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(54) **OPENING/CLOSING BODY STOP DEVICE FOR OPENING/CLOSING DEVICE**

(57) To prevent a load such as a clamping force or a rubbing force from acting on a cord-like material when the cord-like material is pulled in a direction that turns on a brake device. When a shutter curtain (1), which is an opening/closing body performing opening/closing movements, comes into contact with an obstacle during a closing movement, a locking wire (36), which is a cord-like member, is joined with the curtain, and a tensioning force that acts on the wire causes the brake device to be turned on and the closing movement of the curtain is stopped. A pulling device (56) that pulls the wire in a direction that turns on the brake device at the same time when and/or after the curtain comes into contact with the obstacle is provided on the curtain. The pulling device is configured as a device which causes a winding device (40), which is a device for feeding out the wire during a closing movement of the curtain, to perform an operation to wind the wire, a device which makes a linear portion of the wire non-linear by using a rotatable pressure member, a device which causes a rotatable guide member that guides the wire to perform a movement, and a device which causes the winding device to perform a movement.

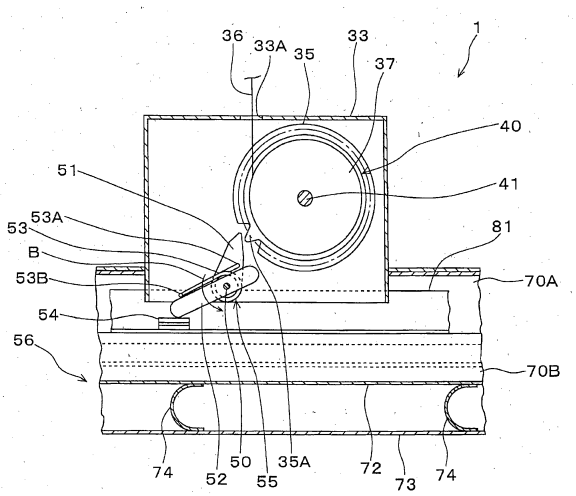

FIG. 6

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Description

TECHNICAL FIELD

[0001] The present invention relates to an opening/closing body stop device of an opening/closing device for stopping a closing movement of an opening/closing body when the opening/closing body comes into contact with an obstacle during the closing movement and is usable in various opening/closing devices in which a shutter curtain serves as an opening/closing body as represented by a shutter device for both security and disaster prevention, an awning device, and a smokeproof drapery device.

BACKGROUND ART

[0002] With a security shutter device which is an opening/closing device and in which a shutter curtain constitutes an opening/closing body that performs opening/closing movements, the shutter curtain for closing an opening such as a doorway performs an opening movement, a closing movement, or a movement stop when a manipulation device is operated. In addition, with a disaster prevention shutter device which similarly constitutes an opening/closing device, a shutter curtain having a disaster prevention function such as a smokeproof function performs a closing movement upon occurrence of an abnormal event such as a fire. As a result, a disaster prevention zone is formed inside a structure such as a building. With such a security shutter device or a disaster prevention shutter device, as well as a shutter device for both security and disaster prevention, a closing movement of a shutter curtain is stopped when an obstacle exists in a closing direction of the shutter curtain and the shutter curtain comes into contact with the obstacle during the closing movement. Devices for executing this stop are disclosed in Patent Document 1 and Patent Document 2 described below.

[0003] These devices are configured to include: a shutter curtain that performs opening/closing movements; a cord-like member that is joined with the shutter curtain when the shutter curtain comes into contact with an obstacle during a closing movement; and a brake device which is turned on by a tensioning force acting on the cord-like member and which stops the closing movement of the shutter curtain. When the shutter curtain comes into contact with an obstacle during a closing movement, the shutter curtain and the cord-like member are joined to generate a tensioning force on the cord-like member, the tensioning force turns on the brake device and, as a result, the closing movement of the shutter curtain is stopped.

[0004] In addition, Patent Document 3 described below discloses a pulling device capable of pulling a cord-like member in a direction that turns on a brake device at the same time when and/or after a shutter curtain comes into contact with an obstacle even in a case of a hard obstacle that does not sustain or hardly sustains a dent deformation even when the shutter curtain comes into contact with the obstacle. According to this pulling device, even in the case of a hard obstacle, the cord-like member can be pulled in a direction that turns on the brake device in a similar manner to a case of a soft obstacle that sustains a dent deformation. As a result, a shutter curtain that comes into contact with an obstacle during a closing movement can be stopped more reliably.

[0005] The pulling device described in Patent Document 3 is configured to include two lever members disposed on both sides of the cord-like member as though sandwiching the cord-like member. When the shutter curtain comes into contact with an obstacle during a closing movement, the cord-like member is clamped by the lever members and the clamping causes a linear portion of the cord-like member to deform into a non-linear portion. As a result, the cord-like member is pulled in a direction that turns on the brake device.

Patent Document 1: Japanese Patent Application Laid-open No. 2000-96961
Patent Document 2: Japanese Patent Application Laid-open No. 2009-13647
Patent Document 3: Japanese Patent Application Laid-open No. 2010-59767

(Paragraphs 0133 to 0144, particularly Paragraph 0138 and FIGS. 15 and 21)

DISCLOSURE OF THE INVENTION

[0006] However, with the pulling device described in Patent Document 3, since the cord-like member is clamped by the two lever members to be pulled in a direction that turns on the brake device, the cord-like member is subjected to a clamping force from the two lever members. In addition, since the cord-like member subjected to the clamping force is pulled in a direction that turns on the brake device, the cord-like member is subjected to a rubbing force from the lever members.

[0007] An object of the present invention is to provide an opening/closing body stop device of an opening/closing device which prevents a load such as a clamping force or a rubbing force from acting on a cord-like material when the cord-like material is pulled in a direction that turns on a brake device.

[0008] An opening/closing body stop device of an opening/closing device according to the present invention includes: an opening/closing body that performs opening/closing movements; a cord-like member that is joined with the opening/closing body when the opening/closing body comes into contact with an obstacle during a closing movement; a brake device that is turned on by a tensioning force acting on the cord-like member and that stops the closing movement of the opening/closing body; and a pulling device that pulls the cord-like member in a direction that turns on the brake device at the same

time when and/or after the opening/closing body comes into contact with the obstacle, wherein the opening/closing body stop device includes a winding device that feedably winds the cord-like member, and the pulling device is configured as a device that causes the winding device, which is a device for feeding the cord-like member during a closing movement of the opening/closing body, to perform an operation to wind the cord-like member.

[0009] Since the opening/closing body stop device of an opening/closing device includes a winding device that feedably winds the cord-like member and the pulling device is configured as a device which causes the winding device that is a device for feeding the cord-like member during a closing movement of the opening/closing body to perform an actuation for winding the cord-like member, when the cord-like material is pulled in a direction that turns on the brake device, the cord-like material is only subjected to a pulling force due to the winding and the cord-like material is not subjected to a load such as a clamping force or a rubbing force. As a result, safety of the cord-like member can be secured.

[0010] In the opening/closing body stop device of an opening/closing device, the winding device may include a winding reel that feedably winds the cord-like member, and the pulling device may be configured as a device that causes the winding reel that is a member for feeding the cord-like member during a closing movement of the opening/closing body to perform a pivot to wind the cord-like member.

[0011] In addition, the winding device may be configured to include a rotate member that has a plurality of tooth sections formed in an outer circumferential part thereof and that is joined integrally with the winding reel, the opening/closing body may be provided with an engaging member that engages the tooth sections of the rotate member by pivoting around a shaft, and the winding reel may be configured to perform a pivot to wind the cord-like member as the engaging member engages the tooth sections of the rotate member.

[0012] Moreover, the joining and integration of the winding reel and the rotate member may be realized by joining the winding reel and the rotate member which had respectively been manufactured as separate components or by configuring a part of a single component as the winding reel and the remainder of the component as the rotate member.

[0013] Furthermore, the engaging member may pivot around the shaft even after being engaged with the tooth sections of the rotate member and the pivot of the engaging member may cause the winding reel to perform a pivot to wind the cord-like member.

[0014] In addition, the opening/closing body may be configured to include an opening/closing body main part and an opening/closing body sub part that performs a movement with respect to the opening/closing body main part when the opening/closing body comes into contact with an obstacle during a closing movement, the opening/closing body sub part may be configured to include a first movable member that is disposed on a side of the opening/closing body main part, a second movable member that is disposed on an opposite side to the opening/closing body main part with respect to the first movable member, and an elastic member that is disposed between the first movable member and the second movable member, and the engaging member may be configured to pivot around the shaft even after being engaged with the tooth sections of the rotate member due to an elastic shrink deformation caused by the elastic member when the opening/closing body comes into contact with the obstacle.

[0015] In addition, the engaging member may be provided with a plurality of engaging parts on a circular arc or an approximately circular arc centered on the shaft, and the winding reel may be configured to perform a pivot to wind the cord-like member as the engaging parts sequentially engage with the tooth sections of the rotate member.

[0016] Furthermore, the pivot performed by the engaging member around the shaft due to the opening/closing body coming into contact with the obstacle may be a pivot of at least two stages, and the pivot of at least two stages may cause the winding reel to perform a pivot to wind the cord-like member.

[0017] In addition, the opening/closing body may be configured to include an opening/closing body main part and an opening/closing body sub part that performs a movement with respect to the opening/closing body main part when the opening/closing body comes into contact with an obstacle during a closing movement, and a movement of the opening/closing body sub part may cause the engaging member to perform a pivot of at least two stages around the shaft.

[0018] Furthermore, the engaging member may be provided with a plurality of locations which is sequentially subjected to a push-up force when the opening/closing body sub part performs a movement with respect to the opening/closing body main part, and the push-up force that sequentially acts on the locations may cause the engaging member to perform a pivot of at least two stages around the shaft.

[0019] In addition, respective distances of the plurality of locations from the shaft may be set to differ from one another, and a distance of a location last subjected to the push-up force from the shaft may be set shorter than a distance of a location first subjected to the push-up force from the shaft.

[0020] Accordingly, due to the push-up force sequentially acting on the respective locations, a winding length of the cord-like member by the winding reel can be increased in stages and, as a result, a length by which the cord-like member is pulled in a direction that turns on the brake device can be sufficiently increased.

[0021] In addition, an opening/closing body stop device of an opening/closing device according to the present invention includes: an opening/closing body that performs opening/closing movements; a cord-like mem-

ber that is joined with the opening/closing body when the opening/closing body comes into contact with an obstacle during a closing movement; a brake device that is turned on by a tensioning force acting on the cord-like member and that stops the closing movement of the opening/closing body; and a pulling device that pulls the cord-like member in a direction that turns on the brake device at the same time when and/or after the opening/closing body comes into contact with the obstacle, wherein the opening/closing body stop device of an opening/closing device includes two rotate members which are bridged by at least a linear part of the cord-like member, the pulling device is configured as a device that makes the linear portion of the cord-like member non-linear, the pulling device is configured to include a moving member that applies pressure to the linear portion of the cord-like member to make the linear portion non-linear, and a portion of the moving member that applies pressure to the linear portion is configured as a rotatable pressure member.

[0022] Since the pulling device in the opening/closing body stop device of an opening/closing device is configured as a device that makes the linear portion of the cord-like member non-linear, the pulling device is also configured to include a moving member which applies pressure to the linear portion of the cord-like member to make the linear portion non-linear, and a portion of the moving member that applies pressure to the linear portion is configured as a rotatable pressure member, the pressure member rotates when the cord-like member is pulled by the moving member in a direction that turns on the brake device. As a result, the cord-like material is not subjected to a load such as a clamping force or a rubbing force and safety of the cord-like member can be secured.

[0023] Alternatively, the moving member may be a swing member that swings around a shaft, a slide member that slides linearly, or a member that performs an arbitrary movement.

[0024] Furthermore, an opening/closing body stop device of an opening/closing device according to the present invention includes: an opening/closing body that performs opening/closing movements; a cord-like member that is joined with the opening/closing body when the opening/closing body comes into contact with an obstacle during a closing movement; a brake device that is turned on by a tensioning force acting on the cord-like member and that stops the closing movement of the opening/closing body; and a pulling device that pulls the cord-like member in a direction that turns on the brake device at the same time when and/or after the opening/closing body comes into contact with the obstacle, wherein a guide member that guides the cord-like member is rotatably provided midway along an extending direction of the cord-like member, and the pulling device is configured as a device that causes the guide member to perform a movement in order to pull the cord-like member in a direction that turns on the brake device.

[0025] With this opening/closing body stop device of an opening/closing device, since a guide member that guides the cord-like member is rotatably provided midway along an extending direction of the cord-like member and the pulling device is configured as a device that causes the guide member to perform a movement in order to pull the cord-like member in a direction that turns on the brake device, the guide member rotates when the cord-like member is pulled in a direction that turns on the brake device due to a movement of the guide member. As a result, the cord-like material is not subjected to a load such as a clamping force or a rubbing force and safety of the cord-like member can be secured.

[0026] In addition, an opening/closing body stop device of an opening/closing device according to the present invention includes: an opening/closing body that performs opening/closing movements; a cord-like member that is joined with the opening/closing body when the opening/closing body comes into contact with an obstacle during a closing movement; a brake device that is turned on by a tensioning force acting on the cord-like member and that stops the closing movement of the opening/closing body; and a pulling device that pulls the cord-like member in a direction that turns on the brake device at the same time when and/or after the opening/closing body comes into contact with the obstacle, wherein the opening/closing body stop device of an opening/closing device includes a winding device that feedably winds the cord-like member, and the pulling device is configured as a device that causes the winding device to perform a movement in order to pull the cord-like member in a direction that turns on the brake device.

[0027] Since the opening/closing body stop device of an opening/closing device includes a winding device that feedably winds the cord-like member, and the pulling device is configured as a device that causes the winding device to perform a movement in order to pull the cord-like member in a direction that turns on the brake device, only a pulling force acts on the cord-like material when the cord-like member is pulled in a direction that turns on the brake device. As a result, the cord-like material is not subjected to a load such as a clamping force or a rubbing force and safety of the cord-like member can be secured.

[0028] In the opening/closing body stop devices of an opening/closing device according to the present invention described above, the cord-like member may be a wire, a chain such as a roller chain, or a cord made of synthetic resin or the like.

[0029] Furthermore, the opening/closing body stop device of an opening/closing device may independently constitute a single device or may be combined with, for example, an electric motor device that causes the opening/closing body to perform opening/closing movements so as to constitute a part of an opening/closing machine that causes the opening/closing body to perform opening/closing movements.

[0030] In addition, a slide member that slides in order to switch between on and off states of the brake device may be provided between the cord-like member and the

brake device, and the slide member may be configured to slide in order to switch the brake device from an off state to an on state when the cord-like member is pulled.

[0031] Furthermore, the slide member may be, for example, a member that constitutes an automatic block device that causes the opening/closing body having stopped at a fully opened position to perform a closing movement or may be a member that constitutes a device or the like that is separate from the automatic block device.

[0032] In addition, the present invention can be applied to arbitrary opening/closing devices in which an arbitrary opening/closing body is capable of performing opening/closing movements. An example of such an opening/closing device is a shutter device in which a shutter curtain constitutes an opening/closing body. Furthermore, the present invention can also be applied to an awning device and to various opening/closing devices such as a smokeproof drapery device.

[0033] Alternatively, the shutter device may be a security shutter device in which a shutter curtain performs opening/closing movements and a movement stop in accordance with a manipulation of a manipulation device, a disaster prevention shutter device in which a fully closed shutter curtain forms a disaster prevention zone, or a shutter device for both security and disaster prevention.

[0034] In addition, a signal transmission system of the manipulation device of the security shutter device may be a wired system or a wireless system.

[0035] According to the present invention, a cord-like material is not subjected to a load such as a clamping force or a rubbing force when the cord-like material is pulled in a direction that turns on a brake device and an effect of securing safety of a cord-like member can be produced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

FIG. 1 is a front view of an entire shutter device that is an opening/closing device according to an embodiment of the present invention;
FIG. 2 is a sectional view taken along S2-S2 in FIG. 1;
FIG. 3 is a sectional view showing an internal structure of an opening/closing machine shown in FIGS. 1 and 2;
FIG. 4 is a sectional view taken along S4-S4 in FIG. 1;
FIG. 5 is a diagram which is similar to FIG. 4 and which shows a mechanical join device housed inside a case shown in FIGS. 1 and 4;
FIG. 6 is a sectional view showing the mechanical join device shown in FIG. 5 from behind a shutter curtain;
FIG. 7 is a diagram which is similar to FIG. 4 and which shows a state where a shutter curtain is in contact with an obstacle;
FIG. 8 is a diagram which is similar to FIG. 6 and which shows the state shown in FIG. 7;
FIG. 9 is a diagram which is similar to FIG. 4 and which shows a state where a shutter curtain has come into contact with an obstacle and a pulling device has been actuated;
FIG. 10 is a diagram which is similar to FIG. 6 and which shows the state shown in FIG. 9;
FIG. 11 is a diagram showing an internal structure of a delay device shown in FIGS. 1 and 2;
FIG. 12 is a front view showing an internal structure of an automatic block device shown in FIGS. 1 to 3;
FIG. 13 is a plan view showing an internal structure of an automatic block device;
FIG. 14 is a diagram which is similar to FIG. 13 and which shows a state where a solenoid of an automatic block device has been energized and excited due to an occurrence of a disaster such as a fire;
FIG. 15 is a diagram which is similar to FIG. 13 and which shows a state where energization and excitation of a solenoid of an automatic block device are stopped;
FIG. 16 is a diagram which is similar to FIG. 13 and which shows a state where a shutter curtain during a closing movement has come into contact with an obstacle;
FIG. 17 is a diagram which is similar to FIG. 4 and which shows a pulling device according to a first alternative embodiment;
FIG. 18 is a diagram which is similar to FIG. 6 and which shows the pulling device according to the first alternative embodiment;
FIG. 19 is a diagram which is similar to FIG. 10 and which shows the pulling device according to the first alternative embodiment;
FIG. 20 is a diagram which is similar to FIG. 6 and which shows a pulling device according to a second alternative embodiment;
FIG. 21 is a diagram which is similar to FIG. 10 and which shows the pulling device according to the second alternative embodiment;
FIG. 22 is a diagram which is similar to FIG. 6 and which shows a pulling device according to a third alternative embodiment;
FIG. 23 is a diagram which is similar to FIG. 10 and which shows the pulling device according to the third alternative embodiment;
FIG. 24 is a diagram which is similar to FIG. 6 and which shows a pulling device according to a fourth alternative embodiment;
FIG. 25 is a diagram which is similar to FIG. 10 and which shows the pulling device according to the fourth alternative embodiment;
FIG. 26 is a diagram which is similar to FIG. 6 and which shows a pulling device according to a fifth alternative embodiment;
FIG. 27 is a diagram which is similar to FIG. 10 and which shows the pulling device according to the fifth

alternative embodiment;
FIG. 28 is a diagram which is similar to FIG. 5 and which shows a pulling device according to a sixth alternative embodiment;
FIG. 29 is a diagram which is similar to FIG. 6 and which shows the pulling device according to the sixth alternative embodiment;
FIG. 30 is a diagram which is similar to FIG. 7 and which shows the pulling device according to the sixth alternative embodiment;
FIG. 31 is a diagram which is similar to FIG. 6 and which shows a state where an actuation of the pulling device has slightly progressed from the state shown in FIG. 29;
FIG. 32 is a diagram which is similar to FIG. 10 and which shows the pulling device according to the sixth alternative embodiment;
FIG. 33 is a partially enlarged view of FIG. 32;
FIG. 34 is a diagram which is similar to FIG. 1 and which shows an alternative embodiment regarding an arrangement of a winding device; and
FIG. 35 is a diagram which is similar to FIG. 1 and which shows an embodiment of a case where a roller chain is adopted as a bridge member.

