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(54) Pneumatic window lifter

(57) The present invention relates to a pneumatic window lift meant to be installed on vehicle doors. The window lift can provide four basic functions performed by specific pneumatic circuits, namely: regulating the position, regulating the speed, pinching and braking when the window is at a certain position without being actuated. The speed regulation implies that despite the presence of gravity, which favours the downward motion, the raising and lowering speeds are identical. Pinching is a function that allows a partial lowering and removal of the raising force on the window if it is detected that the elevation is hindered. Lastly, the window can be braked at any position, whether closed or partially closed.

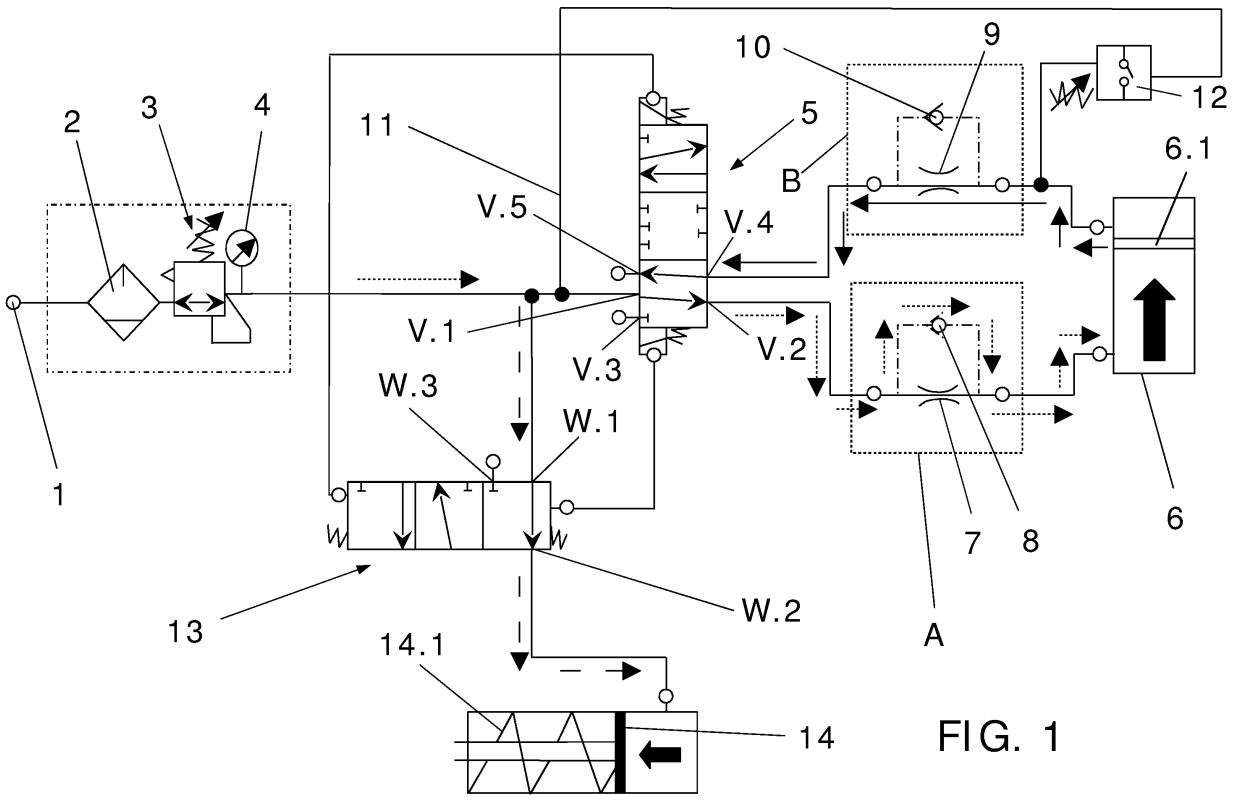

FIG. 1

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Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a pneumatic window lift meant to be installed on vehicle doors. The window lift has at least two basic functions performed by specific pneumatic circuits, namely: regulation of the position and control of the overload pinching during the window motion; secondarily, it also provides control of the speed and braking when the window is in a certain position without being actuated.

[0002] The regulation of the position allows to establish intermediate points at which the window stops in order to determine degrees of partial opening.

[0003] Control of the speed allows the upward and downward speed to be identical despite the action of gravity, which favours the downward motion.

[0004] The clipping function allows a partial descent and elimination of the upward force on the window when it is detected that the elevation movement is hindered. The clearest example of this is when a person's hand is caught by the window while it is being raised.

[0005] Lastly, it is intended to brake the window when it is at any position, whether closed or partially closed.

BACKGROUND OF THE INVENTION

[0006] Cable electrical window lifts are heavy and bulky. Their weight increases the inertia, so that when the door is closed this greater inertia requires stronger supports and retaining means. It also requires a greater area of the door to be moisture resistant. Lastly, the presence of numerous cables is also reduced by the use of pneumatic circuits, which also implies a considerable decrease in the cost of the window lift.

[0007] Pneumatic actuation to raise and lower windows is already known in specific solutions that in principle require a large volume, due to the use of the actuators, the control and the space reserved to the various elements involved in driving the window.

[0008] Japanese patent with publication number JP11050742 describes a window raising and lowering mechanism for automobile doors that incorporates a pneumatic motor whose output drives a worm gear. The displacement produced by the action of the worm gear is used in the angular motion of a set of arms that act as levers to move the window.

[0009] On another hand, patent with publication number DE3103238 does not require any hinged arms nor pneumatic motors; instead, it provides an indirect drive from a pneumatic cylinder using guided cables. The double action is achieved by using drive and descent cables that reach both ends of the double-action cylinder.

[0010] Also known is patent with publication number DE19537295 which again uses a double-action cylinder with its rod anchored to a number or arms that provoke the window raising and lowering motions.

