



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.01.2009 Bulletin 2009/05

(51) Int Cl.:
E05F 11/06^(2006.01)

(21) Application number: **08160950.5**

(22) Date of filing: **23.07.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

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(30) Priority: **26.07.2007 IT BO20070522**

(54) **An operating device for windows**

(57) An operating device for windows comprises drive means (10) that can be associated with a locking device (5) of the window (2) to engage and disengage the locking device (5), and a power-driven control element (11) acting on the drive means (10) to open and close the window (2); the drive means (10) comprise a

rack (13) operatively associated with the control element (11), at least one pinion (14) being able to be meshed with the rack (13), and a system (15) for connecting the pinion to the locking device (5) so as to move the locking device (5) of the window (2) from a locked to an unlocked configuration and vice versa.

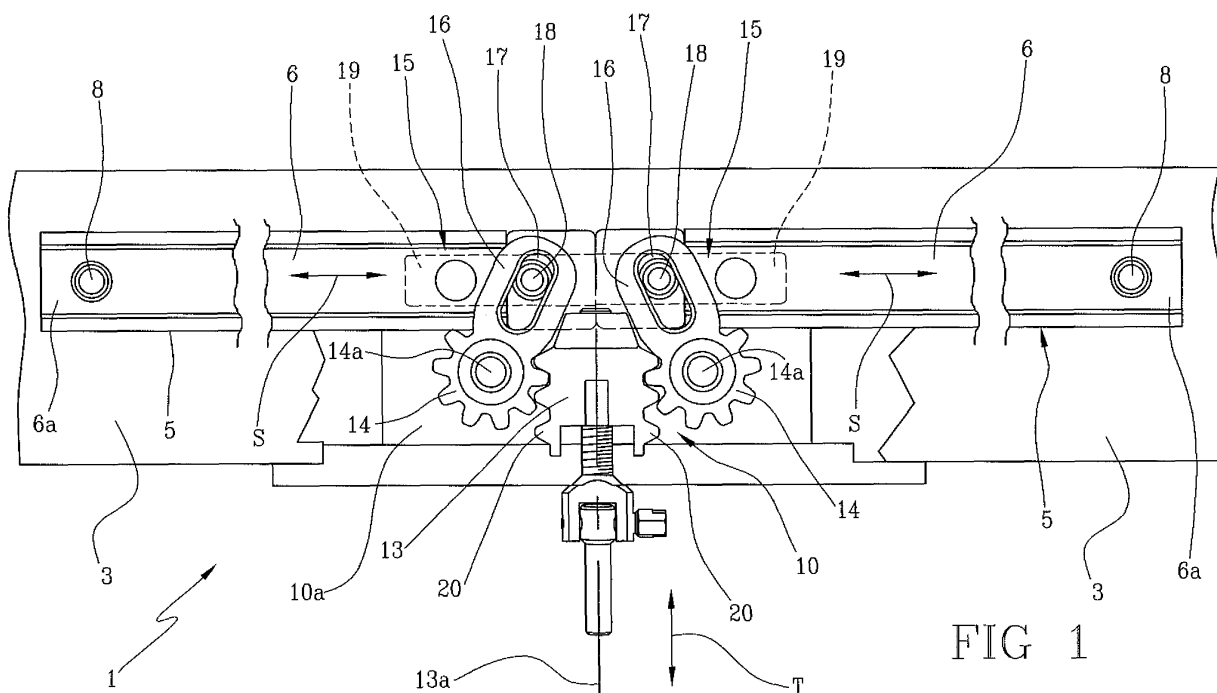


FIG 1

Description

[0001] This invention relates to an operating device for windows.

[0002] The invention applies in particular to single-sash hinged windows, and especially to "awning" windows. Awning windows comprise a mobile frame or sash that opens outwards from the bottom and is hinged at the top to a fixed window frame.

[0003] Prior art windows, be they of the traditional type (opened by turning), bottom-hung or top-hung are equipped with suitable locking devices which prevent the window from being opened.

[0004] Usually, these locking devices keep the window closed at two or more fastening points, in addition to the traditional fastening point located half way along the width of the frame (the latter being normally the case in bottom-hung windows and top-hung, awning windows).

[0005] The locking device is normally mounted on the mobile frame and comprises one or more rods each provided with at least one pin and/or boss (protruding from the end of the rod in the case of the pin or transversally of the rod in the case of the boss) designed to engage or release a respective contact member formed or mounted on the fixed frame.

[0006] The rods are slidable in a groove running along the edge of at least one side of the mobile frame, usually the side opposite the hinged side.

[0007] The locking device is engaged and disengaged by an operating device (handle) used to open and close the window.

[0008] When the locking device is engaged, the window cannot be opened. When the locking device is disengaged, on the other hand, the mobile frame can be moved away from the fixed frame.

[0009] The operating device comprises a control element, which may be either manual (handle) or power driven, and which controls the drive means that can be associated with the locking device.