EXPLANATION OF REFERENCE NUMERALS

[0037]

1	shutter curtain that is an opening/closing body
13	opening/closing machine
16	lintel that is a non-moving member
19	brake device
32	automatic block device
34	obstacle
35, 235, 635	rotate member
35A, 235A, 635A	tooth section
36	locking wire that is a cord-like member
36A	linear portion
37, 637	winding reel
38	delay device
40	winding device
50, 654	center shaft of pivot of engaging member
51, 251, 650	engaging member
55	mechanical join device
56	pulling device
71A	curtain main part that is an opening/closing body main part
71B	curtain sub part that is an opening/closing body sub part
72	first movable member
73	second movable member
74	elastic member
150, 237, 338	guide roller that is a guide member
152, 254	swing member that is also a moving member
153, 238	pressure member
653	engaging part
836	roller chain that is a cord-like member

BEST MODE FOR CARRYING OUT THE INVENTION

[0038] Hereinafter, preferred embodiments the present invention will be described with reference to the drawings. An opening/closing device according to a present embodiment is a shutter device in which a shutter curtain is adopted as an opening/closing body. In addition, the shutter device according to the present embodiment is a shutter device for both security and disaster prevention. In other words, the shutter device according to the present embodiment has a function as a security shutter device in which a shutter curtain performs an opening movement, a closing movement, and a movement stop in accordance with a manipulation of a manipulation device in order to open and close an opening such as a doorway and a function as a disaster prevention shutter device in which a shutter curtain having a disaster prevention function such as a smokeproof function performs a closing movement upon an occurrence of an abnormal situation such as a fire so that the shutter curtain forms a disaster prevention zone inside a structure such as a building when fully closed.

[0039] FIG. 1 shows the shutter device according to the present embodiment in its entirety. An up-down direction in FIG. 1 represents a direction of opening and closing movements. FIG. 1 shows a shutter curtain 1

which performs a closing movement in a downward direction being closed to approximately halfway and is in a half-closed state. An opening that is opened and closed by the shutter curtain 1 is a doorway 2 formed on a building. The doorway 2 is enclosed by left and right building frames 3 that are walls or the like, a floor 4 that is a partner member against which a lower end part of the shutter curtain 1 butts when fully closed, and a ceiling member 5. A pair of left and right guide rails 6 in which both end parts of the shutter curtain 1 in a left-right direction or, in other words, both end parts of the shutter curtain 1 in a width direction are slidably inserted is attached to the left and right building frames 3. The shutter curtain 1 performs opening/closing movements upward and downward while being guided by the guide rails 6 which constitute guide members.

[0040] A shutter box 8 is disposed in a ceiling space 7 that is partitioned by the ceiling member 5 with respect to the doorway 2. As shown in FIG. 2 that is a sectional view taken along S2-S2 in FIG. 1, the shutter box 8 is joined by a joining tool 10 such as a bolt to a building frame 9 such as a suspended wall existing in the ceiling space 7 A winding shaft 11 is horizontally housed and disposed inside the shutter box 8. The winding shaft 11 is rotatably supported by left and right side surface parts 8Aand 8B of the shutter box 8 shown in FIG. 1.

In addition, as shown in FIG. 1, an opening/closing machine 13 is connected via drive force transmitting means 12 constituted by a sprocket wheel and a roller chain to one end part of the winding shaft 11.

The opening/closing machine 13 that is configured as a drive device for driving the winding shaft 11 is also shown in FIG. 2. A rotational force of a drive shaft 14 of the opening/closing machine 13 is transmitted to the winding shaft 11 via the drive force transmitting means 12 constituted by a drive sprocket wheel 12A attached to the drive shaft 14, a driven sprocket wheel 12B attached to the one end part of the winding shaft 11, and an endless roller chain 12C that bridges between the sprocket wheels 12A and 12B.

[0041] Moreover, as shown in FIG. 2, the opening/closing machine 13 according to the present embodiment is attached to a bracket member 15 that is joined to one side surface part 8B among the left and right side surface parts 8A and 8B of the shutter box 8.

[0042] As is apparent from FIG. 2, the shutter curtain 1 is wound around the winding shaft 11 and an upper end of the shutter curtain 1 is joined to an outer circumferential surface of the winding shaft 11. In addition, a portion below the winding shaft 11 of the shutter curtain 1 is hung down toward a lower side of the ceiling member 5 through a slit 17 provided in a lintel 16 disposed on the ceiling member 5, and both end parts of the shutter curtain 1 in a width direction are slidably inserted into the left and right guide rails 6 as described earlier. The lintel 16 is constituted by lintel members 16A and 16B disposed so as to oppose each other, and a space between the lintel members 16A and 16B constitutes the slit 17.

[0043] FIG. 3 is a sectional view showing an internal structure of the opening/closing machine 13. As shown in FIG. 3, the opening/closing machine 13 is constituted by a DC or AC electric motor device 18 and a brake device 19 which are provided side by side in a shaft direction, and the drive shaft 14 described earlier constitutes a rotary shaft that is fixed and disposed at a center of a rotating rotor 18A of the electric motor device 18. A disk-like first brake member 20 is joined to an end part of the drive shaft 14 on a side of the brake device 19. A brake shaft 21 that is configured to be slidable only over a certain distance in a shaft direction is provided in the brake device 19. A second brake member 22 that opposes the first brake member 20 in the shaft direction is joined to the brake shaft 21. Under normal conditions, the brake shaft 21 and the second brake member 22 are urged toward a side of the electric motor device 18 by a spring 23. As a result, the brake device 19 is turned on by pressure contact between the first brake member 20 and the second brake member 22. Therefore, the drive shaft 14 of the electric motor device 18 at this point is prevented from rotating by a brake force of the brake device 19.

[0044] On the other hand, when a solenoid 24 that is disposed in the brake device 19 is energized, due to a magnetic force of the solenoid 24, the brake shaft 21 and the second brake member 22 slide in a direction of separation from the electric motor device 18 against the spring 23. Therefore, the pressure contact between the first brake member 20 and the second brake member 22 is released and the brake device 19 is turned off. Therefore, at this point, the drive shaft 14 of the electric motor device 18 is capable of rotating due to energization of a coil 25.

[0045] As described above, since the brake device 19 is turned off by energization of the solenoid 24 and the brake device 19 is turned on when the energization is stopped, the brake device 19 is configured as a brake device that is electrically turned on and off.

[0046] In the present embodiment, as shown in FIG. 1, a control device 26 is attached to the opening/closing machine 13. The control device 26 electrically controls the electric motor device 18 and the brake device 19 of the opening/closing machine 13. Alternatively, the control device 26 may be attached to a member, means, a device, or the like that is separate from the opening/closing machine 13 and a location where the control device 26 is disposed is arbitrary.

[0047] A manipulation device 30 that causes the shutter curtain 1 to perform an opening movement in an upward direction with respect to the doorway 2, a closing movement in a downward direction with respect to the doorway 2, and a movement stop is attached to one building frame 3A among the left and right building frames 3 shown in FIG. 1. An "open" button, a "close" button, and a "stop" button are provided on the manipulation device 30. In addition, the shutter curtain 1 includes a curtain main body 1A which makes up a large percentage of an area of the shutter curtain 1 and whose upper end is

joined to the winding shaft 11 and a sheet plate 1B that is provided at a lower end part of the curtain main body 1A. The curtain main body 1A according to the present embodiment is formed by consecutively providing a large number of slats up and down.

[0048] The curtain main body 1A constitutes an opening/closing body main part according to the present embodiment and the sheet plate 1B constitutes an end member according to the present embodiment.

[0049] When the "close" button of the manipulation device 30 is manipulated in a fully-opened state of the shutter curtain 1 where the sheet plate 1B has reached a height position of the lintel 16 disposed on the ceiling member 5 described earlier or in a half-closed state (half-opened state) of the shutter curtain 1 where the sheet plate 1B has reached a midway position between the lintel 16 and the floor 4 as shown in FIG. 1, due to control of the control device 26 into which a signal from the "close" button is inputted, the solenoid 24 of the brake device 19 is energized and the brake device 19 is turned off. Accordingly, due to its own weight, the shutter curtain 1 causes a forward rotation of the winding shaft 11 and the drive shaft 14 and is fed out in a downward direction from the winding shaft 11. As the shutter curtain 1 performing the closing movement reaches a fully-closed position, due to control of the control device 26 into which a signal from a sensor (not shown) having detected the fully-closed position is inputted, energization of the solenoid 24 is cut off and the brake device 19 is returned to an on state by the spring 23. In addition, when the "open" button is manipulated in a fully-closed state of the shutter curtain 1 or in a half-opened state (half-closed state) of the shutter curtain 1 where the sheet plate 1B has reached a midway position between the lintel 16 and the floor 4 as shown in FIG. 1, due to control of the control device 26 into which a signal from the "open" button is inputted, the solenoid 24 of the brake device 19 is energized and the brake device 19 is turned off and, at the same time, the coil 25 of the electric motor device 18 is energized by the control of the control device 26. Therefore, the drive shaft 14 rotates in reverse, the rotation is transmitted to the winding shaft 11 via the drive force transmitting means 12 described earlier, and due to a reverse rotation of the winding shaft 11, the shutter curtain 1 is wound by the winding shaft 11 and performs an opening movement. When the shutter curtain 1 reaches the fully opened position, due to control of the control device 26 into which a signal from a sensor (not shown) having detected the fully-opened position is inputted, energization of the solenoid 24 is cut off, the brake device 19 is returned to an on state by the spring 23 and, at the same time, energization of the coil 25 is cut off by the control of the control device 26.

[0050] In addition, when the "stop" button is manipulated during a closing movement of the shutter curtain 1, due to control of the control device 26 into which a signal from the "stop" button is inputted, energization of the solenoid 24 is cut off, the brake device 19 is returned to an on state by the spring 23, and the shutter curtain 1 stops at its present position. Furthermore, when the "stop" button is manipulated during an opening movement of the shutter curtain 1, due to control of the control device 26 into which a signal from the "stop" button is inputted, energization of the solenoid 24 is cut off, the brake device 19 is returned to an on state by the spring 23, energization of the coil 25 of the electric motor device 18 is cut off by the control of the control device 26, and as a result, the shutter curtain 1 stops at its present position.

[0051] As is apparent from the description above, since the floor 4, the guide rails 6, the shutter box 8, the bracket member 15 that is joined to the shutter box 8, the lintel 16, and the like described earlier are non-moving with respect to the shutter curtain 1 which performs opening/closing movements, the floor 4, the guide rails 6, the shutter box 8, the bracket member 15, the lintel 16, and the like are non-moving members with respect to the shutter curtain 1.

[0052] Alternatively, instead of having the shutter curtain 1 perform a closing movement in a downward direction using only its own weight, the shutter curtain 1 may be configured to perform a closing movement using its own weight as well as a forward rotation of the drive shaft 14 that is caused by driving by the electric motor device 18.

[0053] In addition, a return spring constituted by a torsion coil spring or a power spring in which a return force is accumulated during a closing movement of the shutter curtain 1 may be provided in the winding shaft 11 that is configured to be rotatable forward and in reverse as described above, and an opening movement of the shutter curtain 1 in an upward direction may be performed using the return force accumulated in the return spring as an assisting force.

[0054] In the present embodiment, as shown in FIG. 3, a lever member 31 is provided on an end part of the brake shaft 21 on an opposite side to the side of the electric motor device 18. The lever member 31 penetrates the brake shaft 21 and is made up of a first portion 31A and a second portion 31B which are divided by the brake shaft 21 as a boundary. A first flexed part 31C is formed in the first portion 31A and a second flexed part 31D is formed in the second portion 31B. When a load in a direction A or, in other words, a load toward an opposite side to the side of the electric motor device 18 acts on the first portion 31A, the first portion 31A swings in the direction A with the second flexed part 31D acting as a fulcrum. Therefore, the brake shaft 21 and the second brake member 22 slide in a direction A' that is the same direction as the direction A. As a result, even if the solenoid 24 is not energized, the brake device 19 can be turned off.

[0055] Therefore, the brake device 19 also constitutes a mechanical brake device that is turned on and off due to an action of the load in the direction A on the first portion 31A and the spring 23 when the load is released.

[0056] Moreover, the action of the load in the direction

A on the first portion 31A is caused by an automatic block device 32 (to be described later) that is attached to the opening/closing machine 13. As will be apparent from the description below, the automatic block device 32 is a mechanical control device for mechanically controlling the opening/closing machine 13 that constitutes a drive device for driving the shutter curtain 1.

[0057] In addition, when a load in the same direction as the direction A acts on the second portion 31B, since the second portion 31B swings in the same direction as the direction A with the first flexed part 31C acting as a fulcrum, the brake shaft 21 and the second brake member 22 similarly slide in the direction A'. Therefore, in a similar manner, even if the solenoid 24 is not energized, the brake device 19 can be turned off.

[0058] The action of the load in the same direction as the direction A on the second portion 31B as described above can be caused manually. Therefore, the opening/closing machine 13 according to the present embodiment is configured so that that the brake device 19 can also be turned off by a manual operation. Alternatively, the second portion 31B may be omitted with the exception of the second flexed part 31D.

[0059] FIG. 4 is a sectional view taken along S4-S4 in FIG. 1 and shows a structure of a portion of the sheet plate 1B of the shutter curtain 1 shown in FIG. 1. As described earlier, the shutter curtain 1 according to the present embodiment has the curtain main body 1A and the sheet plate 1B, and the sheet plate 1B is made up of a fixed part 70A and a movable part 70B. In addition, the shutter curtain 1 has a curtain main part 71A and a curtain sub part 71B. The curtain main part 71A is constituted by the curtain main body 1A and the fixed part 70A among the sheet plate 1B, and the curtain sub part 71B is constituted by the movable part 70B among the sheet plate 1B. Therefore, the curtain sub part 71B is disposed on a closing side end part of the shutter curtain 1. In addition, the curtain main part 71A constitutes an opening/closing body main part according to the present embodiment and the curtain sub part 71B constitutes an opening/closing body sub part according to the present embodiment.

[0060] Furthermore, as shown in FIG. 4, among the sheet plate 1B, the fixed part 70A that is joined with the curtain main body 1A is formed by inner and outer members 75 and 76 both having box-like sections, and the movable part 70B according to the present embodiment that is movable up and down with respect to the fixed part 70A is configured to include an upper first movable member 72 and a lower second movable member 73 that is movable up and down with respect to the first movable member 72. The first movable member 72 is disposed on a side of the curtain main part 71A described above which constitutes an opening/closing body main part, and the second movable member 73 is disposed on an opposite side of the curtain main part 71A with respect to the first movable member 72. In addition, an elastic member 74 is disposed between the first movable member 72 and the second movable member 73 which are members constituting the curtain sub part 71B. The elastic member 74 is formed by a U-shaped leaf spring as shown in FIG. 6.

[0061] As is apparent from FIG. 4, a lower surface of the inner and outer members 75 and 76 that form the fixed part 70A constitutes an opening 78, and an upper end of a rising part 79 of the first movable member 72 of the sheet plate 1B is inserted into an internal space of the fixed part 70A through the opening 78. Extended parts 79A and 79B that extend outward in a thickness direction of the shutter curtain 1 are formed at the upper end of the rising part 79, and due to the extended parts 79A and 79B being positioned on upper surfaces of projecting piece parts 76A and 76B that are formed on a lower end of the inner member 76 of the fixed part 70A, a downward movement limit of the first movable member 72 with respect to the fixed part 70A is defined. In addition, extended parts 73A and 73B that extend inward in the thickness direction of the shutter curtain 1 are formed at an upper end of the second movable member 73 that is shaped so as to entirely enclose a lower part of the first movable member 72 with the exception of the rising part 79, and due to the extended parts 73A and 73B being positioned on an upper surface of the first movable member 72, a downward movement limit of the second movable member 73 with respect to the first movable member 72 is defined.

[0062] A swing member 81 that is swingable up and down around a fulcrum shaft 80 extending in a width direction of the shutter curtain 1 is housed inside the fixed part 70A. As shown in FIGS. 7 and 9, when the first movable member 72 and the second movable member 73 ascend with respect to the fixed part 70A or, in other words, when the shutter curtain 1 during a closing movement comes into contact with an obstacle 34 shown in FIG. 1 or the like, the extended part 79A of the rising part 79 of the first movable member 72 pushes up the swing member 81. As a result, the swing member 81 swings in an upward direction around the fulcrum shaft 80.