[0011] In all of these mechanisms provided with arms, the volume occupied by the arm and the space that must be allowed for their movement is considerable.

[0012] Lastly, patent with publication number US3442050 should also be cited, describing a device based on the direct action of a pneumatic cylinder on the window. In this case the window is anchored to the cylinder rod.

[0013] In general, existing pneumatic mechanisms are complex as the transmission is not produced linearly or directly, or neither. Similarly, the user of pistons with a rod requires a great space and add considerable weight.

[0014] The present invention consists of a pneumatic window lift that incorporates the functions of position control, speed control, pinching and brake, providing a high integration and minimum space requirements.

DESCRIPTION OF THE INVENTION

[0015] The present invention consists of a pneumatic window lift that uses a circuit with a design that can incorporate and in turn integrate other pneumatic circuits that can perform four functions:

- *Position control:* This function consists of the possibility of stopping the window at a specific point, whether the end of run corresponding the fully open or closed positions, or any intermediate point. This function is basically attained by the possibility of actuation and actuation cut-off in a controlled manner using a main distributor.
- *Speed control:* the upward and downward speed are not necessarily identical, as although the actuation pressure is provided by the same deposit and is therefore identical, there is an external force, gravity, that acts in only one of the directions. The force of gravity does not have to be the only one with a differentiated sense; consider friction forces or small wedge actions on the window due to specific configurations and sliding modes.
- *Pinching:* in this memory the term pinching refers to the actuation in case of an increased resistance. The clearest example is when a person's hand is caught while the window is being raised. The increase in force is detected and activates a mechanism by which the window is lowered slightly, in the opposite direction to its previous motion, to allow removing the hand and prevent causing greater harm.
- *Braking:* the pneumatic actuation allows to move the window so that it can be taken to a specific point; however, after it is located at this point it is possible to overcome the pressure in any direction, or in the case of a circuit pressure drop it will not be possible to fix the window securely at the specific position. The present invention uses a brake to lock the window at a specific position, retiring it when the window must be moved.

[0016] These four functions are provided by three main component blocks of the device:

- *Fluid conditioning system:* this group of elements ensures a minimum feeding pressure in suitable conditions, without moisture or particles hindering the moving elements. This conditioning system is common to all the vehicle's window lifts.
- *Actuator set:* Actuators are responsible for the various movements required of the window lift. This invention uses linear actuators that allow a direct coupling of the actuator and the window. The device has two essential actuators, a first one consisting of a double action piston meant to perform the raising and lowering movements, and a second simple-effect actuator with a spring return action in charge of releasing the window brake.
- *Circuit logic system:* the circuit logic system is the set of components meant to generate the signals for the electronic system and to determine the flows in order to move the actuators. The logic system of each vehicle window lift is independent of the logic system of the other pneumatically-actuated window lifts.

[0017] The upward and downward movements are performed by rod-less actuators, which unite the drive and guide functions of the window anchor point. The transmission is linear and is direct, as there are no additional means such as cables or arms for transmitting the movement to the window, instead being connected directly to the actuator through a carriage guided by the actuator casing.

[0018] A detail of interest is that the rod-less construction of the pneumatic piston reduces the weight and volume compared to conventional rod pistons. This configuration allows to unite the drive and guide functions in a single component.

[0019] In this way the window lift is very compact, reducing the weight and volume compared to a conventional electrical system. In addition, the door volume required for moisture-sensitive elements is smaller. This increased compactness also implies a greater ease of assembly compared to the conventional system.

[0020] The design of this window lift also allows to locate the electronics in the control buttons and to locate the valve actuation electromagnets near it.

DESCRIPTION OF THE DRAWINGS

[0021] The present descriptive memory is completed by a set of drawings that illustrate the preferred embodiment and in no way limit the invention.

[0022] Figure 1 is a schematic representation of the pneumatic circuit of an example of embodiment of the invention when it acts on the window lift.

[0023] Figure 2 is a schematic representation of the pneumatic circuit of the invention when it acts to lower the window.

[0024] Figure 3 is a schematic representation of the pneumatic circuit of the invention in a static situation.

[0025] Figures 4A, 4B, and 4C are schematic representations of a slide valve by way of example of the embodiment used for the detailed description of the invention. Figure 4A represents only the casing with the set of openings allowing the entry and exit of fluid, while figures 4B and 4C show to end positions of the slide valve.

[0026] Figure 5 is a schematic representation of the assembly formed by the window and the rod-less linear actuator.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Having discussed the pneumatic window lift with its main functions and component groups, a detailed description of the invention is provided indicating the components in each group and the pneumatic circuit, with reference to the figures.

[0028] Figure 1 shows, on the left side in a dotted-line box, the set of devices constituting the fluid conditioning system. The circuit starts at the pressurised fluid intake (1) from a deposit placed after a drive pump; neither is shown in the figure. The fluid passes through a filter (2) after which a pressure regulator (3) sets the maximum working pressure of the entire pneumatic circuit. A pressure gauge (4) provides the signal that indicates when the drive pump must be turned on to fill the deposit in order to reach a higher pressure.

[0029] When operating at low temperatures, the moving elements may lock due to condensation and formation of ice inside the circuit. This requires working with dry air. To obtain this dry air, the system may use a membrane dryer (not shown). To prevent these situations it is convenient to incorporate this air drying system.

[0030] In vehicle without a power source, it is understood that one must be provided to include the compressor and deposit.

[0031] In the circuit represented in figures 1, 2 and 3, certain lines cross each other. They are communicated only when the union shows a black circle; otherwise, the lines cross but they are not communicated to each other.

[0032] With the same criterion and in view of figure 1, after the fluid conditioning system the line leads to a main distributor valve (5) with five paths and three positions:

- Way 1 (V.1): connected to the pressurised air input.
- Way 2 (V.2): connected through a unidirectional regulator to one of the cylinder chambers.
- Way 4 (V.4): connected to another unidirectional regulator to the other cylinder chamber.
- Ways 3 (V.3) and 5 (V.5): connected to the surroundings, discharge.