[0010] At present, in the case of awning windows installed mainly in buildings with glazed curtain walls covering large surface areas, the control element is usually power-driven. The power-driven control element comprises a power unit with an electric motor that drives a flexible actuator, such as a chain, or an electromechanical actuator, such as a rigid rod that slides in a cylinder.

[0011] The power unit is usually associated with the fixed part of the frame, while the actuator, connected to the motor at one end, acts on the mobile part of the frame with its other end, exerting a pushing or pulling force that respectively opens or closes the window, which is guided, normally by a pair of hinges and, where necessary, also by guiding arms interposed between the upright members of the mobile frame and those of the fixed frame.

[0012] In particular, the actuator operates on the drive means which lock and unlock the mobile frame to and from the fixed frame.

[0013] Several drive means for windows are known

which are designed to switch the locking device from a configuration in which the mobile frame is rigidly fixed to the fixed frame and cannot be moved, to a configuration in which the mobile frame is released from the fixed frame and can be opened.

[0014] For example, in the case of bottom-hung windows, the drive means comprise a linkage connected to one or two rods for engaging and disengaging the above mentioned boss.

[0015] This mechanism, however, occupies quite a large amount of space, making it necessary to use relatively thick mobile frames.

[0016] Also known are operating devices comprising drive means that have excessively complex structures or do not guarantee a satisfactory level of precision in driving the locking device.

[0017] At present, awning windows cannot be equipped with power-driven operating devices having special linkages for obtaining multiple closures of the type described above, and the systems and units currently used on bottom-hung windows cannot be adapted to suit top-hung, awning windows.

[0018] This invention therefore has for an aim to overcome the above mentioned disadvantages by providing an operating device for windows, in particular for power-driven awning windows.

[0019] Another aim of the invention is to provide an operating device for windows, which can be adapted to suit bottom-hung windows and which is small enough, even during operation, to be mounted on thin mobile frames.

[0020] A further aim of the invention is to provide an operating device for windows which improves the mechanism for transmitting drive from the power unit to the locking device and which guarantees a better level of precision in opening and closing the window.

[0021] According to the invention, these aims are achieved by an operating device for windows comprising the technical characteristics set out in one or more of the appended claims.

[0022] The technical characteristics of the invention, with reference to the above aims, are clearly described in the claims below and its advantages are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate a preferred embodiment of the invention provided merely by way of example without limiting the scope of the inventive concept, and in which:

- Figure 1 is a schematic plan view of an operating device for windows according to the invention in a first operating configuration in which the window is locked;
- Figure 2 is a schematic plan view of the operating device of Figure 1, in a second operating configuration in which the window is unlocked;
- Figure 3 is a perspective view of the operating device according to the invention in an intermediate config-

uration;

- Figure 4 illustrates a part of a window frame on which the device according to the invention is mounted;
- Figure 5 shows an awning window, in an open configuration, equipped with a power-driven opening and closing system that controls the operating device according to the invention, not illustrated;
- Figure 6 shows an awning window in a closed configuration.

[0023] With reference to the accompanying drawings, the numeral 1 denotes an operating device 1 for single-sash hinged windows of the type illustrated in Figures 5 and 6. This specification and the accompanying drawings illustrate an "awning" type window.

[0024] Windows 2 of this type comprise a mobile frame 3 hinged to a fixed frame 4 along one respective first side 3a, 4a (horizontal members).

[0025] In awning windows, the hinged side is the upper horizontal member and the sash or mobile frame 3 opens outwards from the bottom.

[0026] Windows of this kind are used mainly in high-rise buildings with glazed curtain walls to allow good aeration of the interior while at the same time limiting the extent to which the windows themselves can be opened, primarily for security reasons.

[0027] When the awning window is opened, at least one second side 3b (lower horizontal member) of the mobile frame 3 moves away from a second side 4b of the fixed frame 4, as shown in Figure 5, while in the closed configuration of the window 2 (Figure 6), the second side 3b of the mobile frame 3 is in contact with the second side 4b of the fixed frame 4.

[0028] The second side 3b, 4b of the frames is generally opposite and parallel to the first side 3a, 4a (in other words, as stated, they are the two horizontal members of the window unit).

[0029] The operating device 1 is usually associated with the mobile frame 3 which usually comprises a profile made of metal or plastic (such as PVC), a detail of which is shown in Figure 4.

[0030] The window unit 2 may advantageously be locked in the closed configuration to improve the weather seal or to prevent breaking in.

[0031] For this purpose, the window units are normally provided with locking devices 5 which identify further closing points of the window unit 2. The operating device 1 is associated with the locking device 5 to engage or disengage it or, in other words, to move it between a configuration where the window unit 2 is locked and the mobile frame 3 is engaged with the fixed frame 4, and a configuration where the window unit 2 is unlocked and the mobile frame 3 is disengaged from the fixed frame 4, allowing the window unit 2 to be opened.