[0063] As shown in FIG. 4, a case 33 that is also shown in FIG. 1 is attached to the fixed part 70A of the sheet plate 1B. An inside of the case 33 is shown in FIGS. 5 and 6. As shown in FIG. 6, a rotate member 35 with an outer circumferential part on which a large number of tooth sections 35A are formed in a circumferential direction and a winding reel 37 are housed inside the case 33 so as to be rotatable around a shaft 41 provided in the case 33. The rotate member 35 and the winding reel 37 are joined and integrated with one another. In addition, a lower end of a locking wire 36 is joined to the winding reel 37. A lower portion of the locking wire 36 is wound by the winding reel 37 and, at the same time, an upper portion of the locking wire 36 extends upward from a hole 33A formed on an upper surface of the case 33. Furthermore, an upper end of the locking wire 36 is coupled to a pivot member 42 of a delay device 38 shown in FIG. 11 via a spring 43.

[0064] As shown in FIGS. 1 and 2, the delay device 38 is installed on the lintel 16 described earlier. Therefore,

the locking wire 36 constitutes a bridge member that bridges between the shutter curtain 1 on which the winding reel 37 is disposed and the lintel 16 that is a non-moving member with respect to the shutter curtain 1 that performs opening/closing movements. In addition, the locking wire 36 that is woundable by the winding reel 37 also constitutes a flexible cord-like member. Furthermore, when the shutter curtain 1 performs a downward closing movement, the shutter curtain 1 performs the downward closing movement while the locking wire 36 is being fed out from the rotating winding reel 37.

[0065] As shown in FIG. 5, a power spring 39 (the power spring 39 is omitted in FIG. 6) that constitutes a return spring is wound between the rotate member 35 and the winding reel 37 around an outer circumference of the shaft 41 that is a rotation center shaft of the rotate member 35 and the winding reel 37. One end part of the power spring 39 is coupled to the case 33 and another end of the power spring 39 is coupled to the rotate member 35 or the winding reel 37. Therefore, when the shutter curtain 1 performs a downward closing movement, a pressure accumulating force for winding the locking wire 36 by the winding reel 37 that rotates in order to feed out the locking wire 36 is accumulated in the power spring 39, and when the shutter curtain 1 performs an upward opening movement, due to the pressure accumulating force causing the winding reel 37 to rotate in reverse, the locking wire 36 is wound by the winding reel 37.

[0066] Therefore, in the present embodiment, the winding reel 37 and the power spring 39 constitute a winding device 40 for feedably winding the locking wire 36.

[0067] As shown in FIG. 6, an engaging member 51 and a lever member 52 that are pivotable in upward and downward directions around a shaft 50 provided in the case 33 are housed inside the case 33. A torsion coil spring 53 is interposed between the engaging member 51 and the lever member 52 as shown in FIG. 5. One end part 53A of the torsion coil spring 53 whose coil part is wound around an outer circumference of the shaft 50 is inserted into a hole formed on the engaging member 51, and another end port 53B is locked on an upper surface of the lever member 52. Therefore, the torsion coil spring 53 constitutes an elastic member for elastically coupling the engaging member 51 and the lever member 52 with one another in a pivot direction around the shaft 50. Alternatively, the torsion coil spring 53 may be omitted and the engaging member 51 and the lever member 52 may be directly coupled with one another.

[0068] As shown in FIGS. 4 and 5, an urge member 54 is attached to the swing member 81 disposed so as to be swingable up and down around the fulcrum shaft 80 inside the fixed part 70A of the sheet plate 1B described earlier. As shown in FIG. 6, an end part of the lever member 52 comes into contact with an end part of the urge member 54 due to a balance of a total weight of the engaging member 51 and the lever member 52 with respect to the shaft 50. The engaging member 51 and the lever member 52 are elastically coupled with one another around the shaft 50 via the torsion coil spring 53 due to the lever member 52 being pivoted and biased in a direction B around the shaft 50 by the torsion coil spring 53 with respect to the engaging member 51 even if the end part of the lever member 52 comes into contact with the urge member 54.

[0069] When the movable part 70B relatively ascends with respect to the fixed part 70A of the sheet plate 1B of the shutter curtain 1 as shown in FIGS. 7 and 9 due to the sheet plate 1B coming into contact with the obstacle 34 shown in FIG. 1 or the like, the urge member 54 causes the lever member 52 and the engaging member 51 to pivot around the shaft 50 in an opposite direction to the direction B shown in FIG. 6. Therefore, the engaging member 51 engages the tooth sections 35A of the rotate member 35 as shown in FIGS. 8 and 10. Due to the engagement, the rotate member 35 and the winding reel 37 that is joined and integrated with the rotate member 35 are no longer able to rotate in a direction of rotation during a movement of the shutter curtain 1 in a closing direction. Accordingly, the rotate member 35 and the winding reel 37 are locked.

[0070] As a result, at this point, the locking wire 36 having one part wound by the winding reel 37 and the shutter curtain 1 on which the winding reel 37 is disposed are mechanically joined with each other. Therefore, in the present embodiment, the rotate member 35, the engaging member 51, the lever member 52, and the like constitute a mechanical join device 55 for mechanically joining the locking wire 36 and the shutter curtain 1 with each other.

[0071] Next, the delay device 38 shown in FIG. 11 will be described. As described earlier, the delay device 38 is provided with the pivot member 42 to which an upper end of the locking wire 36 is coupled via the spring 43. A pivot direction of the pivot member 42 is an up-down direction around a horizontal center shaft 42A. A return spring 100 constituted by a power spring or the like is disposed behind the pivot member 42. A return force of the return spring 100 acts on the pivot member 42 so as to cause the pivot member 42 to pivot in a direction C or, in other words, to cause the pivot member 42 to pivot in a direction that pulls up the locking wire 36. A circular oblong hole 42B that is centered on the center shaft 42A is formed on the pivot member 42. A stop member 101 attached to a frame 49 of the delay device 38 is inserted into the oblong hole 42B. Due to the stop member 101, a pivot amount of the pivot member 42 is regulated to a certain amount.

[0072] Gear teeth 42C are formed in a part of an outer circumferential part of the pivot member 42. Therefore, the pivot member 42 constitutes a sector gear in which the gear teeth 42C are partially formed. In addition, two rotary dampers 102 are disposed in the delay device 38. The dampers 102 include a pinion gear 103 that meshes with the gear teeth 42C of the pivot member 42. A plurality of blades disposed inside the dampers 102 are attached to a rotation center shaft 104 of the pinion gear 103 via

a one-way clutch. When the pinion gear 103 and the center shaft 104 rotate in a direction E due to a pivot of the pivot member 42 in the direction C, each blade rotates via the one-way clutch in a viscous fluid that is filled inside the dampers 102. Therefore, due to a resistance force of the viscous fluid, the pivot member 42 pivots at a low speed in the direction C. On the other hand, when the pivot member 42 pivots in a direction D that is opposite to the direction C and the pinion gear 103 and the center shaft 104 rotate in a direction F, the rotation in the direction F is not transmitted to the respective blades due to a cut-off action of the one-way clutch. As a result, the pivot member 42 can pivot at high speed in the direction D.

[0073] Alternatively, only one damper 102 may be provided. However, by providing a plurality of the dampers 102 as in the case of the present embodiment, the resistance force that causes the pivot member 42 to pivot at low speed in the direction C can be increased. Accordingly, the speed of the pivot member 42 in the direction C can be reduced to a desired speed.

[0074] As shown in FIG. 1 and 2, the automatic block device 32 is placed on and fixed to an upper part of the opening/closing machine 13. FIG. 12 is a front view showing an internal structure of the automatic block device 32, and FIG. 13 is a plan view showing the internal structure of the automatic block device 32. The automatic block device 32 is provided in order to mechanically control the opening/closing machine 13 upon an occurrence of a disaster such as a fire to cause the shutter curtain 1 having stopped at the fully opened position or at a midway position in an opening/closing direction to automatically perform a closing movement so that the shutter curtain 1 becomes fully closed, and to block the doorway 2 shown in FIG. 1 by the shutter curtain 1 having a smokeproof property and/or a fireproof property. The automatic block device 32 is attached to the opening/closing machine 13 by a bracket part 110A shown in FIG. 12 that is provided on a frame 110 of the automatic block device 32. In addition, as shown in FIG. 13, respective end parts of a first controlling wire 111, a second controlling wire 112, and a third controlling wire 113 for controlling the automatic block device 32 are extended to the automatic block device 32. The controlling wires 111 to 113 constitute flexible cord-like members in a similar manner to the locking wire 36 described earlier and also constitute elongated members.

[0075] In addition, the controlling wires 111 to 113 are slidably inserted through the inside of flexible outer cables 114 to 116. Therefore, the controlling wires 111 to 113 are protected by the outer cables 114 to 116.

[0076] As shown in FIGS. 1, 2, and 11, the first controlling wire 111 is extended to the delay device 38, and an end part of the first controlling wire 111 is coupled with the pivot member 42 of the delay device 38 as shown in FIG. 11.

[0077] As shown in FIGS. 12 and 13, two rising parts 110B and 110C that oppose each other are provided on the frame 110 of the automatic block device 32. A plate-like slide member 120 having a length that straddles the two rising parts 110B and 110C is slidably inserted into holes 110D and 110E formed in the rising parts 110B and 110C. A coil spring 121 is wound around an outer circumference of the slide member 120, and due to a spring force of the spring 121 that constitutes an elastic bias member, and the slide member 120 is constantly subjected to an advancing force toward a side of the rising part 110B. A direction of the advancing force is a direction that moves the first portion 31A of the lever member 31 described earlier that is provided on the opening/closing machine 13 described with reference to FIG. 3 in the direction A.

[0078] As shown in FIG. 3 and 12, an actuating member 122 is attached to a bent part 120A that is formed so as to bend in a downward direction at a front end of the slide member 120, and an actuated member 123 is erected at and joined to the first portion 31A of the lever member 31 shown in FIG. 3. When the slide member 120 advances due to the spring force of the spring 121, the actuating member 122 comes into contact with the actuated member 123, and the first portion 31A of the lever member 31 is subjected to a load in the direction A shown in FIG. 3. As shown in FIG. 12, in the present embodiment, the actuating member 122 is configured as a head part 124A of a bolt 124. Therefore, by rotating and manipulating the head part 124A to cause the bolt 124 to advance or retreat with respect to the bent part 120A of the slide member 120, a spacing between the actuating member 122 and the actuated member 123 can be adjusted to a suitable dimension. After performing such an adjustment, by rotating and manipulating a lock nut 125 that had been screwed on the bolt 124 so as to bring the lock nut 125 into contact with the bent part 120A, a position of the actuating member 122 with respect to the actuated member 123 can be adjusted to a suitable position and the actuating member 122 can be fixed at the position.

[0079] As shown in FIG. 13, a solenoid 126 is attached to the frame 110 of the automatic block device 32. A plunger 127 of the solenoid 126 is constantly subjected to a spring force of a coil spring 128 in a direction that causes the plunger 127 to protrude from the solenoid 126. A tip member 140 is attached by a fastener 127A such as a screw to a tip of the plunger 127. One end part of a L-shaped flexed lever member 129 configured to be pivotable around a center shaft 129A is in contact with the tip member 140. As is apparent from FIG. 12, an erecting/lowering member 141 is in contact with the tip member 140 having an inverted L-shape at a surface on an opposite side to a surface with which the one end part of the flexed lever member 129 is in contact. The erecting/lowering member 141 is pivotably attached to a rising part of a bracket 142 shown in FIG. 13 by a center shaft 142A (also refer to FIG. 12) that is constituted by a screw. As a result, the erecting/lowering member 141 is capable of being erected and/or lowered around a lower part

through which the center shaft 142A is inserted. In addition, as shown in FIG. 13, a roller 130 is rotatably provided at another end part of the flexed lever member 129 that constitutes a trigger lever member.

[0080] A depressed part 120B is formed at a portion of the slide member 120 that opposes the roller 130. A retreating-side portion of the slide member 120 at the depressed part 120B is configured as an inclined surface 120C. In addition, the automatic block device 32 is provided with a spring 131 for imparting a pivot force in a direction G around the center shaft 129A to the flexed lever member 129, and a spring 132 for restoring the erecting/lowering member 141 to an erected state when the erecting/lowering member 141 is lowered toward a side of the solenoid 126 around the center shaft 142A. The spring force of the spring 131 causes the roller 130 under normal conditions that is provided on the other end part described earlier of the flexed lever member 129 to be fitted into the depressed part 120B of the slide member 120 as shown in FIG. 13. Due to the fitting, an advance of the slide member 120 by the coil spring 121 described earlier is stopped. A position of a front end of the slide member 120 whose advance is stopped by the roller 130 fitted into the depressed part 120B as described above is a position H that is a hindmost position among the three positions H, I, and J shown in FIG. 13.

[0081] As shown in FIG. 13, an electrical switch 135 is disposed on the automatic block device 32. The electrical switch 135 is provided with an actuator 136 that is biased by a spring in a protruding direction from the electrical switch 135. In addition, a dog member 137 is attached to the slide member 120 at a location on an opposite side to the depressed part 120B, and the actuator 136 is in contact with the dog member 137.

[0082] A coupling member 138 provided with a first couple part 138A and a second couple part 138B is joined with the slide member 120. Another end part of the first controlling wire 111 described earlier which has one end part coupled to the pivot member 42 of the delay device 38 shown in FIG. 11 is coupled to the first couple part 138A of the coupling member 138 that is joined with the slide member 120, an end part of the second controlling wire 112 is coupled to the erecting/lowering member 141 described earlier and shown in FIGS. 12 and 13, and an end part of the third controlling wire 113 is coupled to the second couple part 138B of the coupling member 138 that is joined with the slide member 120.

[0083] In addition, the second controlling wire 112 that is inserted through the inside of the outer cable 115 extends to the manipulation device 30 shown in FIG. 1, and a manually manipulated member such as a lever member disposed on the manipulation device 30 is coupled to an end part of the second controlling wire 112 which protrudes from the outer cable 115. Furthermore, the third controlling wire 113 that is inserted through the inside of the outer cable 116 also extends to the manipulation device 30, and the manually manipulated member such as a lever member disposed on the manipulation device 30 is also coupled to an end part of the third controlling wire 113 which protrudes from the outer cable 116.

[0084] As is apparent from the description given above, since the delay device 38 shown in FIG. 11 is disposed between the locking wire 36 described earlier which constitutes a bridge member as well as a flexible cord-like member and the automatic block device 32 including the slide member 120 for mechanically controlling the opening/closing machine 13, the delay device 38 constitutes a relay device that provides a relay between the locking wire 36 and the automatic block device 32. The delay device 38 and the slide member 120 of the automatic block device 32 are coupled to one another via the first controlling wire 111.

[0085] In addition, the opening/closing machine 13 that is constituted by a combination of the electric motor device 18 and the brake device 19 is disposed on a line extending from the locking wire 36 via the delay device 38, the first controlling wire 111, and the slide member 120 of the automatic block device 32. Furthermore, in the present embodiment, as will be apparent from the description below, an action of a tensioning force in a downward direction on the locking wire 36 pulls the locking wire 36 downward and causes the slide member 120 of the automatic block device 32 that had been advanced in order to turn off the brake device 19 of the opening/closing machine 13 to retreat. As a result, the brake device 19 is switched from an off state to an on state.

[0086] Next, an overview of an actuation of the shutter device according to the present embodiment will be presented.

[0087] In a building in which the shutter device according to the present embodiment is installed, in the event that a disaster such as a fire occurs when the shutter curtain 1 is stopped at the fully opened position or a midway position in a direction of opening/closing movement, a control device (not shown; the control device 26 shown in FIG. 1 may double as this control device) into which a signal from a sensor having detected the disaster is inputted causes the solenoid 126 of the automatic block device 32 to be energized and excited. As a result, the plunger 127 of the solenoid 126 and the tip member 140 retreat against the spring force of the coil spring 128. Accordingly, the flexed lever member 129 pivots against the spring force of the spring 131 in an opposite direction to the direction G shown in FIG. 13 around the center shaft 129A. A state at this point is shown in FIG. 14. When the flexed lever member 129 pivots in an opposite direction to the direction G around the center shaft 129A, the roller 130 of the flexed lever member 129 removes itself from the depressed part 120B of the slide member 120. Therefore, the slide member 120 advances due to the spring force of the coil spring 121 that constitutes an elastic bias member and the advance is stopped when the front end of the coupling member 138 comes into contact with the rising part 110B described earlier of the frame 110 of the automatic block device 32. A position of the front end of the slide member 120 at this point is a position

I that is a foremost position as shown in FIG. 14 among the three positions H, I, and J shown in FIG. 13.

[0088] In addition, as the slide member 120 advances, the actuator 136 of the electrical switch 135 separates from a position of the dog member 137 that is attached to the slide member 120. Therefore, a signal from the electrical switch 135 due to a protruding movement of the actuator 136 that is caused by a biasing force of a spring causes the control device to stop the energization of the solenoid 126.

[0089] Due to the stopping of energization of the solenoid 126, the spring force of the spring 128 causes a protruding movement of the plunger 127 and the tip member 140 from the solenoid 126, and the spring force of the spring 131 causes the flexed lever member 129 to pivot in the direction G shown in FIG. 13 around the center shaft 129A. Since the slide member 120 at this point has moved to an advancing limit where the front end of the slide member 120 has reached the position I, the roller 130 of the flexed lever member 129 comes into contact with the inclined surface 120C described earlier of the slide member 120 as shown in FIG. 15. Therefore, the pivot of the flexed lever member 129 in the direction G around the center shaft 129A is stopped midway, and the protruding movement of the plunger 127 and the tip member 140 is stopped as the tip member 140 comes into contact with the erecting/lowering member 141.

[0090] When the slide member 120 of the automatic block device 32 advances as described above, the actuating member 122 provided at the front end of the slide member 120 urges the first portion 3 1A of the lever member 31 of the opening/closing machine 13 in the direction A shown in FIG. 3 via the actuated member 123 shown in FIG 3. Therefore, as described earlier, the first portion 31A swings in the direction A with the second flexed part 31D of the lever member 31 acting as a fulcrum and the brake shaft 21, and the second brake member 22 of the brake device 19 of the opening/closing machine 13 slide in the direction A' that is the same as the direction A. As a result, the brake device 19 that had been turned on until this point is turned off. Therefore, the shutter curtain 1 that had been stopped at the fully opened position or a midway position in a direction of opening/closing movement performs a closing movement in a downward direction while rotating the winding shaft 11 described earlier using the own weight of the portion of the shutter curtain 1 below the winding shaft 11 including the sheet plate 1B, and the drive shaft 14 described earlier of the opening/closing machine 13 also rotates feely via the drive force transmitting means 12 to fully close the shutter curtain 1. As a result, a disaster prevention zone by the shutter curtain 1 is formed.