[0033] The ways are represented by lines joined to the box that represents the resting or initial position. When the way is closed and there are no communications two

lines forming a T-shape are shown.

[0034] The positions are represented by the adjacent squares. Each square is a possible position.

[0035] At the ends of the distributor valve (5) is shown the pilot signal input that selects each position. This selection can be performed, for example, by electrically exciting solenoids that impel a core which changes the valve position. The zigzag line indicates the presence of a spring that determines a preferred position when there is no pilot signal.

[0036] By way of example, figures 4A, 4B and 4C show an example of a slide valve. Figure 4A is the casing with the five ways consisting of orifices that communicate to a common internal cavity.

[0037] In this internal cavity is a slide formed by four pistons separated by a common rod, so that a chamber is defined between the pistons.

[0038] When the slide is moved to the left by the action of the valve through the righthand solenoid (in the case of an electrovalve) communication is established between the ways 1 (V.1) and 4 (V.4), and between the ways 2 (V.2) and 3 (V.3) as shown in figure 4B.

[0039] When the slide is moved to the right by the action of the valve through the lefthand solenoid (in the case of an electrovalve), communication is established between the ways 1 (V.1) and 2 (V.2), and between the ways 4 (V.4) and 5 (V.5) as shown in figure 4C.

Window raising operation

[0040] Figure 1 shows the direction of flow of the fluid in the window lift operation. The types of arrow used to represent the flow object of the description are as follows:

- Arrows represented by solid lines: indicate the direction of motion of the discharge fluid.
- Arrows represented by short-dash lines: indicate the direction of motion of the charge fluid.
- Arrows represented by long-dash lines: indicate the direction of motion of the charge fluid that acts on the brake.
- Thick arrows: indicate either the direction of motion of the piston (6.1) that drives the window (15) or the direction of motion of the piston (14) that actuates the brake.
- Arrows with a chevron head: indicate the ways that communicate inside the distribution valves.

  When the solenoid of the bottom part of the valve (5) is actuated, the slide moves toward the upper part of the valve (5) to connect the ways 1 (V.1) and 2 (V.2) and the ways 4 (V.4) and 5 (V.5). In this position the input pressure is connected to the lower cylinder chamber through way 1 (V.1), while the upper chamber is connected to the discharge, way 5 (V.5), thereby producing an upward motion of the piston (6.1) that drives the window (15).

  To allow adjusting the speed of the main piston, both in an upward and downward sense, two unidirectional regulators (A, B) are introduced in the supply lines of the cylinder (6) with the piston (6.1).

  After the outlet (way 2) of the distribution valve (5) is one of the unidirectional regulators (A).

  Said unidirectional regulator (A) is in turn divided into two conducts, one with strangulation (7) and another parallel one without strangulation and with a check valve (8) which in this case does not hinder passage of the fluid.

  The presence of the strangulation (7), which does hinder passage of the fluid, means that the fluid will pass by the other conduct where the check valve (8) is in the open direction.

  The second chamber of the actuator (6) that raises the window (15) will discharge forced by the movement of its internal piston (6.1).

  The discharge indicated by the solid-line arrows will take place through the return conduct formed by the unidirectional regulator (B), which in turn is formed by two parallel conducts, one with strangulation (9) and the other one also with a check valve (10).

  As in this case the check valve (10) is against the direction of flow, closing passage of fluid in this direction, the fluid must pass through the strangulation (9).

  After passing the unidirectional discharge regulator (B), the conduct reaches the main distributor valve (5), passes it and reaches the atmosphere.

Window lowering operation

[0041] The window lowering operation is shown in figure 2. Activation of the solenoid on the upper part causes a downwards displacement of the valve slide, so that the ways 1 (V.1) and 4 (V.4) and the ways 2 (V.2) and 3 (V.3) are connected. After passing through the main valve (5), the fluid is led to the second unidirectional regulator (B). In this direction the check valve (10) allows the flow, so that it will not pass through the strangling (9), which offers a greater resistance.

[0042] The fluid impels the piston (6.1) of the piston (6) that drives the window (15) in a downward sense, so that it forces the other chamber to discharge.

[0043] The discharge fluid passes through the first regulator (A) and, as its check valve (8) prevents its passage, it is forced to pass through the strangling (7).

[0044] After passing the first unidirectional regulator (A), the flow reaches and passes the main distribution valve (5) and reaches the atmosphere.

[0045] Comparing the raising and lowering operation, the fluid does not only change its direction of flow after it passes the main valve (5), but also in either direction it interchanges the flow through the check valve (8, 10) or through the strangulation (7, 9). Although one strangulation is always passed, allowing to adjust the fluid flow and therefore the speed of displacement of the window (15), this adjustment is different: in the raising operation the strangulation (9) is used, and in the lowering opera-

tion a different strangulation (7) is used.

[0046] The differentiated adjustment of the two strangulations (7, 9) allows to make the displacement speeds in the two directions the same, compensating for example the effect of gravity.

Pinching

[0047] Figures 1, 2 and 3 shows an auxiliary line (11) that begins at the supply line and reaches a differential pressostat (12). The differential pressostat (12) is located between the input at the upper cylinder chamber and the main pressure line.

[0048] The mission of the differential pressostat (12) is to detect an excessively low pressure in the cylinder discharge. When the pressure difference between the inlet and the discharge chamber exceeds a certain value, the pressure in the discharge chamber is understood to be below the reference value corresponding to a predetermined criterion that determines the existence of pinching.

[0049] The pressure drop in the discharge line, with the same cylinder inlet pressure, results from an excess load on the piston.

[0050] The pinching pressostat produces a state change in a switch, a button, used as a pinching input signal for the electronic system.

[0051] Pinching can also be detected by the pressure difference between the inlet and outlet of the discharge strangler (9), as a reduced pressure difference will be due to a slower speed of the piston (6.1).