[0032] The locking device 5 may comprise one or more rods 6 slidable in a groove 7 made in the second side 3b of the mobile frame 3 and one or more fastening elements 8 fixed near a free end 6a of the rod 6.

[0033] Typically, the fastening elements 8 are bosses which, in the locked configuration of the window unit 2, engage a respective contact element 9 made on the fixed frame 4. The contact element 9 is embodied, for example, by the walls of a housing socket, rigidly formed on the fixed frame 4 of the window, which define a contact shoulder, or the walls of a part associated with the fixed frame itself.

[0034] In the locked configuration, the bosses engage the respective sockets, interfering with the related contact element 9 and thus preventing the mobile frame 3 from being moved away from the fixed frame 4.

[0035] In the unlocked configuration, the bosses are disengaged from the sockets, in such a way as to lie outside of them, thus enabling the mobile frame 3 to be moved away from the fixed frame 4 to open the window.

[0036] The operating device 1 according to the invention, illustrated in Figures 1 to 4, comprises drive means 10, described in detail below, which are housed in a mounting block 10a located inside the mobile frame 3, and which can be associated with the locking device 5, for reversibly moving the locking device 5 between the locked configuration and the unlocked configuration of the window.

[0037] Advantageously, the drive means 10 are linked to a control element 11, preferably power-driven, as shown in Figure 5.

[0038] The control element 11 comprises a box-shaped body 11a housing a power unit of customary type and therefore not illustrated (such as an electric motor, for example) and an actuator 12 controlled by the power unit. Typically, the actuator 12 may be of electromechanical type, such as, for example, a rigid sliding rod or a hinged rod, or of flexible type, such as a chain actuator.

[0039] In Figure 5, for example, the actuator is embodied by a chain that is unwound to enable the window unit 2 to be opened.

[0040] In the closed configuration of the window unit 2, shown in Figure 6, the chain actuator 12 is wound inside the box-shaped body 11a.

[0041] As shown in Figure 5, the power unit is permanently associated with the fixed frame 4, while the actuator 12 has a first end 12a for connection with the power unit, and a second end 12b through which the actuator 12 operates on the mobile frame 3.

[0042] The power unit unwinds and rewinds the actuator 12 to open and close the window 2, respectively.

[0043] Interposed between the locking device 5 and the control element 11 are the drive means 10. The latter comprise a rack 13 operatively associated with the control element 11, and at least one pinion 14 that meshes with the rack 13. Preferably, the pinion 14 is hinged to the mounting block 10a and is rotatable about an axis 14a transversal to the rods 6 of the locking device 5.

[0044] The drive means 10 also comprise a system 15 for connecting the pinion 14 to the locking device 5 so as to transmit the motion of the rack 13 to the locking device 5 to move the latter from the locked to the unlocked

configuration and vice versa.

[0045] More specifically, the connecting system 15 comprises a protrusion 16, integral with the pinion 14 and having a slot 17 inside which a pin 18 is inserted. The pin 18 is in turn connected to the locking device 5; more specifically, the pin 18 is fixed to a slider 19 that is directly fixed to the rod 6 of the locking device 5.

[0046] Preferably, the rack 13 is two-sided, that is to say, has two opposite toothed profiles 20.

[0047] Consequently, the drive means 10 preferably comprise two pinions 14, each meshing with a respective toothed profile 20 of the rack 13, and each being hinged to the mounting block 10a and rotatable about a respective axis 14a transversal to the rods 6 of the locking device 5.

[0048] There are therefore two locking devices 5, positioned symmetrically with respect to the rack 13 and each associated with a respective pinion 14. In use, the window 2 must be opened in two steps, during the first of which it is unlocked by moving the actuator through a distance defined as the "overtravel" of the actuator, and during the second of which the window is moved to the open position proper.

[0049] During the first step, the power unit activates the actuator 12, and in this particular embodiment, unwinds the chain, which advances at right angles to the mobile frame 3 along a straight path T. In so doing, the actuator 12 pushes the rack 13 and causes it to move in the same direction along the path T, that is to say, along the axis 13a of the rack 13 itself. The straight-line movement of the rack 13 is converted into the rotational movement of the pinions 14 which in turn cause the protrusion 16 to rotate. In particular, the pinions 14 turn in opposite directions about respective parallel axes, causing the protrusions 16 to move away from the axis 13a of the rack 13.

[0050] The rotation of the protrusions 16 causes the pins 18 associated with them to move away from the axis 13a of the rack 13 along a straight path S transversal to the path T.

[0051] The movement of the pins 18, fixed to the sliders 19, simultaneously causes the rods 6 to slide along the groove 7 made on the second side 3b of the mobile frame 3. The rods 6 also move away from the axis 13a of the rack 13, thereby displacing the bosses 8 and disengaging them from the respective contact elements 9 and thus releasing the window frame 4.

[0052] In this way, the locking device 5 is disengaged.