[0091] In addition, when a person discovers that a disaster such as a fire has occurred, the person performs a pull manipulation of the second controlling wire 112 described earlier using the manually manipulated member such as a lever member which is disposed in the manipulation device 30 shown in FIG. 1 and which is coupled to the end part of the second controlling wire 112. Accordingly, the erecting/lowering member 141 shown in FIGS. 12 and 13 to which the second controlling wire 112 is coupled is lowered and pivots toward the side of the solenoid 126 around the center shaft 142A. As a result, the plunger 127 that is pushed by the erecting/lowering member 141 via the tip member 140 retreats and, at the same time, the flexed lever member 129 having the one end part described earlier in contact with the tip member 140 due to the spring force of the spring 131 described earlier pivots in an opposite direction to the direction G shown in FIG. 13 around the center shaft 129A.

[0092] Therefore, even before the solenoid 126 is energized and excited, the roller 130 of the flexed lever member 129 removes itself from the depressed part 120B of the slide member 120 in the same manner as when the solenoid 126 is energized and excited, and the slide member 120 advances due to the spring force of the coil spring 121. As a result, the brake device 19 that had been turned on until then can be turned off to cause the shutter curtain 1 to perform a closing movement to the fully-closed position using its own weight.

[0093] Once the shutter curtain 1 reaches the fully-closed position in this manner and the disaster such as a fire is resolved, a pull manipulation of the third controlling wire 113 described earlier is performed by using the manually manipulated member such as a lever member which is disposed in the manipulation device 30 and which is coupled to the end part of the third controlling wire 113. Accordingly, since the third controlling wire 113 is coupled to the slide member 120 of the automatic block device 32, the slide member 120 retreats against the spring force of the spring 121. Therefore, the slide member 120 is restored from a position shown in FIG. 15 to an initial position where the front end of the slide member 120 is at the position H shown in FIG. 13. In addition, when the slide member 120 is restored to the initial position, the flexed lever member 129 pivots in the direction G shown in FIG. 13 around the center shaft 129A due to the spring force of the spring 131. As a result, the roller 130 of the flexed lever member 129 fits into the depressed part 120B of the slide member 120 as shown in FIG. 13 and the slide member 120 stops in a state where the front end of the slide member 120 has reached the position H. Accordingly, the automatic block device 32 returns to an initial state prior to the occurrence of the disaster such as a fire.

[0094] Furthermore, when the slide member 120 returns to its initial position, since the brake shaft 21 and the second brake member 22 of the brake device 19 of the opening/closing machine 13 move in an opposite direction to the direction A' due to the spring 23 shown in FIG. 3 and described earlier, the brake device 19 returns to an on state. Subsequently, by manipulating the "open" button described earlier that is provided on the manipulation device 30, the shutter curtain 1 performs an opening movement to the fully opened position as described earlier.

[0095] A state where a detection of the occurrence of a disaster such as a fire by the sensor described earlier or a pull manipulation of the second controlling wire 112 by a person having discovered the occurrence of a disaster such as a fire causes the shutter curtain 1 to perform a closing movement to the fully-closed position in order to form a disaster prevention zone is a state where the shutter device according to the present embodiment constitutes the disaster prevention shutter device described earlier. In contrast, a state where a manipulation of the respective buttons of "open", "close", and "stop" of the manipulation device 30 causes the shutter curtain 1 to perform an opening/closing movement or a movement stop is a state where the shutter device according to the present embodiment constitutes the security shutter device described earlier.

[0096] In the event that the shutter device according to the present embodiment constitutes a disaster prevention shutter device and the shutter curtain 1 is performing a closing movement or, in other words, in the event that the automatic block device 32 is in the state shown in FIG. 15 and the shutter curtain 1 is performing a closing movement, when the obstacle 34 shown in FIG. 1 exists below the shutter curtain 1 that is in a direction of the closing movement, the curtain sub part 71B disposed at a closing side tip part of the shutter curtain 1 or, in other words, the movable part 70B shown in FIGS. 4 and 5 that forms a lower portion of the sheet plate 1B of the shutter curtain 1 or, more specifically, the second movable member 73 shown in FIGS. 4 and 5 comes into contact with the obstacle 34 during the closing movement of the shutter curtain 1. As a result, the descent of the movable part 70B is stopped.

[0097] Since the curtain main part 71A described earlier that is constituted by the curtain main body 1A and the fixed part 70A shown in FIGS. 4 and 5 among the sheet plate 1B descends from the state shown in FIG. 4 even if the descent of the movable part 70B is stopped, due to a relative ascent of the curtain sub part 71B (the movable part 70B) with respect to the curtain main part 71A that is caused by the descent, the swing member 81 that is disposed inside the fixed part 70A swings in an upward direction around the fulcrum shaft 80 as shown in FIG. 7. Accordingly, due to the urge member 54 provided on the swing member 81, as shown in FIG. 8 the lever member 52 and the engaging member 51 of the mechanical join device 55 pivot around the shaft 50 in an opposite direction to the direction B shown in FIG. 6 and the engaging member 51 engages the tooth sections 35A of the rotate member 35.

[0098] As a result, the rotate member 35 and the winding reel 37 that had been rotating during the closing movement of the shutter curtain 1 are no longer able to rotate, and the shutter curtain 1 and the locking wire 36 that has been fed out from the winding reel 37 are joined with one another by the mechanical join device 55 having the lever member 52 and the engaging member 51 as components. Consequently, the locking wire 36 is subjected to a tensioning force in a downward direction due to the weight of the shutter curtain 1 or, more specifically, a tensioning force in a downward direction due to the weight of the shutter curtain 1 excluding the movable part 70B that is the curtain sub part 71B or, in other words, a weight of the curtain main part 71A.

[0099] Moreover, while the lever member 52 and the engaging member 51 of the mechanical join device 55 may be directly coupled and integrated with one another as described earlier, by elastically coupling the lever member 52 and the engaging member 51 in a pivot direction around the shaft 50 by the torsion coil spring 53 as in the case of the present embodiment, the engaging member 51 can be prevented from suddenly biting the tooth sections 35A of the rotate member 35 and the engaging member 51 and the rotate member 35 can be prevented from being damaged.

[0100] When the obstacle 34 sustains a dent deformation after the shutter curtain 1 that is performing a closing movement comes into contact with the obstacle 34 as described above and a tensioning force in a downward direction acts on the locking wire 36 due to the weight of the shutter curtain 1 excluding the movable part 70B, the locking wire 36 that is joined with the shutter curtain 1 by the mechanical join device 55 is pulled downward by an amount corresponding to the dent deformation. Therefore, the pivot member 42 of the delay device 38 shown in FIG. 11 pivots in the direction D shown in FIG. 11 against the return spring 100 described earlier, and the amount of the pivot corresponds to a length of the circular oblong hole 42B into which the stop member 101 described earlier is inserted. While the pivot at this point causes the pinion gear 103 of the rotary damper 102 to rotate in the direction F, the rotation of the pinion gear 103 in the direction F does not generate a resistance force by the viscous fluid on the damper 102 as described earlier. Therefore, the locking wire 36 causes the pivot member 42 to pivot at high speed in the direction D to pull the first controlling wire 111 having one end part coupled to the pivot member 42.

[0101] Moreover, since the locking wire 36 according to the present embodiment is not directly coupled to the pivot member 42 and the spring 43 that constitutes an impact load-absorbing elastic member is interposed between the locking wire 36 and the pivot member 42, even if the locking wire 36 is suddenly pulled downward, the pulling force can be mitigated before being transmitted to the pivot member 42.

[0102] In addition, even if the pivot amount of the pivot member 42 in the direction D reaches a limit value that is defined by the stop member 101 being inserted into the circular oblong hole 42B, due to the impact load-absorbing action of the spring 43, a large impact load can be prevented from propagating between the locking wire 36 and the pivot member 42.

[0103] As described above, when the first controlling wire 111 is pulled, since the other end part of the first controlling wire 111 is coupled to the slide member 120

of the automatic block device 32 shown in FIG. 15, the slide member 120 retreats against the spring 121. Since an amount by which the first controlling wire 111 is pulled and an amount by which the slide member 120 retreats are amounts defined by a length of the oblong hole 42B of the pivot member 42 shown in FIG. 11, the slide member 120 whose front end had reached the position I shown in FIGS. 13 and 15 does not retreat to a retreating limit where the front end of the slide member 120 is positioned at the position H shown in FIG. 13 and stops at a position where the position of the front end is the position J or, in other words, a midway position between the position H and the position I. A state at this point is shown in FIG. 16. Although a location of the slide member 120 with which the roller 130 of the flexed lever member 129 is in contact has moved from the location shown in FIG. 15 in an advancing direction of the slide member 120 that is a sliding direction of the slide member 120, the roller 130 is still in contact with the inclined surface 120C described earlier.

[0104] In addition, since the position of the front end of the slide member 120 at this point has retreated from the position I to the position J, a load by which the first portion 31A of the lever member 31 shown in FIGS. 3 and 12 had been urged in the direction A shown in FIG. 3 by the actuating member 122 of the slide member 120 is released. Therefore, the brake device 19 of the opening/closing machine 13 is switched from an off state to an on state. Furthermore, since the on state of the brake device 19 prevents the drive shaft 14 described earlier of the opening/closing machine 13 from rotating, the winding shaft 11 to which the upper end of the shutter curtain 1 is joined is also unable to rotate.

[0105] Therefore, the shutter curtain 1 having come into contact with the obstacle 34 stops its closing movement at the contact position. This stop is performed by a mechanical construction that is constituted by the mechanical join device 55 described above, the delay device 38 that is also mechanical, the slide member 120 which slides mechanically and which functions as a member of the automatic block device 32, the brake device 19 of the opening/closing machine 13 which is mechanically turned on, and the like. Therefore, even when an occurrence of a disaster such as a fire or another factor causes a power outage of the building in which the shutter device according to the present embodiment is installed after the shutter curtain 1 starts a closing movement, the shutter curtain 1 having come into contact with the obstacle 34 during the closing movement can be stopped.

[0106] As described above, when the obstacle 34 is removed after the shutter curtain 1 during a closing movement comes into contact with the obstacle 34 and the brake device 19 of the opening/closing machine 13 is turned on, since the curtain sub part 71B of the shutter curtain 1 descends, the joining between the shutter curtain 1 and the locking wire 36 by the mechanical join device 55 is released. Accordingly, the tensioning force of the locking wire 36 is eliminated, the pivot member 42 of the delay device 38 subjected to the return force created by the return spring 100 shown in FIG. 11 pivots in the direction C shown in FIG. 11, and the pivot causes the slide member 120 of the automatic block device 32 which had been pulled in a retreating direction by the first controlling wire 111 to advance so that a position of the front end of the slide member 120 makes a transition from the position J shown in FIG. 16 to the position I shown in FIGS. 13 and 15 due to the spring force of the spring 121. Therefore, the brake device 19 of the opening/closing machine 13 is once again switched from an on state to an off state and the shutter curtain 1 restarts a closing movement.

[0107] In addition, when the pivot member 42 of the delay device 38 pivots in the direction C shown in FIG. 11, the pinion gear 103 of the rotary damper 102 rotates in the direction E. In the direction E, a resistance force due to the viscous fluid is generated on the damper 102. As a result, due to a delaying action of the damper 102, the transition of the position of the front end of the slide member 120 from the position J shown in FIG. 16 to the position I shown in FIGS. 13 and 15 and the switching of the brake device 19 of the opening/closing machine 13 from the on state to the off state in association with the transition do not take place instantaneously. Therefore, the restart of the closing movement by the shutter curtain 1 after the obstacle 34 is removed occurs with a time delay after the removal of the obstacle 34. As a result, an operation for removing the obstacle 34 can be performed with a sufficient time margin.

[0108] While the description provided above is related to a case where the obstacle 34 with which the shutter curtain 1 performing a closing movement comes into contact sustains a dent deformation or, in other words, a case where the obstacle 34 is soft or flexible, when the obstacle 34 is hard, a dent deformation for pulling the locking wire 36 downward does not occur or hardly occurs on the obstacle 34.

[0109] In consideration thereof, to enable the locking wire 36 to be pulled downward even when the obstacle 34 is hard in a similar manner to a case where the dent deformation occurs, in the present embodiment as described with reference to FIG. 4, the movable part 70B of the sheet plate 1B of the shutter curtain 1 is configured to include the first movable member 72 that is movable up and down with respect to the fixed part 70A of the sheet plate 1B, the second movable member 73 which is disposed on a lower side of the first movable member 72 and which is movable up and down with respect to the first movable member 72, and the elastic member 74 which is interposed between the first movable member 72 and the second movable member 73 and which is constituted by a leaf spring.

[0110] When the shutter curtain 1 performing a closing movement comes into contact with the obstacle 34, the movable part 70B that is constituted by the first movable member 72 and the second movable member 73 or, in other words, the curtain sub part 71B relatively ascends

with respect to the curtain main part 71A as described earlier, the shutter curtain 1 and the locking wire 36 are joined with one another by the mechanical join device 55, and a tensioning force in a downward direction created by the weight of the curtain main part 71A acts on the locking wire 36. When the obstacle 34 is hard, the curtain main part 71A descends due to the own weight of the curtain main part 71A while causing an elastic shrink deformation of the elastic member 74 via the mechanical join device 55, the urge member 54 described earlier, the swing member 81, and the first movable member 72 which are respectively disposed on the curtain main part 71A with respect to the second movable member 73 with which the obstacle 34 has come into contact, and to the first movable member 72 that is pushed in an upward direction by the elastic member 74 with respect to the second movable member 73. A state at this point is shown in FIGS. 9 and 10.

[0111] In FIG. 9, the first movable member 72 has descended by an amount corresponding to the shrink deformation of the elastic member 74 with respect to the second movable member 73 from the state shown in FIG. 7, and the curtain main part 71A has also descended. At the same time, the first movable member 72 has relatively ascended with respect to the curtain main part 71A due to an elastic force of the elastic member 74 whose spring force has increased as a result of its own elastic shrink deformation. As a result, the swing member 81 swings further in an upward direction around the fulcrum shaft 80 as compared to the state shown in FIG. 7. Therefore, in the present embodiment, the elastic shrink deformation of the elastic member 74 creates a similar effect to the dent deformation that occurs on the obstacle 34.

[0112] As described above, when an elastic shrink deformation of the elastic member 74 causes the swing member 81 to swing further in an upward direction around the fulcrum shaft 80 than the state shown in FIG. 7, the engaging member 51 which is a component of the mechanical join device 55 and which is already engaged with the tooth sections 35A of the rotate member 35 as shown in FIG. 8 further pivots around the shaft 50 in an opposite direction to the direction B shown in FIG. 6 from the state shown in FIG. 8 to the state shown in FIG. 10. Therefore, the rotate member 35 and the winding reel 37 that is joined and integrated with the rotate member 35 pivot in a direction K shown in FIG. 10. This pivot direction is a direction in which the winding reel 37 winds the locking wire 36. Due to the winding, the locking wire 36 is pulled in a downward direction.

[0113] The pulling in a downward direction of the locking wire 36 that is caused by the swing of the swing member 81 in the upward direction around the fulcrum shaft 80 occurs not only when the obstacle 34 is hard but also when the obstacle 34 is soft or flexible. Therefore, even when the obstacle 34 has an arbitrary property including hardness, the locking wire 36 can be pulled in a downward direction.

[0114] In addition, due to the locking wire 36 being pulled in a downward direction, as is apparent from the description given above, the pivot member 42 of the delay device 38 shown in FIG. 11 can be pivoted in the direction D to cause the slide member 120 of the automatic block device 32 shown in FIG. 15 to retreat so that the front end position of the slide member 120 makes a transition from the position I shown in FIG. 15 to the position J shown in FIG. 16. As a result, the brake device 19 of the opening/closing machine 13 can be switched from an off state to an on state and a closing movement of the shutter curtain 1 having come into contact with the obstacle 34 can be stopped. In other words, in order to stop the shutter curtain 1 that had come into contact with the obstacle 34 during a closing movement, the brake device 19 can be turned on in a more reliable manner.

[0115] As is apparent from the description provided above, due to the movable part 70B of the sheet plate 1B that constitutes the curtain sub part 71B of the shutter curtain 1 being constituted by the first movable member 72, the second movable member 73, and the elastic member 74 which is interposed between the first movable member 72 and the second movable member 73, the locking wire 36 can be pulled in a direction that turns on the brake device 19 of the opening/closing machine 13 at the same time when and/or after the shutter curtain 1 comes into contact with the obstacle 34. Therefore, a pulling device 56 is constituted by the first movable member 72, the second movable member 73, and the elastic member 74.

[0116] In addition, according to the present embodiment, as is apparent from the description given above, when the locking wire 36 is pulled by the pulling device 56 in a direction that turns on the brake device 19, the locking wire 36 is only subjected to a pulling force due to winding by the winding reel 37 and is not subjected to a load such as a clamping force or a rubbing force. As a result, safety of the locking wire 36 can be secured.

[0117] Moreover, even if the shutter curtain 1 comes into contact with the obstacle 34 when performing a closing movement as the shutter curtain 1 of the security shutter device described earlier, the pivot member 42 of the delay device 38 shown in FIG. 11 pivots in the direction D and pulls the first controlling wire 111. However, since the automatic block device 32 at this point is in the state shown in FIG. 13 and the roller 130 of the flexed lever member 129 is fitted into the depressed part 120B of the slide member 120, the slide member 120 retreats only slightly by an amount corresponding to a gap between the roller 130 and the depressed part 120B. Therefore, the automatic block device 32 does not change significantly.

[0118] Alternatively, an electrical switch that is actuated by a pivot of the pivot member 42 in the direction D may be provided on the delay device 38, whereby the shutter curtain 1 may be configured to be reversed to ascend and then stopped after coming into contact with the obstacle 34 due to the opening/closing machine 13 being driven and controlled by the control device 26

shown in FIG. 1 into which a signal from the electrical switch is inputted upon actuation of the electrical switch. Moreover, when the shutter curtain performs a closing movement in the event that a signal from the sensor described earlier that detects a disaster such as a fire is inputted to the control device described earlier and the shutter device according to the present embodiment is the disaster prevention shutter device described earlier, a signal from the electrical switch is disabled by allowing a signal from the sensor to be inputted to the control device 26.