Braking of the window

[0052] Similarly, figures 1, 2 and 3 show on their bottom part a second distribution valve (13) that acts with a pressure piston (14) on a brake.

[0053] The distribution valve (13) consists of a three-way, three-position valve piloted by the pilot lines of the main valve (5). This means that each position of the main valve (5) corresponds to a position of the brake distribution valve (13).

[0054] The brake is a friction element that rubs directly or indirectly against the window (15) or an element joined to the window (15). The brake must be released to allow any movement of the window (15), whether up or down.

[0055] The rest position is the central position of the valve, as shown in figure 3. In this rest position the pressure line is internally closed, while the cylinder line is in discharge. At this position the brake cylinder or piston (14) is retracted by the action of the spring (14.1), braking the window (15) by a clamp that is activated by the spring (14.1).

[0056] This means that the brake is always applied by default in the absence of fluid by the action of the spring (14.1), while the brake piston (14) allows removing the brake in case of an action that involves moving the window (15).

[0057] Any of the raising or lowering positions corresponding to he end positions of the distribution valve (13) establish a similar configuration of communication between lines: the pressurised fluid inlet occurs in way 1 (W.1), the outlet occurs in way 2 (W.2) with a direct connection to the brake piston (14) and the way 3 (W.3) is used for discharge.

[0058] When the bottom solenoid of the main distribution valve (5) is activated (when raising the window (15)), the slide of the distributor valve (13) moves to the left, connecting the pressure line to the cylinder chamber and closing the discharge way 3 (W.3), which increases the pressure in the right chamber of the brake valve, against the action of the spring (14.1), opening the clamp and releasing the window (15).

[0059] In summary, the brake distributor acts as a three-way, two-position (cylinder at rest and actuated) valve. It is provided with three positions because the physical execution of the system with a two-position piloted valve would require an element to detect any of the possible activations of the main valve (5) keeping separate the two pilot lines.

[0060] Another possible embodiment consists of making the brake valve (13) a three-way, two-position valve with electric activation. This possibility would imply the need for a third solenoid and its activation electrical line, as well as requiring an electrical output of the electronic circuit activated whenever any of the outputs is activated corresponding to the raising or lowering operations of the window (15).

Construction of the relevant components

[0061] All the pneumatic components, except the actuators, can be constructed on a single casing: distribution valves (5, 13), strangulators (7, 9) and check valves (8, 10), as well as the pinching pressostat (13).

[0062] • The stranglers (7, 9) and the check valves (8, 10) can be integrated in the same device. The configuration is based on hollow cylinders inserted in the valve block, so that their behaviour as stranglers is determined by their length and the difference in diameter between the cylinder and the sleeve. There is also a spring that tends to keep the cylinder base seated on the o-ring gasket at the base of the housing, so that if the air flow is in a direction from the spring to the gasket, the force of the spring and that due to the air pressure will seat the cylinder and the housing. The seal is further ensured and the passage of fluid is prevented.

[0063] When the air flow is from the base of the gasket to the spring, the air pressure exerted on the inner piston will overcome the opposition of the spring and the air will be able to flow freely inside the inner orifice of the cylinder.

[0064] • One example of the embodiment of the differential pressostat (12) is that constituted by a membrane that divides and the two chambers and seals them from each other. The pressure difference between the two chambers causes the deformation of the membrane to-

wards one side, where a sensor can be installed. The adjustment of the relative position between the membrane and the sensor using a button will determine the pressure difference value that triggers the output signal. This adjustment can be performed with an externally driven screw.

[0065] The pressure difference that triggers the pressostat is defined by the membrane rigidity and the distance between the button and the membrane surface in its rest position.

[0066] • In this example of embodiment the actuator construction selected is a rod-less piston. Figure 5 shows a schematic representation of an embodiment. This solution has the special characteristic that the free length required for implementation in the system is slightly larger than the piston race, which allows a direct coupling to the window (15) and avoids the need for an additional transmission system.

[0067] This actuator will perform the drive function and the guide function: the carriage (16) to which the window (15) is connected is guided along the actuator casing (18). In figure 5 the carriage (16) is guided as it slides along a groove (17), allowing the mechanical dependence of the carriage (16) on the outside and the piston that moves on the inside of the casing (18).

[0068] Depending on the coupling between the inner piston and the outer carriage (16), two options are available:

Piston with magnetic coupling

[0069] In these elements the piston is coupled to the carriage (16) by the magnetic attraction between them.

[0070] The piston comprises a non-magnetic sleeve that acts as a casing (18). This sleeve is externally surrounded by magnetic elements joined to the carriage (16) that slides on it. Inside it is the plunger, constituted by sealing elements and a sealing elements and a set of magnetic elements.

[0071] In this example there is no possibility of leaks to the outside. The casing (18) together with its bases constitutes a sealed and rigid vessel.

Piston with mechanical coupling

[0072] In these elements the casing (18) is grooved (17) along its entire length and a sheet closes the groove (17) on the inside. This sheet is deformed at the level of the plunger and follows its shape to allow passage of the coupling of the carriage (16) to the inside of the casing 818).

[0073] On the outside the groove (17) is a second sheet that also deforms and acts as a dust guard.

[0074] The displacement of the carriage (16) is forced by coupling the shapes of the plunger and the coupling of the carriage (16).

[0075] A disadvantage of this type of pistons compared to those with a magnetic coupling is that they show greater mechanical losses and a greater likelihood of leaks. Their advantage is that they provide a mechanically robust link between the plunger and the carriage (16).

[0076] A specific embodiment of a piston with mechanical coupling has an actuator with two independent, sealed flexible chambers separated by a plunger inside a rigid casing (18). In it two elastic bellows are used as the independent sealed chambers.

[0077] This solution solves the problems of mechanical losses and leaks.

