that** said dampening means are integral with said wing (4), or they are independently provided with respect to the same wing (4).

3. Device (5) according to claim 1 or 2, **characterized in that** said dampening means comprise a cylinder (7), a piston (8), slidable within said cylinder (7), defining an upper chamber and a lower chamber of the cylinder, and connected with said wing (4) by connection means (81, 82, 83), provided above said cylinder (7), and a one-way valve (9), provided on the end (72) of said cylinder (7) opposed to the end connecting said piston (8) with said wing (4), permitting exit of air from lower chamber of said cylinder (7) only during the descent stroke of the piston (8) along the cylinder (7).

4. Device (5) according to claim 3, **characterized in that** said cylinder (7) is substantially vertical and is coupled with said rear lateral edge of said wing (4) by coupling means, such as a pair of fixed supports (11).

5. Device (5) according to one of preceding claims 3 - 4, **characterized in that** said closure means (6, 61, 62) comprises
   a counterweight, slidingly coupled with said cylinder (7), and
   further motion transmission means, such as a first cable (61), having one end fixed to said counterweight (6) and the other end fixed to said sliding traverse (2) in a first fixing point (P1) and passing through transmission means, such as a pulley (62), so that when said wing (4) passes from said opening position to said closure position and vice versa, said counterweight (6) exerts a force causing the closure of said wing (4).

6. Device (5) according to claim 5, **characterized in that** said first fixing point (P1) is in an intermediate position between projections on sliding traverse (2) of said front lateral edge and of said rear lateral edge of said wing (4), when the latter is in said closure position.

7. Device (5) according to one of preceding claims 5 or 6, **characterized in that** it comprises a pair of supports (10) suitable to sliding couple said counterweight (6) with said cylinder (7).

8. Device (5) according to one of preceding claims 3 - 7, **characterized in that** said connection means are comprised of motion transmission means, such as a second cable (81), having one end fixed to said piston (8) and another end fixed to said sliding traverse (2) in a second fixing point (P2), and passing through said transmission means (82, 83).

9. Device (5) according to claim 8, **characterized in that** said motion transmission means comprise a transmission channel (82) obtained within a transmission (84) substantially provided at one end of said sliding traverse (3), and a pulley (83), provided in correspondence of a further end (71) of said cylinder (7).

10. Device (5) according to one of preceding claims, **characterized in that** said door (1) further comprises a counter frame having a box coupled with said sliding traverse (2), said wing (4) fully or partially entering by said rear lateral edge within said box in said opening position.

11. Device (5) according to one of preceding claims, **characterized in that** it comprises means, prefera-

bly a magnet (12), suitable to maintain said wing (4) in an open position.

12. Device (5) according to claim 11, **characterized in that** said means for maintaining open said wing (4) are fixed to said cylinder (7) or to one of said fixed supports (11).

13. Device (5) according to one of preceding claims 11 or 12 when depending from claim 10, **characterized in that** said magnet (12) can be coupled to the metallic bottom of said box.