[0119] Next, a pulling device according to an alternative embodiment will be described. It should be noted that, in the following description, members, parts, and the like which are the same or which have the same functions as the members, parts, and the like described above will be denoted by the same reference numerals and descriptions thereof will be omitted.

[0120] The shutter curtain 1 according to an embodiment shown in FIG. 17 also includes the curtain main body 1A and the sheet plate 1B, and the sheet plate 1B is constituted by the fixed part 70A that is joined with the curtain main body 1A and the movable part 70B that is movable up and down with respect to the fixed part 70A. However, the movable part 70B according to the present embodiment is constituted by a single movable member 77.

[0121] As shown in FIG. 17, a case 133 is attached to the fixed part 70A of the sheet plate 1B. FIG. 18 shows an inside of the case 133. Housed inside the case 133 are the winding device 40 and the mechanical join device 55 described earlier with reference to FIG. 6 as well as a guide roller 150 that is rotatable around a shaft 134 provided in the case 133 and a swing member 152 that is swingable up and down around a shaft 151 provided in the case 133. The swing member 152 constitutes a moving member according to the present embodiment.

[0122] As shown in FIG. 18, two urge members 54 are attached to the swing member 81 that is swingable up and down around the fulcrum shaft 80 of the fixed part 70A of the sheet plate 1B shown in FIG. 17. An end part of the lever member 52 constituting the mechanical join device 55 is in contact with one of the urge members 54, and one end part protruding below from the case 133 among the swing member 152 is in contact with the other urge member 54. Alternatively, in order to cause the one end part of the swing member 152 to constantly come into contact with the other urge member 54, an elastic member such as a spring for pivoting and biasing the swing member152 may be disposed in the case 133.

[0123] The locking wire 36 which constitutes the bridge member described earlier and which also constitutes a flexible cord-like member is wound around the guide roller 150 and then wound by the winding reel 37 that is a constituent member of the winding device 40. Therefore, among the locking wire 36, a portion that bridges between the guide roller 150 and the winding reel 37 constitutes the linear portion 36A. Another end part of the swing member 152 is on an upper side of the linear portion 36A and a roller-shaped pressure member 153 is rotatably disposed at this end part. Moreover, the guide roller 150 and the winding reel 37 constitute two rotate members that are bridged by the locking wire 36 according to the present embodiment.

[0124] When the shutter curtain 1 constitutes a shutter curtain of a disaster prevention shutter device and comes into contact with the obstacle 34 when performing a closing movement, due to the swing member 81 disposed inside the fixed part 70A of the sheet plate 1B swinging in an upward direction around the fulcrum shaft 80, the engaging member 51 of the mechanical join device 55 engages the tooth sections 35A of the rotate member 35 as described earlier. Accordingly, the shutter curtain 1 and the locking wire 36 that has been fed out from the winding reel 37 are joined with one another by the mechanical join device 55. This state is shown in FIG. 19.

[0125] In addition, when the shutter curtain 1 comes into contact with the obstacle 34 and the swing member 81 swings in an upward direction around the fulcrum shaft 80, the swing member 152 that constitutes the moving member described earlier swings around the shaft 151 as shown in FIG. 19 and the pressure member 153 provided at the end part of the swing member 152 pushes down the linear portion 36A of the locking wire 36. Therefore, the portion 36A becomes an approximately V-shaped non-linear portion having a flex angle that is greater than 90 degrees. Accordingly, the locking wire 36 is pulled downward.

[0126] Therefore, in the present embodiment, the pulling device 56 for pulling the locking wire 36 downward in order to turn on the brake device 19 is constituted by the swing member 152 and the pressure member 153.

[0127] In addition, according to the present embodiment, since the portion of the swing member 152 which pushes down the linear portion 36A of the locking wire 36 and makes the linear portion 36A non-linear is the rotatable pressure member 153, the pressure member 153 rotates when the swing member 152 pushes down and applies pressure to the linear portion 36A to make the linear portion 36A non-linear. Therefore, even if the locking wire 36 performs a movement with respect to the pressure member 153, pressure can be applied to the locking wire 36 while reducing friction between the locking wire 36 and the pressure member 153.

[0128] As a result, also in this embodiment, when the pulling device 56 pulls the locking wire 36 in a direction that turns on the brake device 19, the locking wire 36 is not subjected to a load such as a clamping force or a rubbing force. Therefore, safety of the locking wire 36 can be secured.

[0129] Even in an embodiment shown in FIG. 20, the winding device 40 which is constituted by the winding reel 37 that rotates around the shaft 41 and a power spring that causes the winding reel 37 to pivot and to be biased in a winding direction of the locking wire 36 and which is configured to feedably wind the locking wire 36

is housed inside a case 233 that is attached to the fixed part 70A of the sheet plate 1B, a rotate member 235 that rotates around the shaft 41 is joined and integrated with the winding reel 37, and a large number of tooth sections 235A are formed in a circumferential direction at an outer circumferential part of the rotate member 235.

[0130] In addition, an engaging member 251, a swing member 254, and a lever member 252 which are configured to be swingable up and down around a shaft 250 provided in the case 233 are housed inside the case 233, and the engaging member 251 and the swing member 254 are joined and integrated with each other. Furthermore, the engaging member 251 and the swing member 254, and the lever member 252 are elastically coupled in a pivot direction around the shaft 250 by a torsion coil spring 253. Due to the coupling, one end part 253A of the torsion coil spring 253 whose coil part is wound around an outer circumference of the shaft 250 is locked to at least one of the engaging member 251 and the swing member 254, and another end part 253B is locked to the lever member 252. Moreover, the swing member 254 constitutes a moving member according to the present embodiment.

[0131] In addition, the engaging member 251 and the swing member 254, and the lever member 252 may be directly joined and integrated with each other as is the case of the relationship between the engaging member 251 and the swing member 254, or the engaging member 251, the swing member 254, and the lever member 252 may be configured as a single member.

[0132] The engaging member 251 is disposed on a lower side of the rotate member 235, and a plurality of tooth sections 251A configured to be engageable with the tooth sections 235A of the rotate member 235 are formed in an upper surface part of the engaging member 251.

[0133] A guide roller 237 that is rotatable around a shaft 236 provided in the case 233 is housed inside the case 233, and the locking wire 36 is wound around the guide roller 237 and then wound by the winding reel 37 that is a constituent member of the winding device 40. Therefore, also in this embodiment, among the locking wire 36, a portion that bridges between the guide roller 237 and the winding reel 37 constitutes the linear portion 36A. Among both end parts of the swing member 254, an end part on an opposite side to a side of the shaft 250 is on a lower side of the linear portion 36A and a roller-shaped pressure member 238 is rotatably disposed at this end part.

[0134] When the shutter curtain 1 constitutes a shutter curtain of a disaster prevention shutter device and comes into contact with the obstacle 34 when performing a closing movement, due to the swing member 81 disposed inside the fixed part 70A of the sheet plate 1B swinging in an upward direction around the fulcrum shaft 80 described earlier, the urge member 54 provided on the swing member 81 causes the lever member 252 to pivot in an upward direction around the shaft 250 as shown in FIG. 21. Accordingly, the tooth sections 251A of the engaging member 251 engage the tooth sections 235A of the rotate member 235 and, as a result, the shutter curtain 1 and the locking wire 36 that has been fed out from the winding reel 37 are joined with one another.

[0135] Therefore, in the present embodiment, the rotate member 235, the engaging member 251, and the lever member 252 constitute the mechanical join device 55 for mechanically joining the shutter curtain 1 and the locking wire 36 with each other.

[0136] In addition, when the shutter curtain 1 comes into contact with the obstacle 34 and the swing member 81 swings in an upward direction around the fulcrum shaft 80, the swing member 254 that constitutes the moving member described earlier swings in an upward direction around the shaft 250 as shown in FIG. 21. As a result, the pressure member 238 provided at the end part of the swing member 254 pushes up the linear portion 36A of the locking wire 36. Therefore, the portion 36A becomes an approximately inverted V-shaped non-linear portion having a flex angle that is greater than 90 degrees. Accordingly, the locking wire 36 is pulled downward.

[0137] Therefore, in the present embodiment, the pulling device 56 for pulling the locking wire 36 downward in order to turn on the brake device 19 is constituted by the swing member 254 and the pressure member 238.

[0138] In addition, also in this embodiment, since the portion of the swing member 254 which pushes up the linear portion 36A of the locking wire 36 and makes the linear portion 36A non-linear is the rotatable pressure member 238, the pressure member 238 rotates when the swing member 254 pushes down the linear portion 36A and makes the linear portion 36A non-linear. Therefore, even if the locking wire 36 performs a movement with respect to the pressure member 238, pressure can be applied to the locking wire 36 while reducing friction between the locking wire 36 and the pressure member 238.

[0139] As a result, when the pulling device 56 pulls the locking wire 36 in a direction that turns on the brake device 19, the locking wire 36 is not subjected to a load such as a clamping force or a rubbing force. Therefore, safety of the locking wire 36 can be secured.

[0140] In addition, also in this embodiment, since the engaging member 251 and the swing member 254, and the lever member 252 are elastically coupled in a pivot direction around the shaft 250 by the torsion coil spring 253, the tooth sections 251A of the engaging member 251 can be prevented from suddenly biting the tooth sections 235A of the rotate member 235 and the pressure member 238 can be prevented from suddenly pushing up the portion 36A of the locking wire 36 with a large force.

[0141] The winding device 40 and the mechanical join device 55 according to an embodiment shown in FIG. 22 are the same as the winding device and the mechanical join device according to the embodiment shown in FIG. 20. In the present embodiment, a swing member 354 is joined and integrated with the engaging member 251 that

constitutes a component of the mechanical join device 55. While the swing member 354 is shorter in length than the swing member 254 shown in FIG. 20, the swing member 354 is configured to be swingable in a similar manner to the swing member 254 in upward and downward directions around the shaft 250 that is a pivot center shaft of the engaging member 251 and the lever member 252.

[0142] In addition, a lever member 336 configured to be swingable in upward and downward directions around a shaft 335 provided in a case 333 that is attached to the fixed part 70A of the sheet plate 1B is housed inside the case 333, and an end part of the swing member 354 on an opposite side to a side of the shaft 250 is brought into contact from below with one end part of the lever member 336. Furthermore, a guide roller 338 that is configured to be rotatable around a shaft 337 provided at another end part of the lever member 336 is disposed at the other end part of the lever member 336, and the locking wire 36 is wound around the guide roller 338 and then wound by the winding reel 37 that is a constituent member of the winding device 40. The guide roller 338 according to the present embodiment constitutes a guide member for guiding the locking wire 36 in a similar manner to the guide roller 150 shown in FIG. 18 and the guide roller 237 shown in FIG. 20. In addition, the guide roller 338 is provided midway in an extending direction of the locking wire 36 or, in other words, provided between the delay device 38 shown in FIG. 11 and the winding device 40 shown in FIG. 22.

[0143] When the shutter curtain 1 constitutes a shutter curtain of a disaster prevention shutter device and comes into contact with the obstacle 34 when performing a closing movement, due to the swing member 81 disposed inside the fixed part 70A of the sheet plate 1B swinging in an upward direction around the fulcrum shaft 80, the urge member 54 provided on the swing member 81 causes the lever member 252 to pivot in an upward direction around the shaft 250 as shown in FIG. 23. Accordingly, the tooth sections 251A of the engaging member 251 engage the tooth sections 235A of the rotate member 235 or, in other words, the mechanical join device 55 is actuated and, as a result, the shutter curtain 1 and the locking wire 36 that has been fed out from the winding reel 37 are joined with one another.

[0144] In addition, when the shutter curtain 1 comes into contact with the obstacle 34 and the swing member 81 swings in an upward direction around the fulcrum shaft 80, the swing member 354 swings in an upward direction around the shaft 250 as shown in FIG. 23. As a result, the lever member 336 pivots around the shaft 335, and the pivot causes the guide roller 338 to descend while rotating. Accordingly, the locking wire 36 is pulled downward.

[0145] Therefore, in the present embodiment, the swing member 354 and the lever member 336 constitute the pulling device 56 which is capable of pulling the locking wire 36 downward in order to turn on the brake device 19 by causing the guide roller 338 that constitutes a guide member of the locking wire 36 to perform a movement.

[0146] In addition, in the present embodiment, when the pulling device 56 pulls the locking wire 36 in a direction that turns on the brake device 19, since the guide roller 338 that is configured as a member that performs the pulling rotates, the locking wire 36 is not subjected to a load such as a clamping force or a rubbing force. Therefore, safety of the locking wire 36 can be secured.

[0147] The winding device 40 and the mechanical join device 55 according to an embodiment shown in FIG. 24 are also the same as the winding device and the mechanical join device according to the embodiment shown in FIG. 20. However, the locking wire 36 according to the present embodiment differs from that shown in FIG. 20 in that the locking wire 36 reaches the winding reel 37 that constitutes a component of the winding device 40 and is wound by the winding reel 37 without being wound around a guide member constituted by a guide roller or the like. In addition, unlike in the previous embodiments, a case 433 according to the present embodiment which is disposed at the fixed part 70A of the sheet plate 1B is not fixed to the fixed part 70A and is configured to be pivotable in upward and downward directions around a shaft 451 that is provided at the fixed part 70A.

[0148] Furthermore, a lever member 453 configured to be pivotable in upward and downward directions around a shaft 452 provided at the fixed part 70A is disposed at the fixed part 70A, and one end part of the lever member 453 comes into contact from above with a protrusion 454 which is constituted by a pin or the like and which is provided on the case 433. Another end part of the lever member 453 comes into contact from above with one of the two urge members 54 attached to the swing member 81 that is provided at the fixed part 70A so as to be swingable in upward and downward directions around the fulcrum shaft 80. An end part of the lever member 252 that is a constituent member of the mechanical join device 55 comes into contact from above with the other urge member 54 in a similar manner to the embodiment shown in FIG. 20.

[0149] When the shutter curtain 1 constitutes a shutter curtain of a disaster prevention shutter device and comes into contact with the obstacle 34 when performing a closing movement, due to the swing member 81 disposed inside the fixed part 70A of the sheet plate 1B swinging in an upward direction around the fulcrum shaft 80, the urge member 54 provided on the swing member 81 causes the lever member 252 to pivot in an upward direction around the shaft 250 as shown in FIG. 25. Accordingly, the tooth sections 251A of the engaging member 251 engage the tooth sections 235A of the rotate member 235 or, in other words, the mechanical join device 55 is actuated and, as a result, the shutter curtain 1 and the locking wire 36 that has been fed out from the winding reel 37 are joined with one another.

[0150] In addition, when the shutter curtain 1 comes into contact with the obstacle 34 and the swing member 81 swings in an upward direction around the fulcrum shaft

80, a push-up action of the urge member 54 provided on the swing member 81 causes the lever member 453 to pivot around the shaft 452 as shown in FIG. 25. As a result, the lever member 453 pushes down the protrusion 454 and the case 433 pivots in a downward direction around the shaft 451.

[0151] Furthermore, since the winding device 40 that winds the locking wire 36 is disposed inside the case 433, when the case 433 pivots in a downward direction around the shaft 451, the winding device 40 also pivots in a downward direction. As a result, the locking wire 36 is pulled downward.

[0152] Therefore, in the present embodiment, the pulling device 56 capable of pulling the locking wire 36 downward in order to turn on the brake device 19 is constituted by the case 433 and the lever member 453.

[0153] In addition, also in this embodiment, when the pulling device 56 pulls the locking wire 36 in a direction that turns on the brake device 19, the locking wire 36 is not subjected to a load such as a clamping force or a rubbing force and safety of the locking wire 36 can be secured.

[0154] Similarly, in an embodiment shown in FIG. 26, a case 533 disposed at the fixed part 70A of the sheet plate 1B is not fixed to the fixed part 70A and is configured to be pivotable in upward and downward directions around a shaft 551 provided at the fixed part 70A. The winding device 40 that is similar to that in the embodiment shown in FIG. 20 is housed inside the case 533, and the rotate member 235 is joined and integrated with the winding reel 37 that is a constituent member of the winding device 40 in a similar manner to the embodiment shown in FIG. 20.

[0155] In addition, a lever member 553 configured to be pivotable in upward and downward directions around a shaft 552 provided at the fixed part 70A is disposed at the fixed part 70A, one end part of the lever member 553 is deeply inserted into the case 533, and an engaging part 553A that is configured to be engageable with the tooth sections 235A of the rotate member 235 is provided at a tip of the lever member 553. Furthermore, another end part of the lever member 553 comes into contact from above with the urge member 54 attached to the swing member 81 that is provided at the fixed part 70A so as to be swingable in upward and downward directions around the fulcrum shaft 80.

[0156] When the shutter curtain 1 constitutes a shutter curtain of a disaster prevention shutter device and comes into contact with the obstacle 34 when performing a closing movement, due to the swing member 81 disposed inside the fixed part 70A of the sheet plate 1B swinging in an upward direction around the fulcrum shaft 80, the urge member 54 provided on the swing member 81 causes the lever member 553 to pivot around the shaft 552 as shown in FIG. 27. Due to the pivot, the engaging part 553A of the lever member 553 engages the tooth sections 235A of the rotate member 235, the engagement causes a rotation of the rotate member 235 and the winding reel 37 around the shaft 41 to be locked and, as a result, the locking wire 36 which constitutes the bridge member described earlier and which also constitutes a flexible cord-like member and the shutter curtain 1 are joined with one another.

[0157] Therefore, in the present embodiment, the rotate member 235 and the lever member 553 constitute the mechanical join device 55 for mechanically joining the locking wire 36 and the shutter curtain 1 with each other.

[0158] In addition, since a push-down force is applied to the rotate member 235 from the engaging part 553A of the lever member 553 when the engaging part 553A engages the tooth sections 235A of the rotate member 235, the case 533 in which the rotate member 235 is disposed pivots in a downward direction around the shaft 551 as shown in FIG. 27. Furthermore, since the winding device 40 that winds the locking wire 36 is disposed inside the case 533, when the case 533 pivots in a downward direction around the shaft 551, the winding device 40 also pivots in a downward direction. As a result, the locking wire 36 is pulled downward.