[0078] • The logic system consists of an electronic system with two outputs, corresponding to the actuation signals of the main valve of the pneumatic circuit. The system inputs are all digital and correspond to:

- o Close button: normally-open manually operated button.
- o Open button: normally-closed manually operated button.
- o Close end of race: relay that activates at the fully closed position of the window (15).
- o Open end of race: relay that activates at the fully open position of the window (15).
- o Pinching signal: obtained when the pressure difference between the supply pneumatic line and the point of discharge of the main cylinder exceeds a certain value.
- o Pinching inhibit system: relay that remains active from the moment in which the window (15) is about to enter the rubber seals until its fully closed position. The signal it generates corresponds to an area in which pinching is physically impossible, while it is possible to increase the mechanical faces of the seal.

[0079] The electronic system outputs correspond to the activation of the valve piloting solenoids, acting on the previously described circuit according to the aforementioned input signals.

Claims

1. Pneumatic window lift for motor vehicles that provides the drive by rod-less linear actuators, **characterised in that** these rod-less linear actuators act on the window (15) in a linear and direct manner by guiding the carriage (16) along the casing (18) of the actuator (6) and **in that** its pneumatic circuit simultaneously integrates other pneumatic circuits among which is at least included the circuit that controls the position of the window (15) and the circuit that controls the pinching due to overload during the movement of the window (15).

2. Pneumatic window lift according to claim 1 **characterised in that** the pneumatic circuit incorporates a differentiated control of the speed during the raising

and lowering motions.

3. Pneumatic window lift according to claim 1 **characterised in that** the pneumatic circuit incorporates the circuit for releasing a permanent brake that acts during the resting state of the window 815) to allow its displacement.

4. Pneumatic window lift according to claim 1 **characterised in that** the position control for the window (15) is performed by a distribution valve (5) in which raising communicates the fluid supply line to an access line to a first chamber of the piston (6.1) of a double-action actuator (6) and the second chamber of the actuator (6) to a second line providing access to the atmosphere for discharge; and in which lowering uses the same conduct lines in an inverse sense, so that charging occurs in the second chamber of the actuator (6) and discharge occurs in the first chamber of the actuator (6).

5. Pneumatic window lift according to claim 2 **characterised in that** the differentiated speed control during the raising and lowering of the window (15) is performed by incorporating in the charge and discharge lines between the distributor valve (5) and the window raising actuator (6) corresponding unidirectional regulators (A, B) that in turn incorporate in parallel lines with a check valve (8, 10) and a strangulation (7, 9) respectively, where in one direction the flow passes through a check valve (8) of a regulator (A) and through the strangulation (9) of the second regulator (B), while in the opposite direction the flow passes through the strangulation (7) of the first regulator (A) and through the check valve (10) of the second regulator (B).

6. Pneumatic window lift according to claim 5 **characterised in that** the differentiated regulation of the raising and lowering speeds is performed by the also differentiated adjustment of the extent of strangulation of the strangulations (7,9) of the unidirectional regulators (A, B).

7. Pneumatic window lift according to claim 4 **characterised in that** the main distribution valve (5) is a five-way, three position valve.

8. Pneumatic window lift according to claim 7 **characterised in that that** the main distribution valve (5) is electrically piloted.

9. Pneumatic window lift according to claim 3 **characterised in that** the brake that retains the window (15) is released by a distribution valve (13) which, when it is actuated during both raising and lowering, acts by connecting the supply line with a piston (14) so that its displacement will overcome the resistance of the braking spring (14.1).

10. Pneumatic window lift according to claim 9 **characterised in that** the distribution valve (13) to release the brake is a three-way, three-position valve.

11. Pneumatic window lift according to claim 4 and 9 **characterised in that** the brake distribution valve (13) is piloted by the piloting lines of the main valve (5).

12. Pneumatic window lift according to claim 9 **characterised in that** the brake release distribution valve (13) is electrically actuated.

13. Pneumatic window lift according to claim 9 **characterised in that** the brake release distribution valve (13) is pneumatically actuated.

14. Pneumatic window lift according to claim 1 **characterised in that** the pinching control due to overload in the motion of the window (15) is performed by a differential pressostat (12) that measures the pressure difference between the supply line and the discharge pressure of the actuator (6) that drives the window (15).

15. Pneumatic window lift according to claim 14 **characterised in that** the pressostat (12) is a membrane pressostat.

16. Pneumatic window lift according to claim 1 **characterised in that** all the pneumatic elements except the actuators are mounted on a single casing.

17. Pneumatic window lift according to claim 1 **characterised in that** the coupling between the inner plunger of the double-actionrod-less cylinder and the external carriage (16) carried by it is magnetic.

18. Pneumatic window lift according to claim 1 **characterised in that** the coupling between the double-action rod-less cylinder and the external carriage (16) carried by it is mechanical.

19. Pneumatic window lift according to claim 1 **characterised in that** a control electronic system acts with two outputs corresponding to the actuation signals of a main distribution valve on the pneumatic circuit to raise and lower the window (15); and its inputs correspond to:

- the close button;
- the open button;
- the close end of race;
- the open end of race;
- the pinching signal;
- the pinching inhibition system.