[0053] The further movement of the actuator 12 towards the mobile frame 3 pushes the window 2 in such a way as to open it.

[0054] In order to close the window 2, the power unit again activates the actuator 12, but this time rewinding it inside the box-shaped body 11a.

[0055] The actuator 12 exerts a tractive force on the mobile frame 3, pulling it towards the fixed frame 4 in such a way as to close the window 2. During this step, the rack 13 does not mesh with the pinions 14 and does

not perform any movement relative to other parts of the operating device 1 but is pulled along as one with the rest of the operating device 1.

[0056] Once the window 2 is closed, that is to say, after the second side 3b of the mobile frame 3 comes into contact with the second side 4b of the fixed frame 4, the actuator 12 continues its movement, dragging the rack 13 along with it for a short distance, defined as its "overtravel", while the mobile frame 3 remains stationary.

[0057] During the "overtravel", the rack 13 moves relative to the other parts of the operating device 1 in a straight line along the path T in the direction opposite to the previous direction, that is to say, it withdraws in such a way as to move the mobile frame 3 close to the fixed frame 4. During its movement, the rack 13 meshes with the pinions 14 causing them to turn in the direction opposite to the previous direction. The protrusions 16 are also made to rotate accordingly, thereby causing the pins 18 to move in a straight line along the path S towards the axis 13a of the rack 13.

[0058] The two rods 6 of the locking device 5, each connected to a respective pin 18 through the slider 19, slide in the groove 7 towards the axis 13a of the rack 13.

[0059] The straight-line movement of the rods 6 displaces the fastening elements 8 which re-engage the contact elements 9, that is to say, they move into their respective sockets, thus engaging the shoulder defined by the walls of the socket and locking the window 2 in the closed position.

[0060] An operating device of the type described above achieves the above mentioned aims since the drive means occupy a very limited space and do not require more space for operation than the space they actually occupy.

[0061] Further, the transmission of drive through the rack and pinion mechanism ensures the precision and smoothness of locking device movements.

[0062] Moreover, the rack and pinion coupling mechanism creates an extremely "sturdy" system that appreciably reduces the possibility of forcibly reversing the stable open and closed positions adopted by the system.

[0063] The operating device according to the invention can also be applied to bottom-hung windows.

[0064] The invention described above is susceptible of industrial application and may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all details of the invention may be substituted by technically equivalent elements.

Claims

1. An operating device for windows comprising at least:

- drive means (10) that can be associated with a locking device (5) of a window (2) to move the locking device (5) between a locked configura-

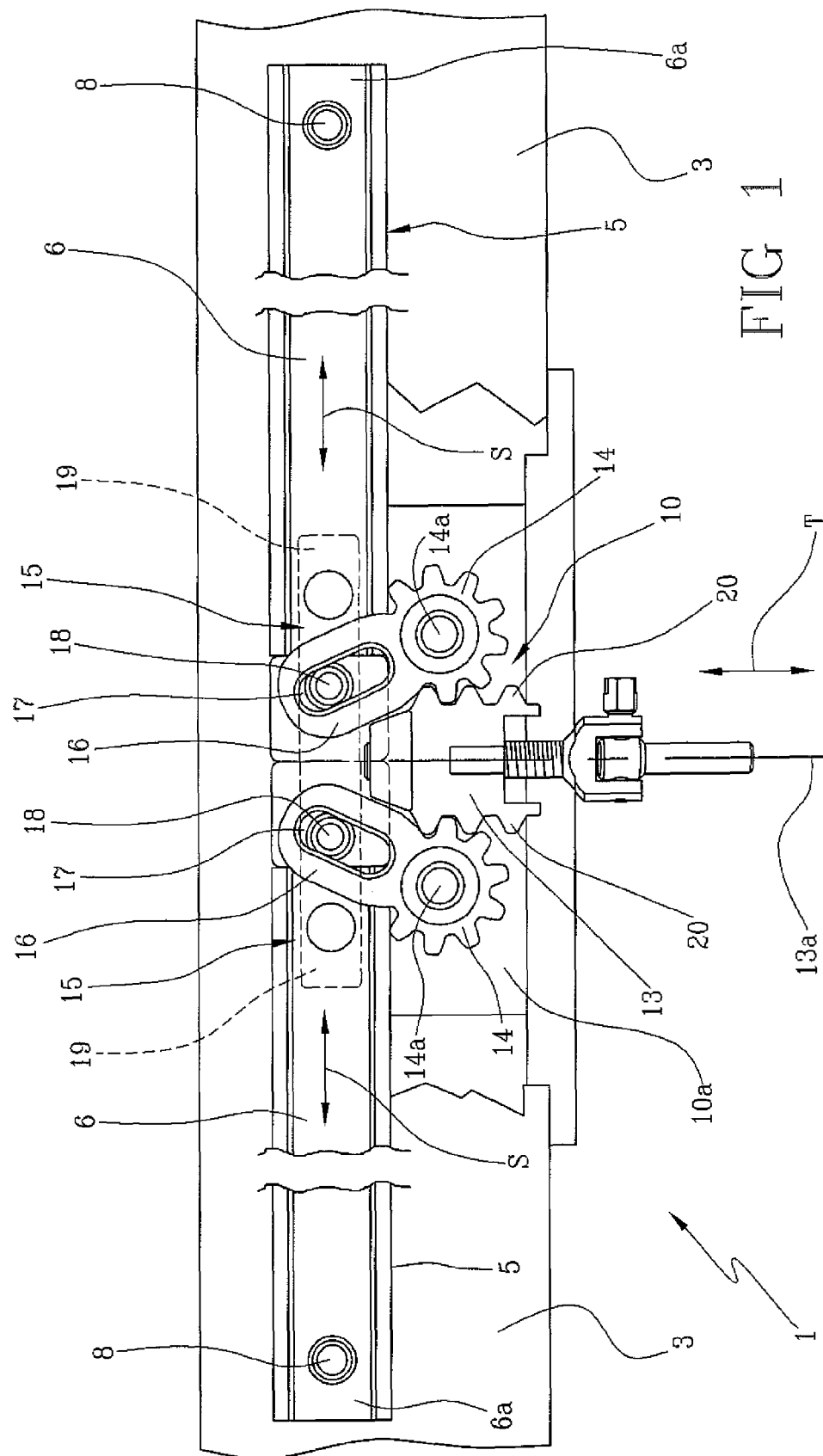
tion and unlocked configuration of the window (2);
 - a control element (11) acting on the drive means (10) along a straight path (T) to open and close the window (2);