[0159] Therefore, in the present embodiment, the pulling device 56 for pulling the locking wire 36 downward in order to turn on the brake device 19 is constituted by the case 533 and the lever member 553.

[0160] In addition, even according to the present embodiment, when the pulling device 56 pulls the locking wire 36 in a direction that turns on the brake device 19, the locking wire 36 is not subjected to a load such as a clamping force or a rubbing force. As a result, safety of the locking wire 36 can be secured.

[0161] FIGS. 28 to 33 show a mechanical join device and a pulling device according to a further alternative embodiment. In a similar manner to the pulling devices described with reference to FIGS. 4 to 10, the pulling device 56 (refer to FIGS. 29, 31, and 32) according to the present embodiment is configured as a pulling device which causes the winding device 40 that constitutes a device for feeding out the locking wire 36 during a closing movement of the shutter curtain 1 to perform an actuation for winding the locking wire 36.

[0162] In a similar manner to the shutter curtain shown in FIG. 17, the shutter curtain 1 according to the present embodiment also includes the curtain main body 1A and the sheet plate 1B, the sheet plate 1B is constituted by the fixed part 70A that is joined with the curtain main body 1A and the movable part 70B that is configured to be movable up and down with respect to the fixed part 70A, and the movable part 70B is constituted by the single movable member 77.

[0163] As shown in FIG. 28, a case 633 is attached to the fixed part 70A of the sheet plate 1B. An inside of the case 633 is also shown in FIG. 29. A rotate member 635 with an outer circumferential part on which a large number of tooth sections 635A are formed in a circumferential direction and a winding reel 637 are housed inside the case 633 so as to be rotatable around a shaft

641 configured as a fixed shaft that is fixed to the case 633. The rotate member 635 and the winding reel 637 are joined and integrated with one another. In addition, a lower end of the locking wire 36 is joined to the winding reel 637. A lower portion of the locking wire 36 is wound by the winding reel 637 and, at the same time, an upper portion of the locking wire 36 extends upward from a hole 633A formed on an upper surface of the case 633. Furthermore, an upper end of the locking wire 36 is coupled to the pivot member 42 of the delay device 38 shown in FIG. 11 via the spring 43.

[0164] Alternatively, one or a plurality of guide rollers may be rotatably housed inside the case 633 shown in FIG. 29, and the locking wire 36 may be guided by the guide rollers to the winding reel 637.

[0165] As shown in FIG. 28, a space part 637A is formed inside the winding reel 637 that is joined and integrated with the rotate member 635, and a return spring 639 that is shown partially omitted in FIG. 29 is housed inside the space part 637A. The return spring 639 that is in a wound state around an outer circumference of a shaft 641 that is a rotation center shaft of the rotate member 635 and the winding reel 637 is a power spring. One end part of the return spring 639 is joined with a shaft 641 that constitutes a member on a side of the case 633, and another end part is coupled with the winding reel 637 that is integrated with the rotate member 635. When the rotate member 635 and the winding reel 637 rotate in a direction S shown in FIG. 29 and the shutter curtain 1 performs a downward closing movement, the winding reel 637 that rotates in the direction S in order to feed out the locking wire 36 causes a winding force for winding the locking wire 36 by the winding reel 637 to accumulate in the return spring 639. When the rotate member 635 and the winding reel 637 rotate in a direction T and the shutter curtain 1 performs an upward opening movement, the pressure accumulating force accumulated in the return spring 639 causes the winding reel 637 to rotate in the direction T and, as a result, the locking wire 36 is wound by the winding reel 637.

[0166] Therefore, also in this embodiment, the winding reel 637 and the return spring 639 constitute the winding device 40 for feedably winding the locking wire 36.

[0167] In the present embodiment, since the return spring 639 constituted by a power spring is housed in the space part 637A that is formed inside the winding reel 637, even if a dimension of the case 633 in a thickness direction of the shutter curtain 1 is small, a dimension of the winding reel 637 in the thickness direction of the shutter curtain 1 can be sufficiently increased as is apparent from FIG. 28. Accordingly, a winding length of the locking wire 36 by the winding reel 637 can be sufficiently increased and a shutter device with a long opening/closing movement length of the shutter curtain 1 can also be accommodated.

[0168] As shown in FIG. 29, an engaging member 650 configured to be pivotable in upward and downward directions around a shaft 654 provided in the case 633 is housed inside the case 633. The engaging member 650 according to the present embodiment is made up of a first constituent member 651 having an engaging part 653 configured to be engageable with the tooth sections 635A of the rotate member 635 and a second constituent member 652 which is joined with the first constituent member 651 and which has a length in a width direction of the shutter curtain 1. The second constituent member 652 does not have an engaging part that is configured to be engageable with the tooth sections 635A of the rotate member 635. By configuring the engaging member 650 as a combination of the first constituent member 651 and the second constituent member 652 which are separate parts as described above and performing a quenching treatment or the like on the first constituent member 651 on which is formed the engaging part 653 that engages the tooth sections 635A of the rotate member 635 or by forming the first constituent member 651 and the second constituent member 652 using different materials, the first constituent member 651 can be configured to be harder than the second constituent member 652. Accordingly, even if the entire engaging member 650 is not subjected to a quenching treatment or the like or even if the entire engaging member 650 is not formed using an expensive material, the engaging part 653 can be given significant strength in a similar manner to the tooth sections 635A of the rotate member 635.

[0169] Moreover, in the present embodiment, as shown in FIG. 29, a first engaging part 653A and a second engaging part 653B that are separated from one another in a pivot direction of the engaging member 650 around the shaft 654 are provided as the engaging part 653 of the engaging member 650. The first engaging part 653A and the second engaging part 653B are formed on a circular arc or an approximately circular arc centered on the shaft 654 that is a pivot center part of the engaging member 650.

[0170] In addition, as is apparent from FIG. 28, a torsion coil spring 657 is provided on the engaging member 650. A coil part 657C of the torsion coil spring 657 is wound around the shaft 654, one end part 657A of the torsion coil spring 657 is locked by the engaging member 650, and another end part 657B is locked by a lower surface part 633B which is flexed and which has a small dimension among the case 633. Therefore, in FIG. 29, the engaging member 650 is constantly pivoted and biased in a direction M around the shaft 654 by a spring force of the torsion coil spring 657. Accordingly, an end part of the engaging member 650 comes into contact with the urge member 54 disposed on the swing member 81 that is swingable up and down around the fulcrum shaft 80 described earlier.

[0171] Therefore, as will be apparent from the description below, the shutter curtain 1 and the engaging member 650 are provided with a shutter curtain-side contact part 658 and an engaging member-side contact part 659 which come into contact with each other in order to cause the engaging member 650 to pivot in a direction N that

is an opposite direction to the direction M shown in FIG. 29 when the shutter curtain 1 comes into contact with the obstacle 34 during a closing movement. In addition, the shutter curtain-side contact part 658 is constituted by the urge member 54, and the engaging member-side contact part 659 exists as two parts on the second constituent member 652 of the engaging member 650 as a first engaging member-side contact part 659A and a second engaging member-side contact part 659B. The first engaging member-side contact part 659A and the second engaging member-side contact part 659B are separated from each other in a width direction of the shutter curtain 1.

[0172] Furthermore, providing the first engaging member-side contact part 659A and the second engaging member-side contact part 659B described above on the engaging member 650 can be realized as shown in FIG. 29 by giving a portion on a lower side of the shaft 654 among the engaging member 650 or, more specifically, a portion of the second constituent member 652 that constitutes the engaging member 650 together with the first constituent member 651 with the exception of a portion that overlaps with the first constituent member 651 an L shape or an approximate L shape.

[0173] In addition, when the shutter curtain 1 during a closing movement comes into contact with the obstacle 34, due to a pivot of the engaging member 650 in the direction N shown in FIG. 29 around the shaft 654, a repulsive force that attempts to pivot and bias the engaging member 650 in the direction M around the shaft 654 is accumulated in the torsion coil spring 657. Therefore, the torsion coil spring 657 is configured as an elastic member that is provided on the engaging member 650 in order to accumulate such a repulsive force.

[0174] Furthermore, one end 657A of the torsion coil spring 657 is locked by the engaging member 650, and another end 657B is locked by the case 633 that is configured as a shutter curtain non-moving member (in other words, an opening/closing body non-moving member) by being non-movably disposed on the shutter curtain 1 with respect to the engaging member 650. Therefore, the torsion coil spring 657 is also configured as an elastic member that is interposed between the engaging member 650 and the case 633.

[0175] In the event that the sheet plate 1B of the shutter curtain 1 during a closing movement comes into contact with the obstacle 34 shown in FIG. 1 or the like, when the movable part 70B (the curtain sub part 71B) relatively ascends with respect to the fixed part 70A (the curtain main part 71A) of the sheet plate 1B of the shutter curtain 1 as shown in FIG. 30, the swing member 81 swings in an upward direction around the fulcrum shaft 80 described earlier. Therefore, the urge member 54 causes the engaging member 650 to pivot in the N direction around the shaft 654 in FIG. 29. Accordingly, the engaging part 653 of the engaging member 650 engages the tooth sections 635A of the rotate member 635 as shown in FIG. 32 through the state shown in FIG. 31. Due to the engagement, the rotate member 635 and the winding reel 637 that is joined and integrated with the rotate member 635 are no longer able to rotate in a direction of rotation (the direction S shown in FIG. 29) during a movement of the shutter curtain 1 in a closing direction. As a result, the rotate member 635 and the winding reel 637 are locked by the engaging member 650 and become non-rotatable.

[0176] As a result, at this point, the locking wire 36 having one part wound by the winding reel 637 and the shutter curtain 1 on which the winding reel 637 is disposed are mechanically joined with each other. Therefore, in the present embodiment, the rotate member 635, the engaging member 650, and the like constitute the mechanical join device 55 for mechanically joining the locking wire 36 and the shutter curtain 1 with each other.

[0177] In the event that the shutter device constitutes a disaster prevention shutter device and the shutter curtain 1 is performing a closing movement or, in other words, in the event that the automatic block device 32 is in the state shown in FIG. 15 and the shutter curtain 1 is performing a closing movement, when the obstacle 34 shown in FIG. 1 exists below the shutter curtain 1 that is in a direction of the closing movement, the movable part 70B disposed on the closing side tip part of the shutter curtain 1 comes into contact with the obstacle 34 during the closing movement of the shutter curtain 1. As a result, the descent of the movable part 70B is stopped.

[0178] Since the curtain main part 71A described earlier descends even if the descent of the movable part 70B has stopped, the swing member 81 swings in an upward direction around the fulcrum shaft 80 as shown in FIG. 30. Accordingly, due to the urge member 54 provided on the swing member 81, the engaging member 650 that constitutes the mechanical join device 55 rotates in the direction N around the shaft 654 shown in FIG. 29 as described earlier to pass through the state shown in FIG. 31 and reach the state shown in FIG. 32, and the engaging part 653 of the engaging member 650 engages the tooth sections 635A of the rotate member 635.

[0179] As a result, the rotate member 635 and the winding reel 637 that had been rotating in the direction S shown in FIG. 29 during the closing movement of the shutter curtain 1 are locked by the engaging member 650 and are no longer able to rotate in the direction S, and the shutter curtain 1 and the locking wire 36 that has been fed out from the winding reel 637 are joined with one another by the mechanical join device 55. Therefore, the locking wire 36 is subjected to a tensioning force in a downward direction due to the weight of the shutter curtain 1 excluding the weight of the movable part 70B or, in other words, due to the weight of the curtain main part 71A.

[0180] When the obstacle 34 sustains a dent deformation after the shutter curtain 1 that is performing a closing movement comes into contact with the obstacle 34 as described above and a tensioning force in a downward direction acts on the locking wire 36 due to the weight of

the shutter curtain 1 excluding the movable part 70B, the locking wire 36 that is joined with the shutter curtain 1 by the mechanical join device 55 is pulled downward by an amount corresponding to the dent deformation. Accordingly, the slide member 120 of the automatic block device 32 described earlier performs a movement in a retreating direction as shown in FIG. 16 via the delay device 38 and the first controlling wire 111 shown in FIG. 11, and the brake device 19 of the opening/closing machine 13 is switched from an off state to an on state.

[0181] In addition, even when the obstacle 34 is a hard obstacle that does not sustain or hardly sustains a dent deformation, when the urge member 54 of the swing member 81 causes the engaging member 650 to pivot in the direction N shown in FIG. 29, among the first engaging part 653A and the second engaging part 653B which are the two engaging parts provided as the engaging part 653 on the engaging member 650, the first engaging part 653A first engages the tooth sections 635A of the rotate member 635 and the second engaging part 653B next engages the tooth sections 635A of the rotate member 635 as shown in FIG. 32. Among these engagements, as shown in FIG. 29, at least the engagement of the first engaging part 653A with the tooth sections 635A is performed as the first engaging member-side contact part 659A at a distant location from the shaft 654 acting as a center shaft of the pivot of the engaging member 650 among the first engaging member-side contact part 659A and the second engaging member-side contact part 659B which are the two contact parts provided separated from each other in a length direction of the engaging member 650 as the engaging member-side contact part 659 is pushed up into the engaging member 650 by the urge member 54 that constitutes the shutter curtain-side contact part 658.

[0182] In addition, since a spacing dimension between the first engaging part 653A and the second engaging part 653B is set to a same dimension or an approximately same dimension as a spacing dimension (tooth pitch) between the tooth sections 635A of the rotate member 635 or to a dimension that is an multiple or approximately an multiple by an integer equal to or greater than 2 of the spacing dimension between the tooth sections 635A, when the first engaging part 653A engages the tooth sections 635A, the second engaging part 653B also engages the tooth sections 635A.

[0183] FIG. 33 is a partially enlarged view of FIG. 32 when the first engaging part 653A and the second engaging part 653B engage the tooth sections 635A of the rotate member 635 as described above. When the first engaging part 653A engages the tooth sections 635A of the rotate member 635 and the second engaging part 653B engages the tooth sections 635A of the rotate member 635, or after the first engaging part 653A has engaged the tooth sections 635A of the rotate member 635 and the second engaging part 653B has also engaged the tooth sections 635A of the rotate member 635, or after the first engaging part 653A has engaged the tooth sections 635A of the rotate member 635 but before the second engaging part 653B engages the tooth sections 635A of the rotate member 635, the second engaging member-side contact part 659B of the engaging member 650 comes into contact with the urge member 54 and is pushed up as shown in FIG. 32. In other words, the pushing up of the engaging member-side contact part 659 of the engaging member 650 that is performed by the urge member 54 is first performed at the first engaging member-side contact part 659A and next performed at the second engaging member-side contact part 659B among the first engaging member-side contact part 659A and the second engaging member-side contact part 659B which are provided as two locations on the engaging member 650. Therefore, the pushing up of the engaging member-side contact part 659 of the engaging member 650 by the urge member 54 is to be sequentially performed while making a transition from the first engaging member-side contact part 659A to the second engaging member-side contact part 659B. In other words, the pushing up is performed in two stages.

[0184] Accordingly, in FIG. 33, the pivot of the engaging member 650 in the direction N is to be performed in two stages. Therefore, even after the first engaging part 653A engages the tooth sections 635A of the rotate member 635, the pivot of the engaging member 650 in the direction N continues. As a result, even if the first engaging part 653A of the engaging member 650 disengages from the tooth sections 635A of the rotate member 635, the second engaging part 653B continues its engagement with the tooth sections 635A of the rotate member 635 and causes the rotate member 635 to pivot in a direction T. The pivot in the direction T is a pivot in a direction in which the winding reel 37 winds the locking wire 36.

[0185] In addition, since the pivot of the rotate member 635 in the direction T by the second engaging part 653B is performed as the second engaging member-side contact part 659B whose distance from the shaft 654 acting as a center of the pivot of the engaging member 650 is shorter than the first engaging member-side contact part 659A is pushed up by the urge member 54, an amount of the pivot of the rotate member 635 in the direction T by the second engaging part 653B is greater than an amount of pivot of the rotate member 635 in the direction T by the first engaging member-side contact part 659A. As a result, a winding length of the locking wire 36 by the winding reel 637 that is joined and integrated with the rotate member 635 increases in stages. Therefore, even if an amount of a relative ascent of the curtain sub part 71B with respect to the curtain main part 71A when the shutter curtain 1 during a closing movement comes into contact with the obstacle 34 is a constant amount, the winding length of the locking wire 36 by the winding reel 637 can be increased in a similar manner to a case where the obstacle 34 sustains a significant dent deformation and a downward pull amount of the locking wire 36 can be sufficiently secured.

[0186] Therefore, even when the obstacle 34 is a hard

obstacle that does not sustain or hardly sustains a dent deformation, the locking wire 36 that is joined with the shutter curtain 1 by the mechanical join device 55 can be sufficiently pulled downward in a similar manner to a case where a dent deformation of the obstacle 34 occurs.

[0187] Moreover, while the number of engaging parts 653 provided on the engaging member 650 is set to two in the present embodiment, the number of the engaging parts 653 may be set to three or more. In addition, the number of locations of the engaging member 650 that are pushed up by the urge member 54 may also be set to three or more.

[0188] Furthermore, when the shutter curtain 1 during a closing movement comes into contact with the obstacle 34 to cause the engaging member 650 to pivot in the direction N shown in FIG. 29 and the engaging part 653 of the engaging member 650 engages the tooth sections 635A of the rotate member 635, a tip of the engaging part 653 and a tip of the tooth sections 635A may butt against one another and create a sort of a deadlocked state between the engaging part 653 and the tooth sections 635A (refer to FIG. 31). In consideration thereof, for example, by forming the urge member 54 described earlier using an elastic member such as a leaf spring or configuring a part of the engaging member 650 which comes into contact with the urge member 54 as an elastic part formed using an elastic member such as a leaf spring, when the tip of the engaging part 653 and the tip of the tooth sections 635A butt against one another, the butting reaction force causes an elastic deformation of the urge member 54 or the elastic part described above and causes a temporary displacement of the tip of the engaging part 653 in a separating direction from the tip of the tooth sections 635A. After this displacement, the elastic repulsive force of the urge member 54 or the elastic part may cause the engaging part 653 of the engaging member 650 to engage the tooth sections 635A of the rotate member 635 whose rotation had slightly advanced during the displacement.