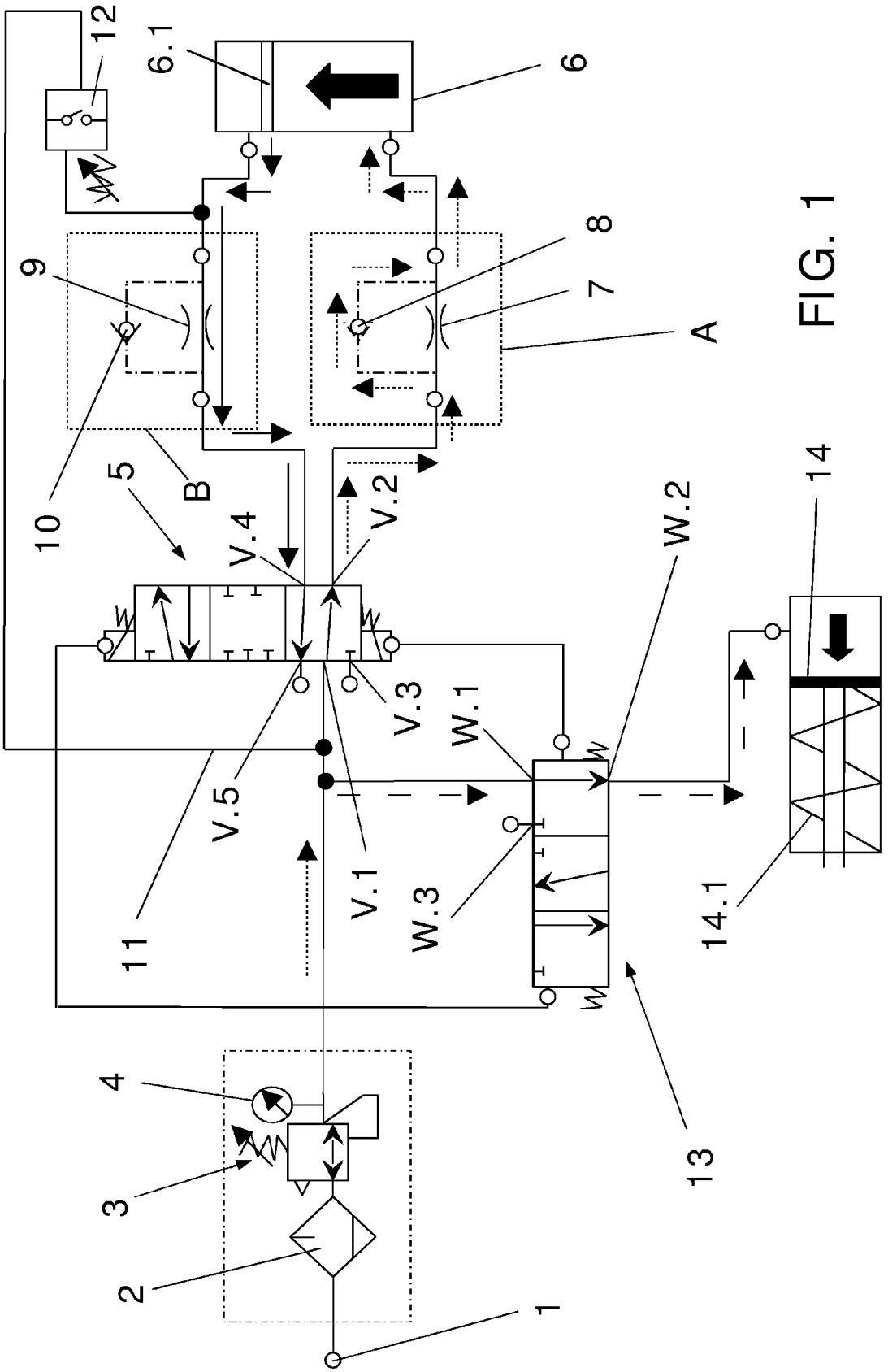

FIG. 1

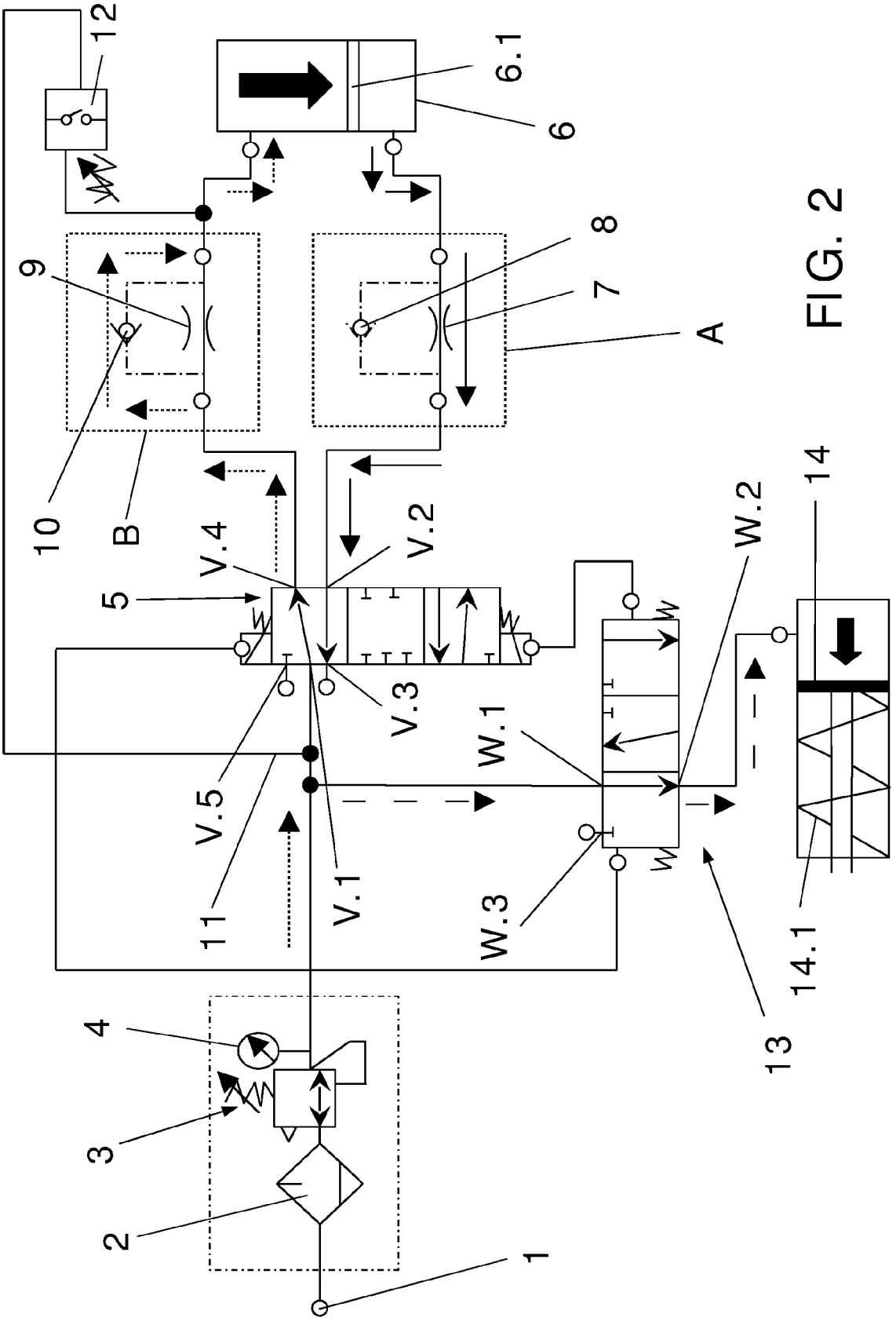

FIG. 2

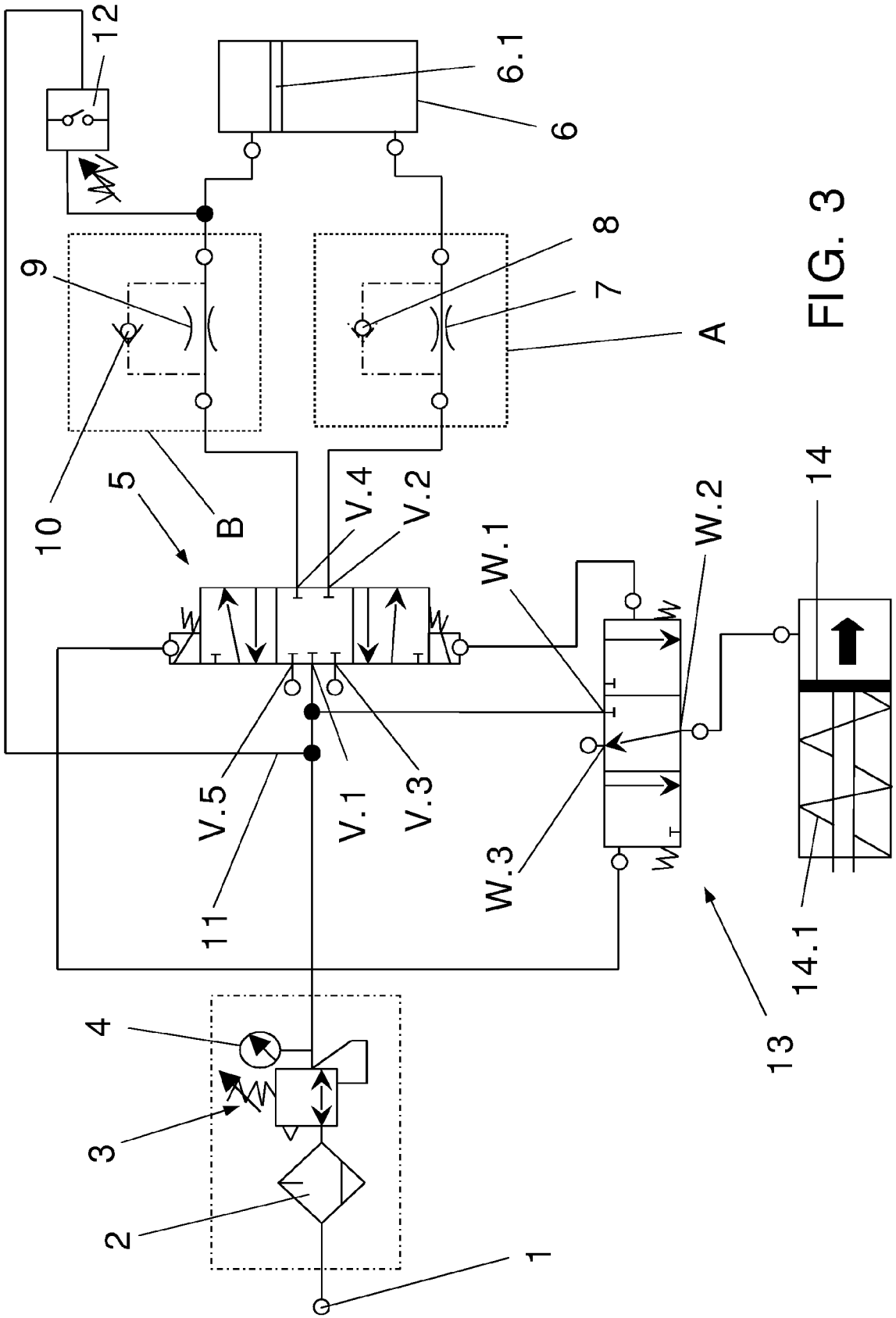

FIG. 3

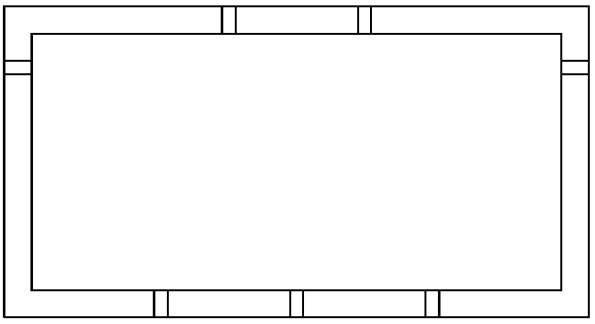

FIG. 4A

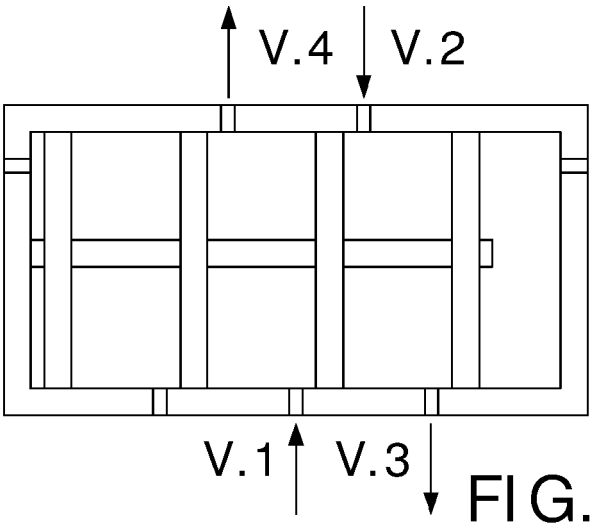

FIG. 4B