14. Method for installing a device as defined in claims 1 - 13, comprising the following steps:

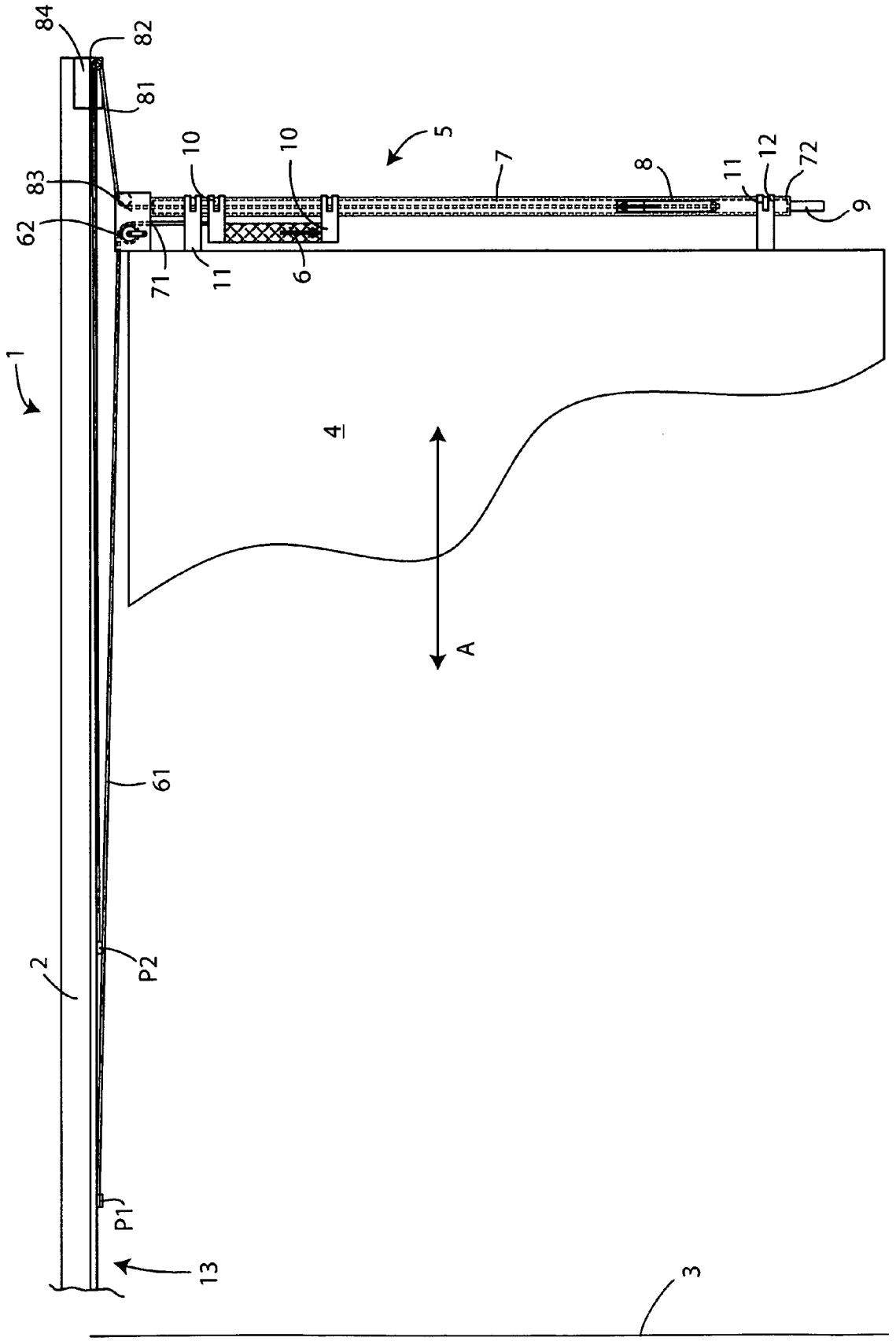
- dismounting wing (4) and relevant sliding carriages from said sliding traverse (2);
- introducing transmission block (84), having said transmission channel (82), in said sliding traverse (2);
- pushing said transmission block (84) until the rear end of said sliding traverse (2);
- fixing magnet (12) to the second lower support;
- fixing said pair of fixed supports (11) of said cylinder (7) to the rear lateral edge of said wing (4);
- installing again said sliding carriages and said wing (4) into said sliding traverse (2);
- placing said wing (4) in an opening position, maintained in said position thanks to the coupling action of said magnet (12) with the metallic bottom of said box;
- pulling said first cable (61) until fully lifting said counterweight (6), putting it close to the second upper fixed support (11);
- fixing the free end of said first cable (61) to said first fixing point (P1);
- placing said wing (4), which is fully open or in partially closed, in position where it is wished starting slowing down during its closure stoke;
- pulling said second cable (81) until putting under tension the same and fixing free end of the same cable in said second fixing point (P2); and
- cutting excess of said cables (61 and 81).

15. Method according to claim 14, **characterized in that** said sliding traverse (2) is provided with a slot (13) wherein it is possible introducing said transmission block (84).

16. Kit for a device (5) for closing and dampening as defined in claims 3 - 13, comprising:

- a cylinder provided with fixed supports (11) that can be fixed to the edge of said wing (4) and with a valve (9) on one end;
- a piston (8) sliding within said cylinder (7);
- a cable (81), having one end fixed to said piston (8) and another end that can be fixed to said sliding traverse (2), passing through transmission means, such as a pulley (83), and a transmission channel (82);
- a counterweight (6) sliding coupled with said cylinder (7); and
- a cable (61), having one end fixed to said counterweight, and another end that can be fixed to said sliding traverse (2), and passing through transmission means, such as a pulley (62).

17. Kit according to claim 16, **characterized in that** it comprises a magnet (12).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EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5427

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 3 437 125 A (HARGROVE SANFORD L) 8 April 1969 (1969-04-08) * column 3, line 70 - column 4, line 60; figures 1-9 * -----	1,2,11 3,14,16	INV. E05F1/02
			TECHNICAL FIELDS SEARCHED (IPC) E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 February 2010	Guillaume, Geert

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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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

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 42 5427

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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10-02-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3437125 A	08-04-1969	NONE	

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