[0189] As is apparent from the description provided above, in the embodiment shown in FIGS. 28 to 33, the pulling device 56 for pulling the locking wire 36 downward in order to turn on the brake device 19 is constituted by the engaging member 650, the rotate member 635, and the like.

[0190] In addition, even according to the present embodiment, as is apparent from the description given above, when the locking wire 36 is pulled by the pulling device 56 in a direction that turns on the brake device 19, the locking wire 36 is only subjected to a pulling force due to winding by the winding reel 637 and is not subjected to a load such as a clamping force or a rubbing force. As a result, safety of the locking wire 36 can be secured.

[0191] In the respective embodiments described above, the winding device 40 that feedably winds the locking wire 36 is disposed in the shutter curtain 1.

[0192] In comparison, in an embodiment shown in FIG. 34 in which the opening/closing machine 13, the automatic block device 32, and the like have been omitted, the winding device 40 that feedably winds the locking wire 36 is not disposed on the shutter curtain 1. Instead, the winding device 40 is disposed on a non-moving member that is non-movable with respect to the shutter curtain 1 that performs opening/closing movements or, more specifically, on the lintel 16 shown in FIG. 1. In addition, the delay device 38 described with reference to FIG. 11 is disposed on the lintel 16, and the locking wire 36 that extends in a downward direction from the delay device 38 is folded back in an upward direction inside a case 733 disposed on the shutter curtain 1 and reaches the winding device 40. One or two or more guide members for guiding the locking wire 36 are housed inside the case 733.

[0193] By causing a movement of the guide member described above using a device similar to the pulling device shown in FIG. 22 when the shutter curtain 1 comes into contact with an obstacle during a closing movement or by changing a linear portion of the locking wire 36 that bridges between two guide members inside the case 733 into a non-linear portion using a device similar to the pulling device shown in FIG. 18 or 20, the locking wire 36 can be pulled downward or, in other words, the locking wire 36 can be pulled with respect to the delay device 38.

[0194] In addition, in the present embodiment shown in FIG. 34, the delay device 38 and the winding device 40 may be configured as a mutually-coupled unit.

[0195] In an embodiment shown in FIG. 35 in which the opening/closing machine 13, the automatic block device 32, and the like have been omitted in a similar manner to FIG. 34, a bridge member having a portion that bridges between the shutter curtain 1 and a non-moving member is a roller chain 836 that is configured as a flexible cord-like member. The roller chain 736 extends in a downward direction inside the guide rail 6 from the delay device 38 disposed on the lintel 16 and is wound around first to third guide members 801 to 803 which are respectively rotatably disposed on the shutter curtain 1, reaches the lower end part of the guide rail 6, and is coupled to the lower end part. The first to third guide members 801 to 803 are sprocket wheels, and the second guide member 802 is disposed inside a case 833 provided on the shutter curtain 1.

[0196] In the present embodiment, by causing a movement of at least one guide member among the first to third guide members 801 to 803 using a device similar to the pulling device shown in FIG. 22 or by changing a linear portion of the roller chain 836 that bridges between two guide members into a non-linear portion using a device similar to the pulling device shown in FIG. 18 or 20, the roller chain 836 can be pulled downward. In addition, by causing the second guide member 802 to pivot using a device similar to the pulling device according to the embodiment shown in FIGS. 28 to 33, the roller chain 836 can be pulled downward.

[0197] Moreover, in the respective embodiments de-

scribed above, the locking wire 36 and the roller chain 836 are coupled to the slide member 120 of the automatic block device 32 via the delay device 38 and the first controlling wire 111. Alternatively, the delay device 38 and the first controlling wire 111 may be omitted and the locking wire 36 and the roller chain 836 may be directly coupled to the slide member 120 of the automatic block device 32.

INDUSTRIAL APPLICABILITY

[0198] The present invention can be used in various opening/closing devices in which a shutter curtain constitutes an opening/closing body such as a shutter device for both security and disaster prevention, an awning device, and a smokeproof drapery device.

Claims

1. An opening/closing body stop device of an opening/closing device, comprising:

an opening/closing body that performs opening/closing movements;
a cord-like member that is joined with said opening/closing body when said opening/closing body comes into contact with an obstacle during a closing movement;
a brake device that is turned on by a tensioning force acting on said cord-like member and that stops a closing movement of said opening/closing body; and
a pulling device that pulls said cord-like member in a direction that turns on said brake device at the same time when and/or after said opening/closing body comes into contact with said obstacle, wherein
said opening/closing body stop device includes a winding device that feedably winds said cord-like member, and said pulling device is configured as a device that causes said winding device, which is a device for feeding said cord-like member during a closing movement of said opening/closing body, to perform an operation to wind said cord-like member.

2. The opening/closing body stop device of an opening/closing device according to claim 1, wherein said winding device includes a winding reel that feedably winds said cord-like member, and said pulling device is configured as a device that causes said winding reel that is a member for feeding said cord-like member during a closing movement of said opening/closing body to perform a pivot to wind said cord-like member.

3. The opening/closing body stop device of an opening/closing device according to claim 2, wherein said winding device is configured to include a rotate member that has a plurality of tooth sections formed in an outer circumferential part thereof and that is joined integrally with said winding reel, said opening/closing body is provided with an engaging member that engages said tooth sections of said rotate member by pivoting around a shaft, and said winding reel is configured to perform a pivot to wind said cord-like member as said engaging member engages said tooth sections of said rotate member.

4. The opening/closing body stop device of an opening/closing device according to claim 3, wherein said engaging member pivots around said shaft even after being engaged with said tooth sections of said rotate member and the pivot of said engaging member causes said winding reel to perform a pivot to wind said cord-like member.

5. The opening/closing body stop device of an opening/closing device according to claim 4, wherein said opening/closing body is configured to include an opening/closing body main part and an opening/closing body sub part that performs a movement with respect to said opening/closing body main part when said opening/closing body comes into contact with said obstacle during a closing movement, said opening/closing body sub part is configured to include a first movable member that is disposed on a side of said opening/closing body main part, a second movable member that is disposed on an opposite side to said opening/closing body main part with respect to said first movable member, and an elastic member that is disposed between said first movable member and said second movable member, and said engaging member is configured to pivot around said shaft even after being engaged with said tooth sections of said rotate member due to an elastic shrink deformation caused by said elastic member when said opening/closing body comes into contact with said obstacle.

6. The opening/closing body stop device of an opening/closing device according to claim 4, wherein said engaging member is provided with a plurality of engaging parts on a circular arc or an approximately circular arc centered on said shaft, and said winding reel is configured to perform a pivot to wind said cord-like member as said engaging parts sequentially engage with said tooth sections of said rotate member.

7. The opening/closing body stop device of an opening/closing device according to claim 4, wherein the pivot performed by said engaging member around said shaft due to said opening/closing body coming into contact with said obstacle is a pivot of at least two stages, and the pivot of at least two stages caus-

es said winding reel to perform a pivot to wind said cord-like member.

8. The opening/closing body stop device of an opening/closing device according to claim 7, wherein said opening/closing body is configured to include an opening/closing body main part and an opening/closing body sub part that performs a movement with respect to said opening/closing body main part when said opening/closing body comes into contact with said obstacle during a closing movement, and a movement of said opening/closing body sub part causes said engaging member to perform a pivot of at least two stages around said shaft.

9. The opening/closing body stop device of an opening/closing device according to claim 8, wherein said engaging member is provided with a plurality of locations which is sequentially subjected to a push-up force when said opening/closing body sub part performs a movement with respect to said opening/closing body main part, and the push-up force that sequentially acts on the locations causes said engaging member to perform a pivot of at least two stages around said shaft.

10. The opening/closing body stop device of an opening/closing device according to claim 9, wherein respective distances of said plurality of locations from said shaft are set so as to differ from one another, and a distance of a location last subjected to the push-up force from said shaft is set shorter than a distance of a location first subjected to the push-up force from said shaft.

11. An opening/closing body stop device of an opening/closing device, comprising:

an opening/closing body that performs opening/closing movements;
a cord-like member that is joined with said opening/closing body when said opening/closing body comes into contact with an obstacle during a closing movement;
a brake device that is turned on by a tensioning force acting on said cord-like member and that stops a closing movement of said opening/closing body; and
a pulling device that pulls said cord-like member in a direction that turns on said brake device at the same time when and/or after said opening/closing body comes into contact with said obstacle, wherein
said opening/closing body stop device of an opening/closing device includes two rotate members which are bridged by at least a linear part of said cord-like member, said pulling device is configured as a device that makes the linear portion of said cord-like member non-linear, said pulling device is configured to include a moving member that applies pressure to the linear portion of said cord-like member to make the linear portion non-linear, and a portion of said moving member that applies pressure to said linear portion is configured as a rotatable pressure member.

12. The opening/closing body stop device of an opening/closing device according to claim 11, wherein said moving member is a swing member that swings around a shaft.

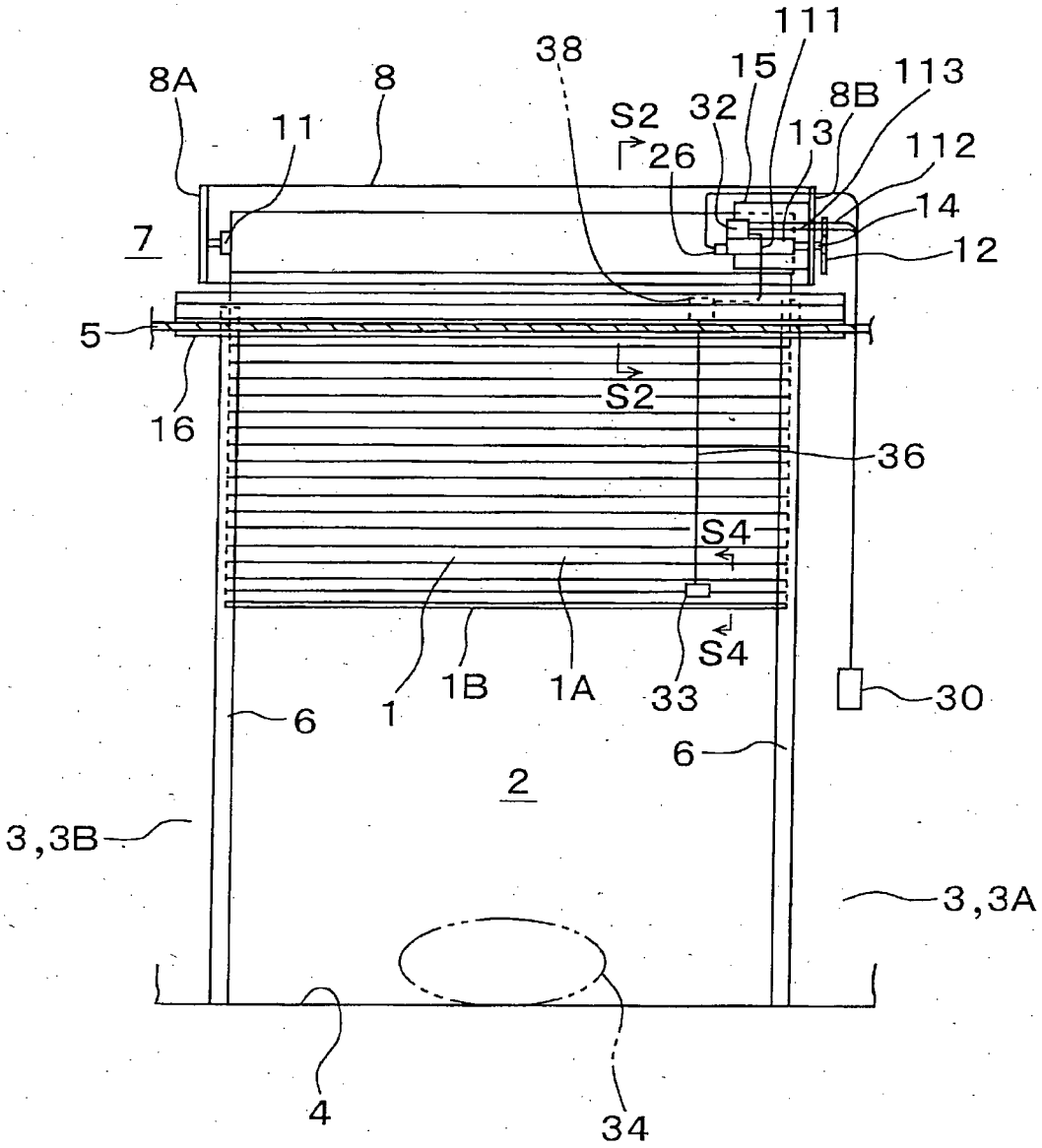
13. An opening/closing body stop device of an opening/closing device, comprising:

an opening/closing body that performs opening/closing movements; a cord-like member that is joined with said opening/closing body when said opening/closing body comes into contact with an obstacle during a closing movement;
a brake device that is turned on by a tensioning force acting on said cord-like member and that stops a closing movement of said opening/closing body; and
a pulling device that pulls said cord-like member in a direction that turns on said brake device at the same time when and/or after said opening/closing body comes into contact with said obstacle, wherein
a guide member that guides said cord-like member is rotatably provided midway along an extending direction of said cord-like member, and
said pulling device is configured as a device that causes said guide member to perform a movement in order to pull said cord-like member in a direction that turns on said brake device.

14. An opening/closing body stop device of an opening/closing device, comprising:

an opening/closing body that performs opening/closing movements;
a cord-like member that is joined with said opening/closing body when said opening/closing body comes into contact with an obstacle during a closing movement;
a brake device that is turned on by a tensioning force acting on said cord-like member and that stops a closing movement of said opening/closing body; and a
pulling device that pulls said cord-like member in a direction that turns on said brake device at the same time when and/or after said opening/closing body comes into contact with said obstacle, wherein
said opening/closing body stop device of an

opening/closing device includes a winding device that feedably winds said cord-like member, and said pulling device is configured as a device that causes said winding device to perform a movement in order to pull said cord-like member in a direction that turns on said brake device.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S2
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S4
S4
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1B
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3,3A
4
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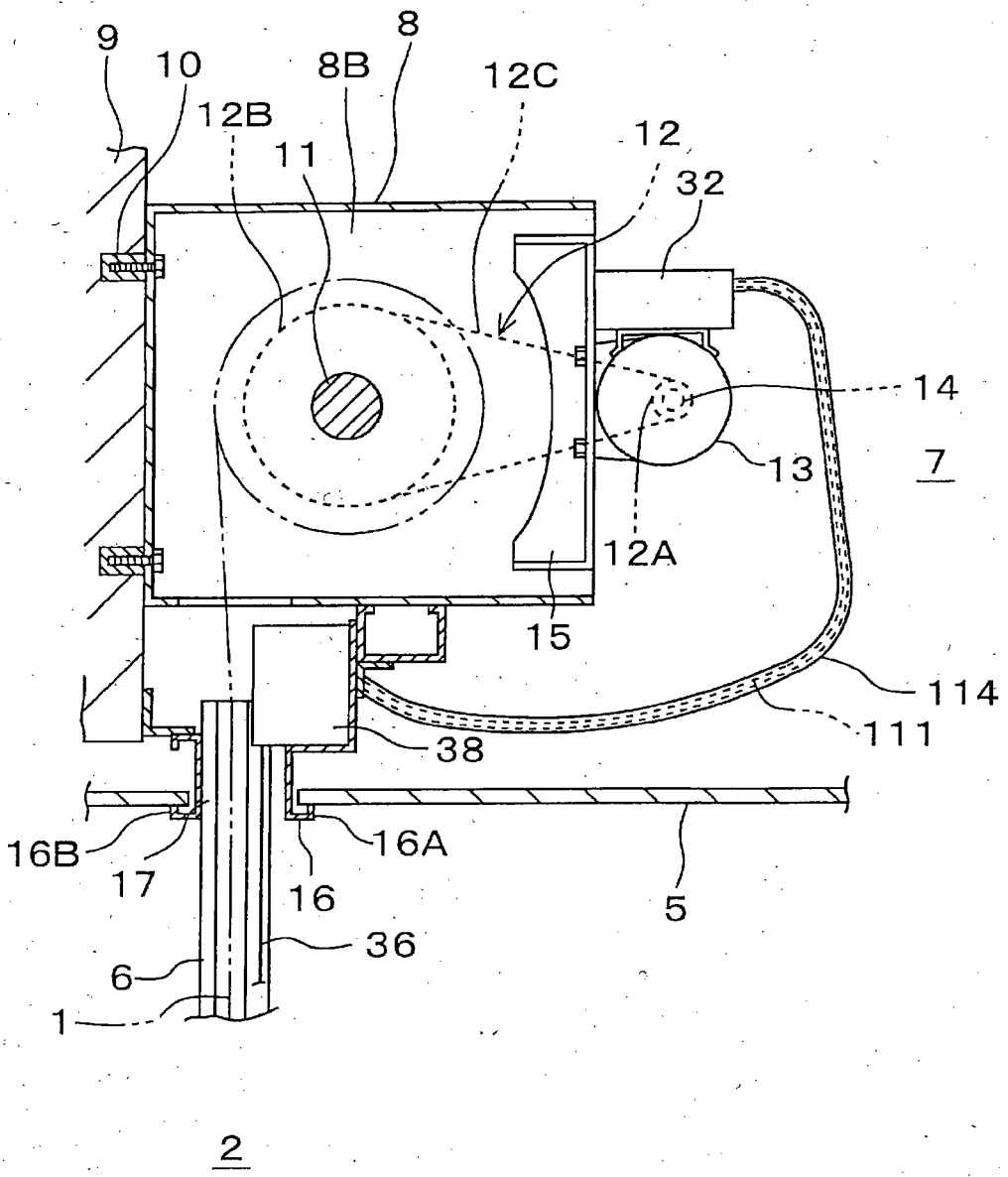
FIG. 1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16A
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1
2