the device being **characterized in that** the drive means (10) comprise a rack (13), operatively associated with the control element (11), which is slidable along the straight path (T), at least one pinion (14) being able to be meshed with the rack (13), and a system (15) for connecting the pinion to the locking device (5) so as to move the locking device (5) of the window (2) from a locked to an unlocked configuration and vice versa.

2. The device according to claim 1, **characterized in that** the connecting system (15) comprises a protrusion (16), integral with the pinion (14) and having a slot (17) inside which a pin (18) connected to the locking device (5) is inserted; the pin (18) being movable, following rotation of the protrusion (16), along a straight path (S) transversal to the path followed by the rack (13). 20
3. The device according to claim 2, **characterized in that** the pin (18) is fixed to a slider (19) connected to the locking device (5). 25
4. The device according to any of the claims from 1 to 3, **characterized in that** the locking device (5) comprises at least one rod (6) having at least one fastening element (8) that can be engaged with a contact element (9) made on the window (2). 30
5. The device according to claims 3 and 4, **characterized in that** the slider (19) is fixed to the rod (6); the rod (6) being slidable in a groove (7) made in a second side (3b) of a mobile frame (3) of the window (2) to lock/unlock the locking device (5) by engaging/disengaging the fastening element (8) to/from the contact element (9). 35
6. The device according to any of the foregoing claims, **characterized in that** the rack has two opposite toothed profiles (20); the drive means (10) comprising two pinions (14), each meshing with a respective toothed profile (20) of the rack (13). 40
7. The device according to claim 6, **characterized in that** each of the pinions (14) can be associated with a respective locking device (5) of the window (2) on opposite sides of the rack (13). 45
8. The device according to any of the foregoing claims, **characterized in that** each of the pinions (14) is linked to a mounting block (10a) housed in the mobile frame (3); each pinion (14) being rotatable about a 50

rotation axis (14a) at right angles to the rack (13).

9. The device according to any of the foregoing claims, **characterized in that** the control element (11) comprises a power unit and an actuator (12) driven by said power unit; the actuator (12) moving the rack (13). 5
10. The device according to claim 9, **characterized in that** the actuator (12) is a chain type actuator. 10
11. The device according to claim 9, **characterized in that** the actuator (12) is an electromechanical actuator. 15