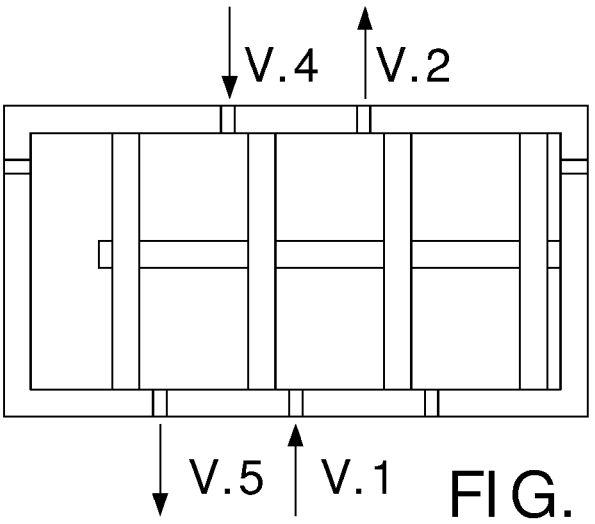

FIG. 4C

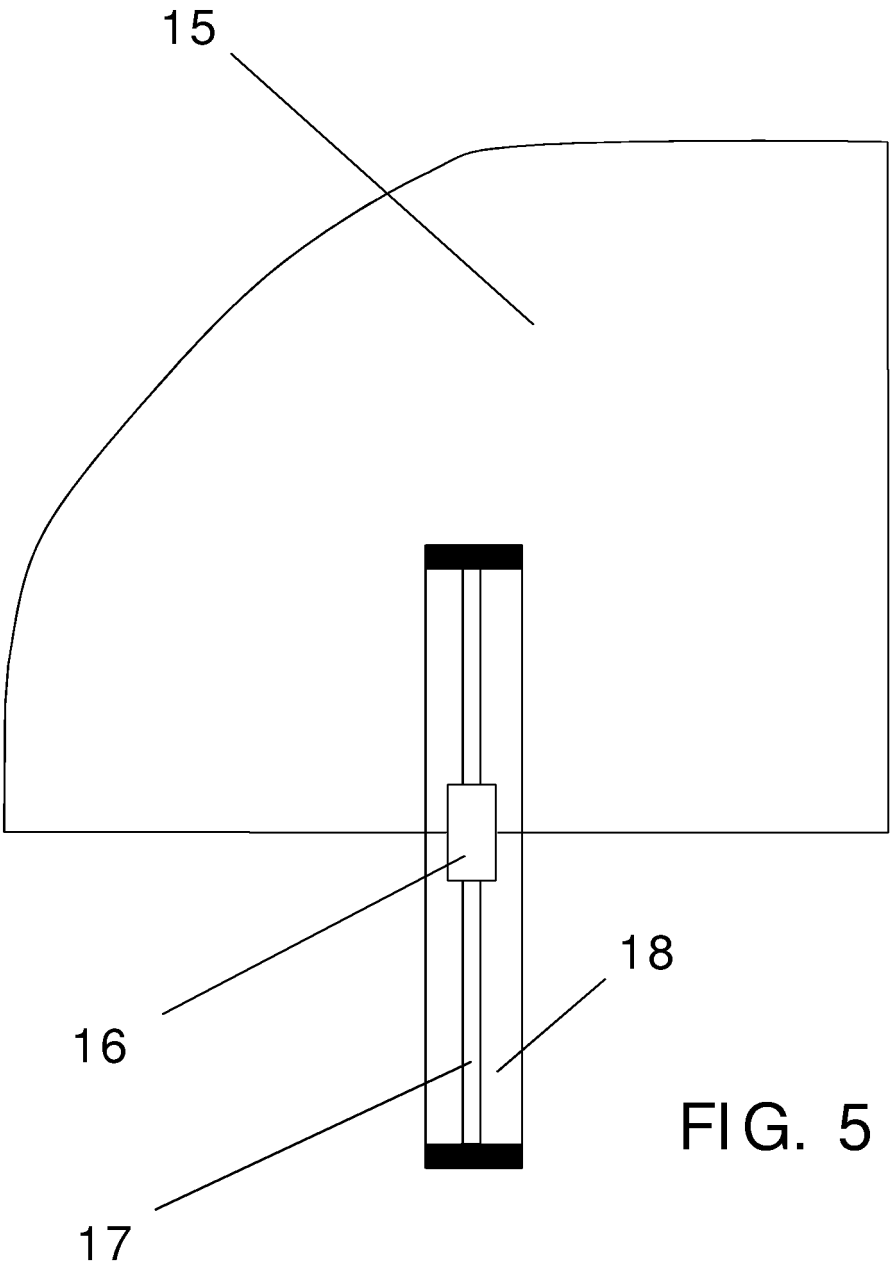

FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 38 1024

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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E05F
B60J
F15B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 October 2005	Balice, M

CATEGORY OF CITED DOCUMENTS

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1

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

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