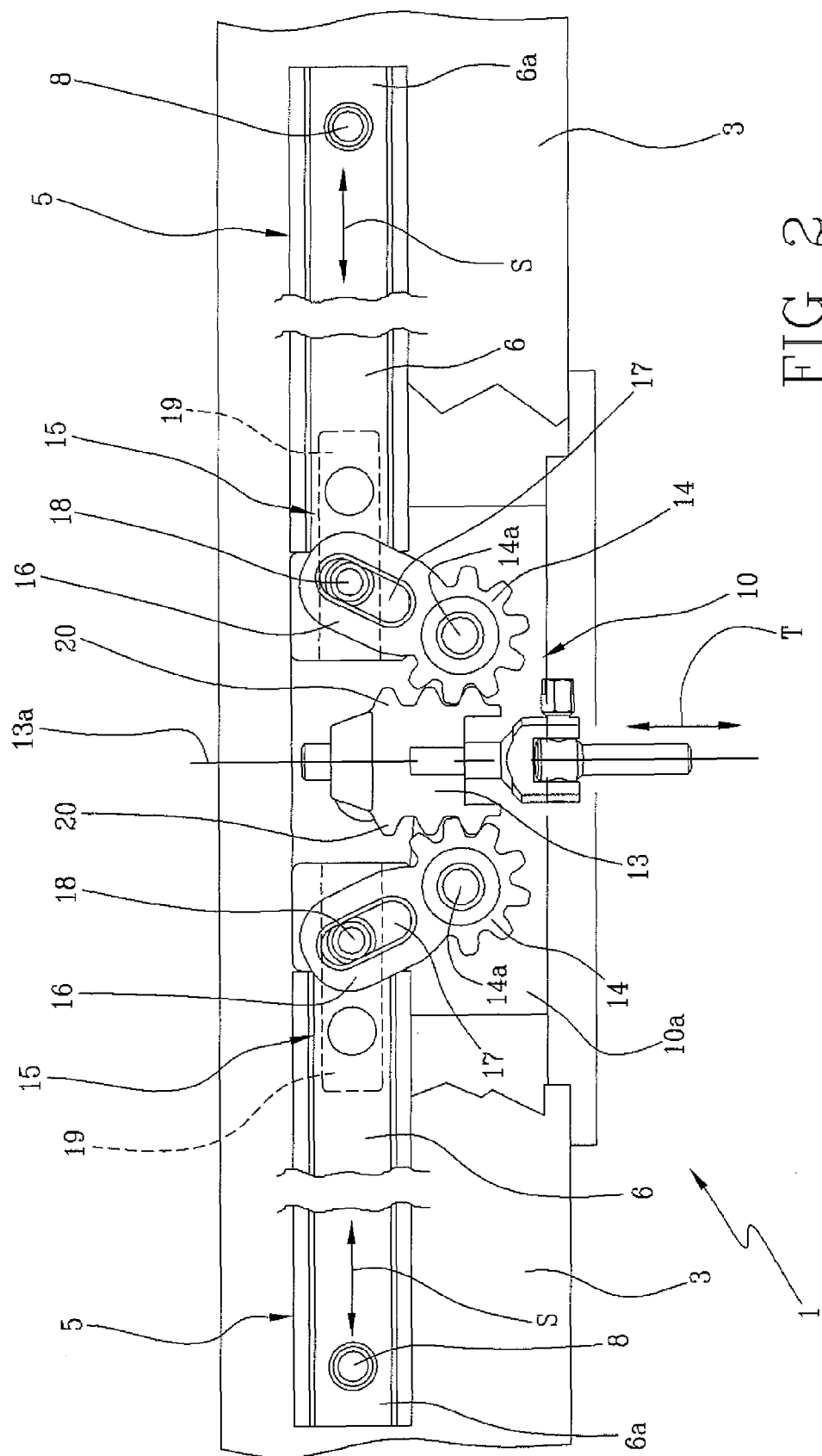


FIG 2

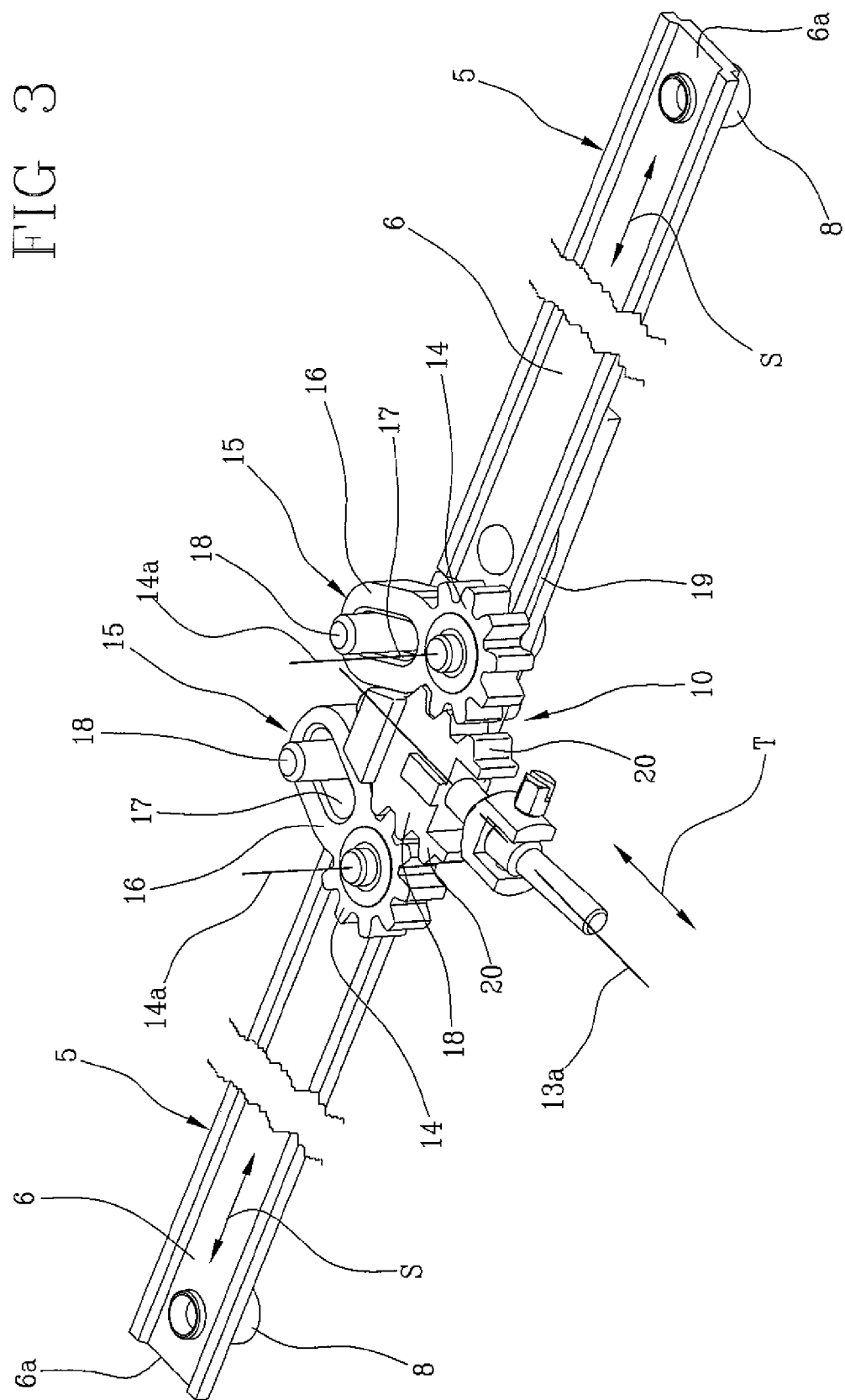


FIG 4

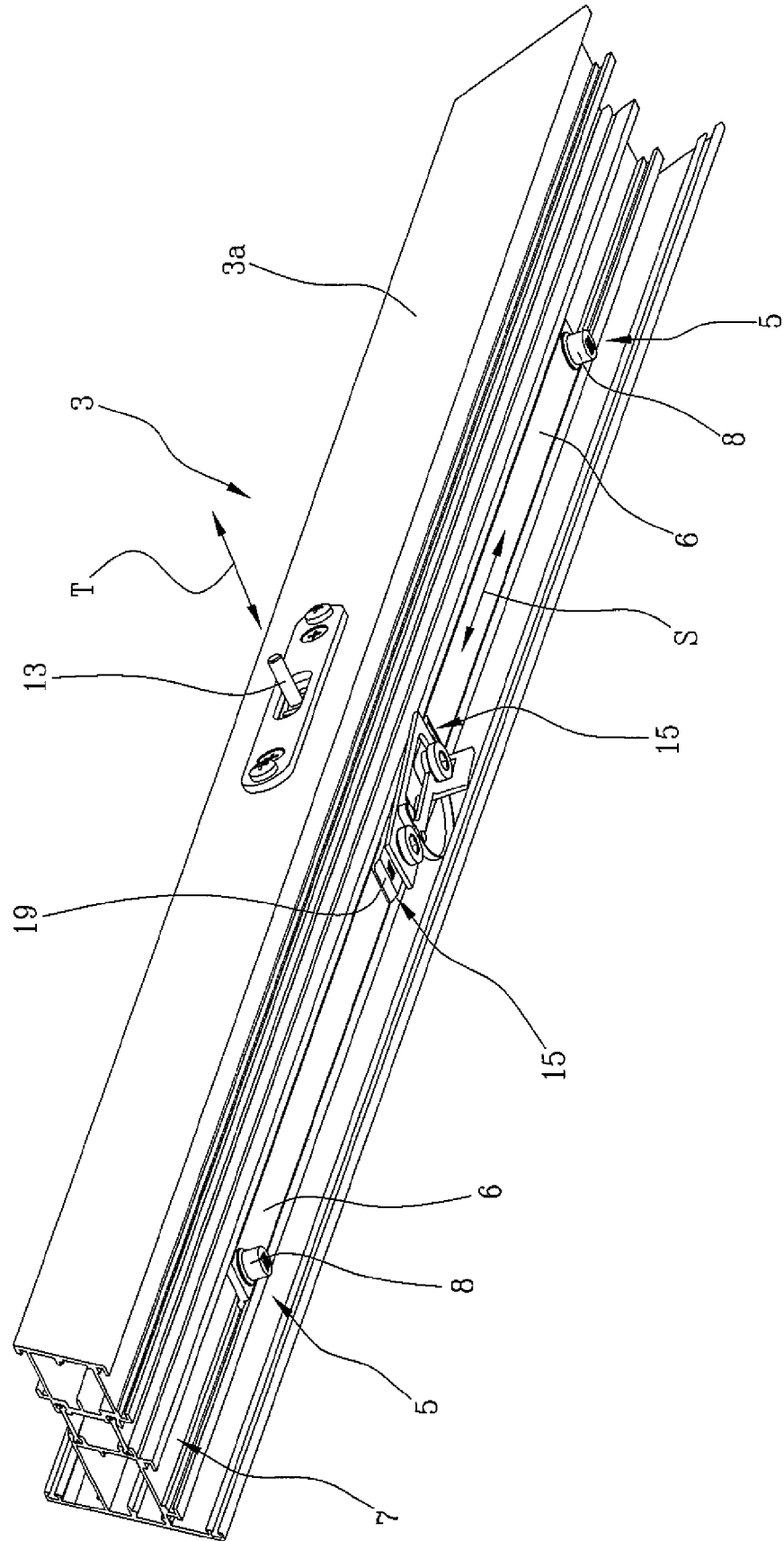


FIG 5

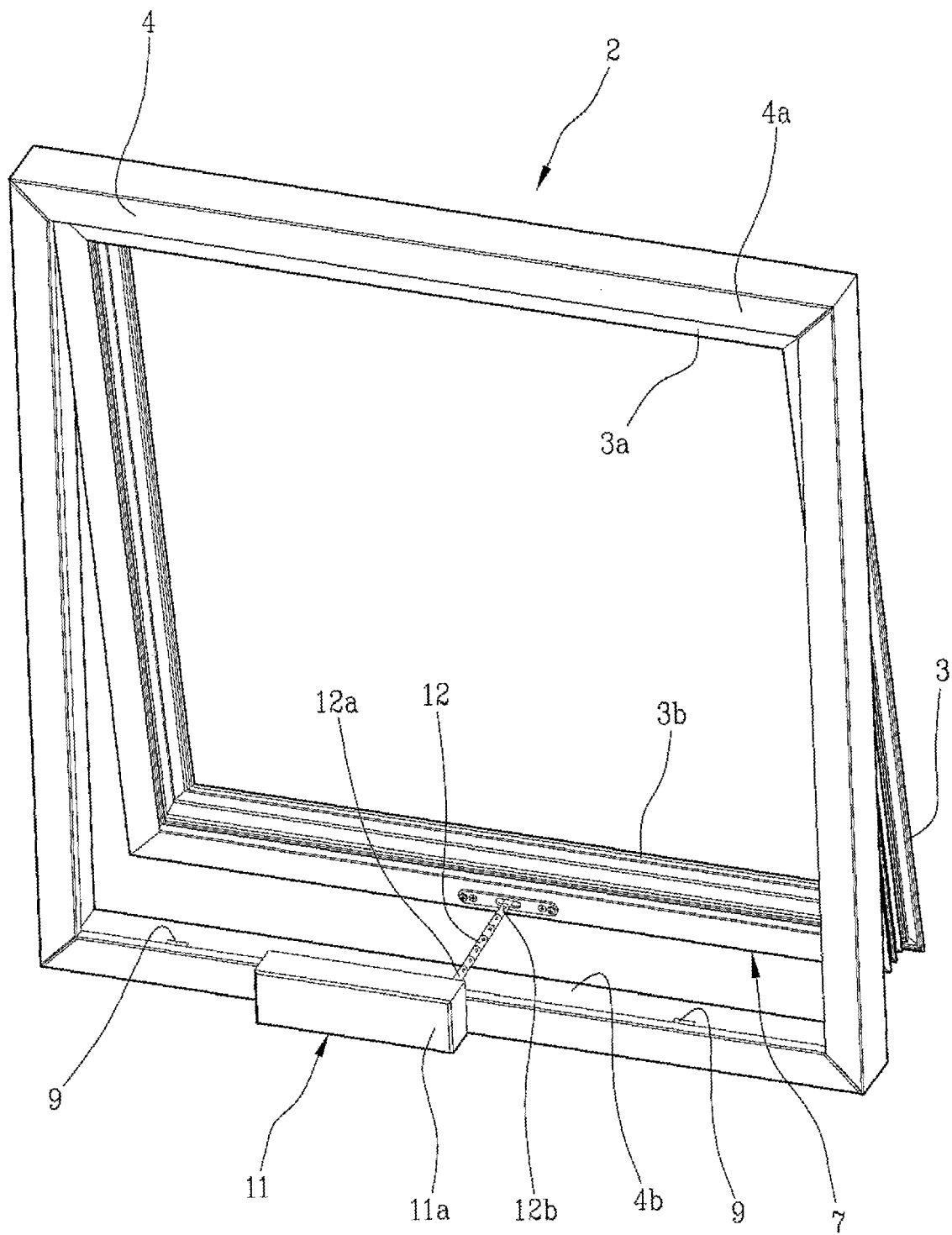


FIG 6