FIG. 2

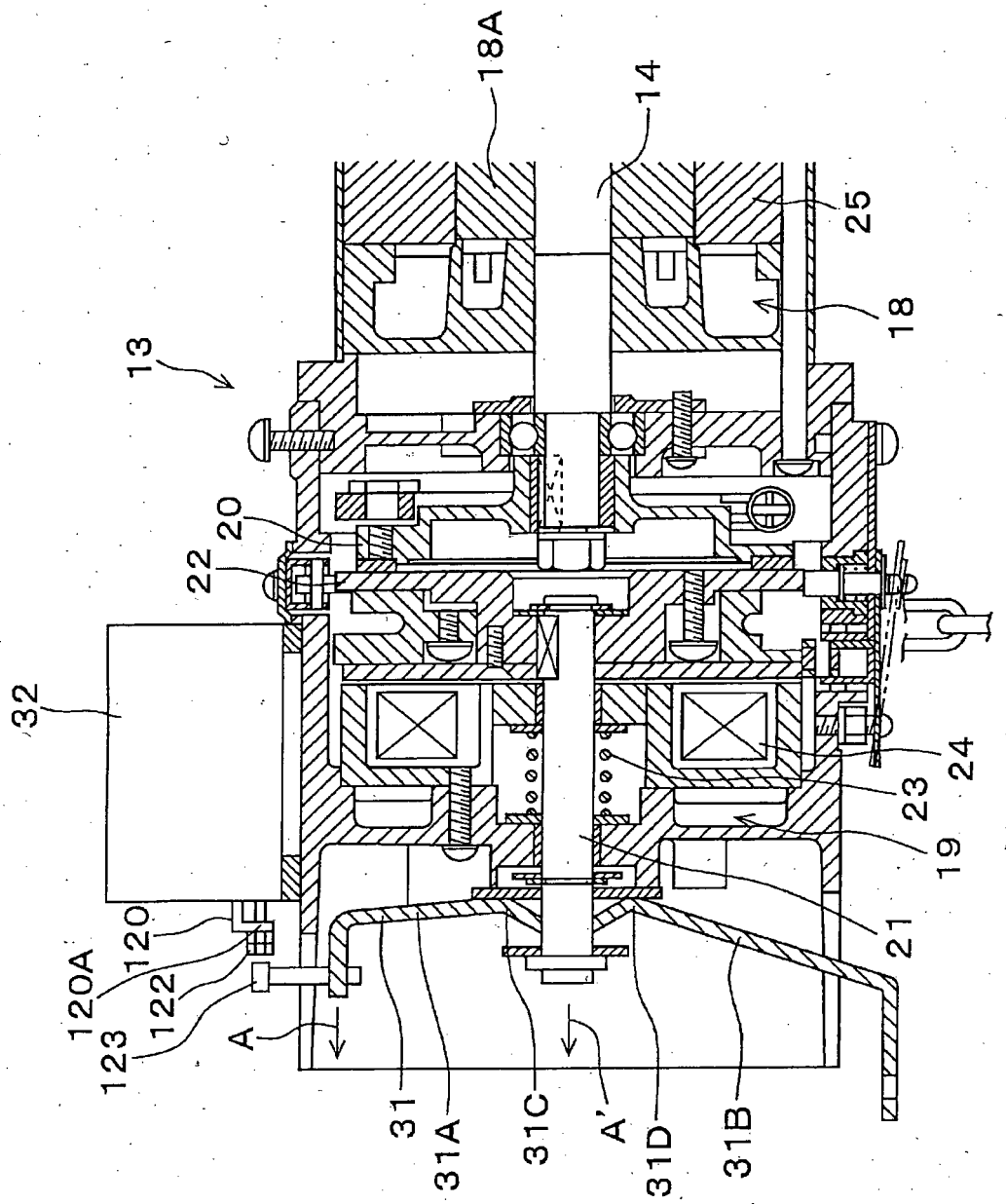
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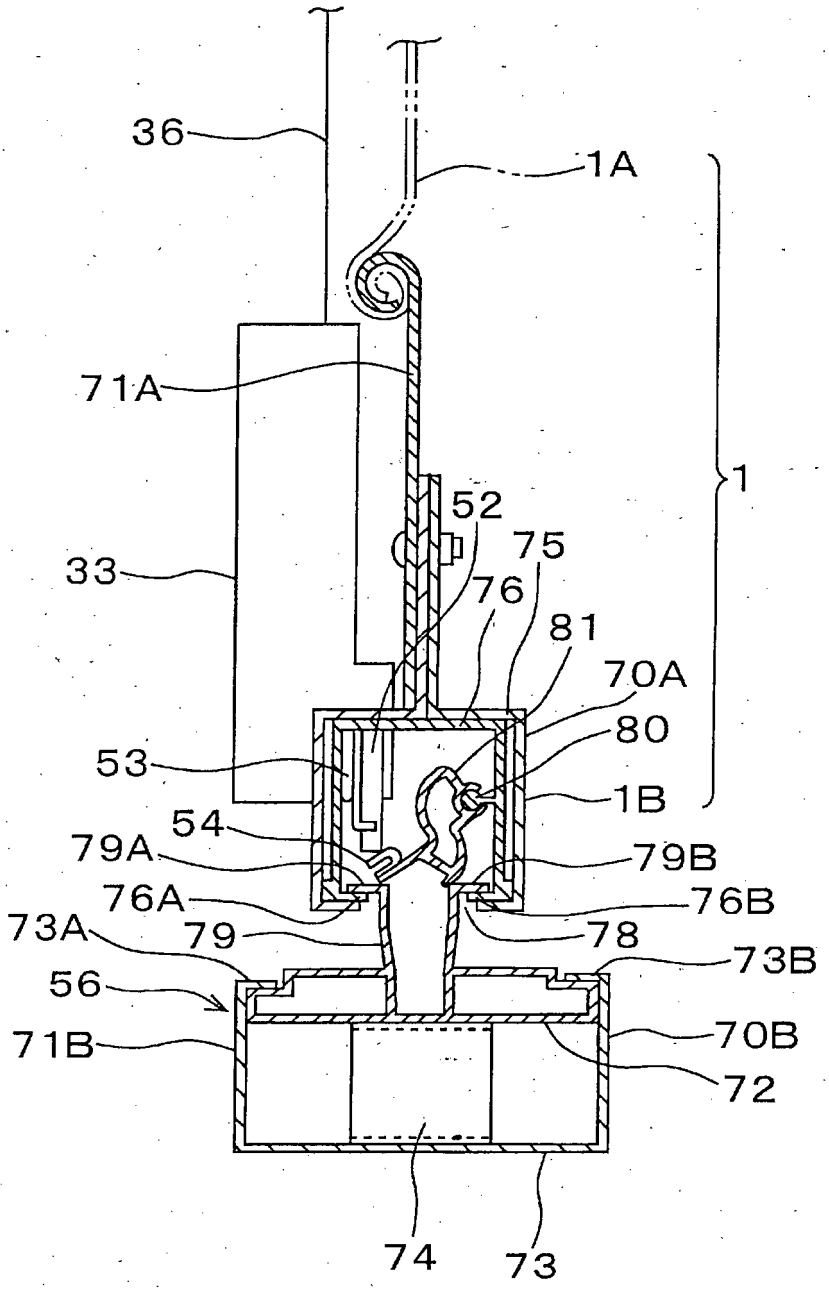
FIG. 3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74
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FIG. 4

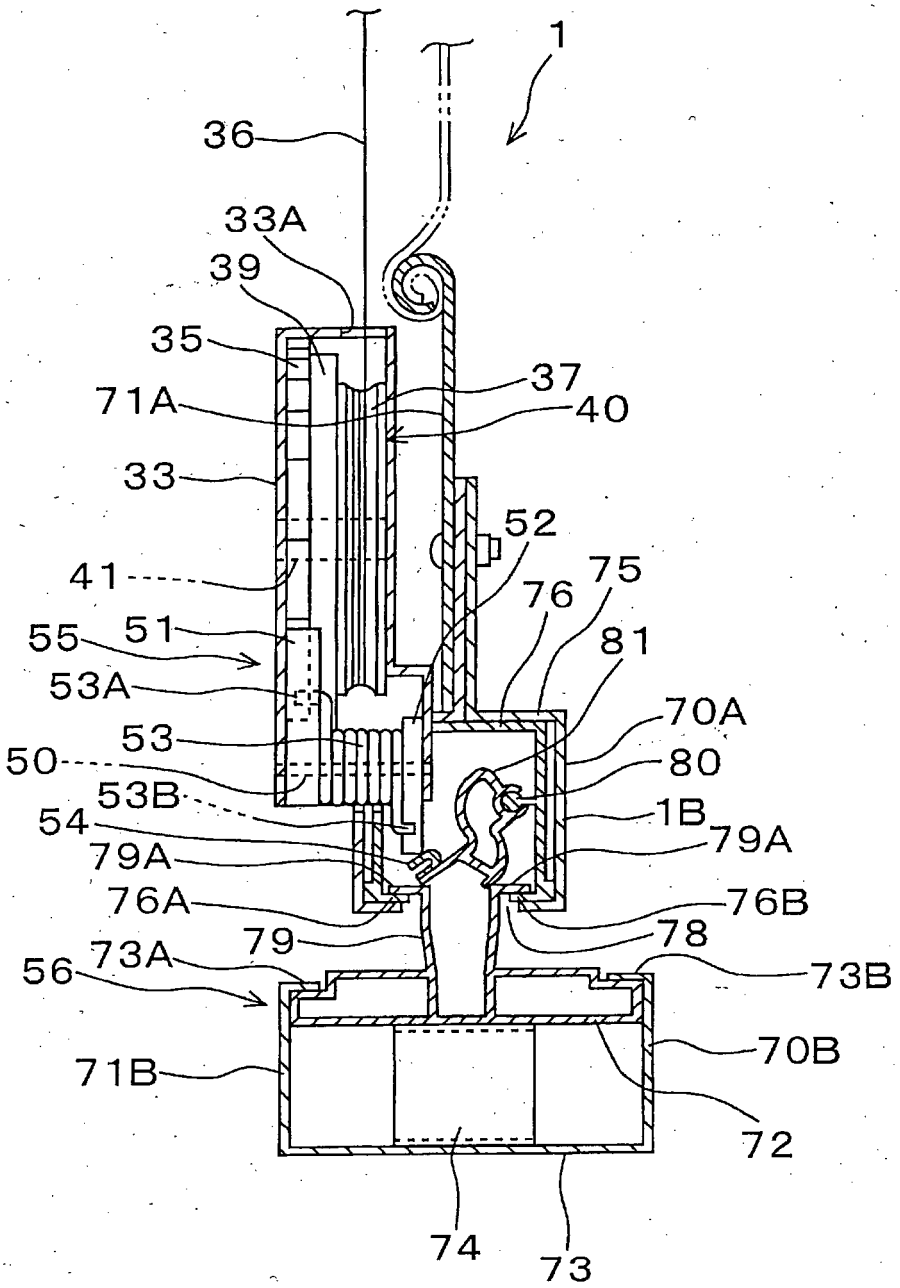
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FIG. 5

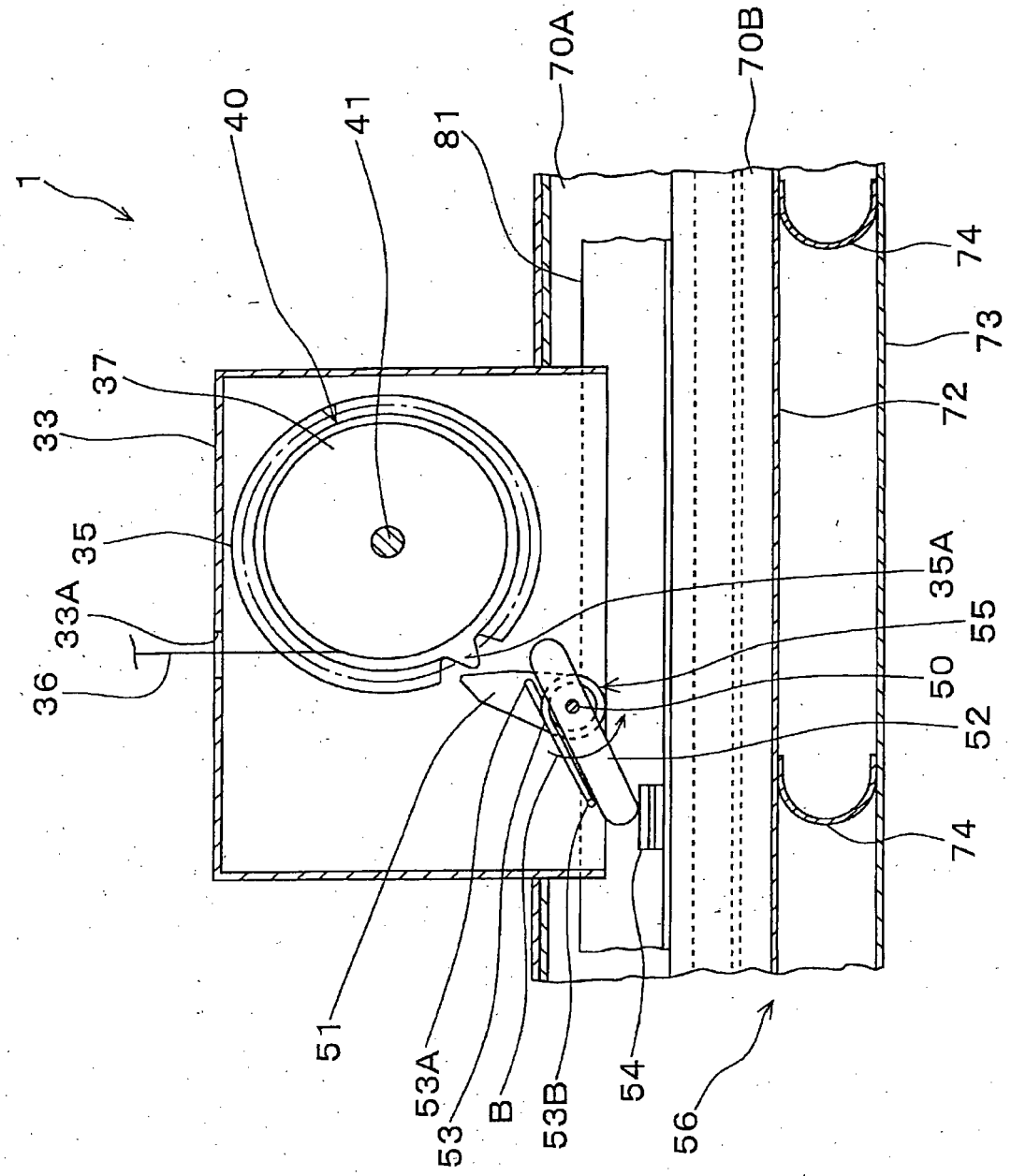
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FIG. 6

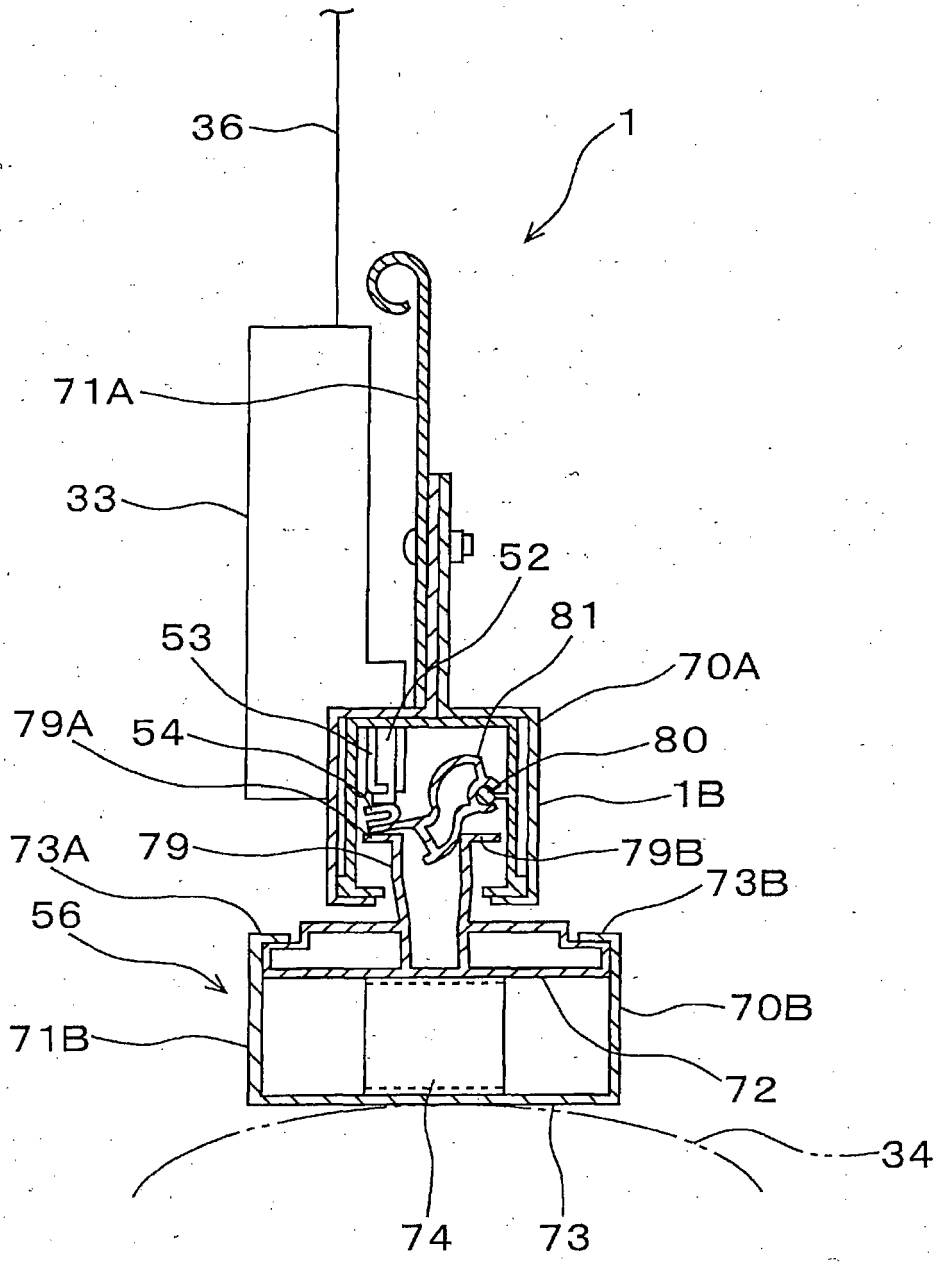
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FIG. 7

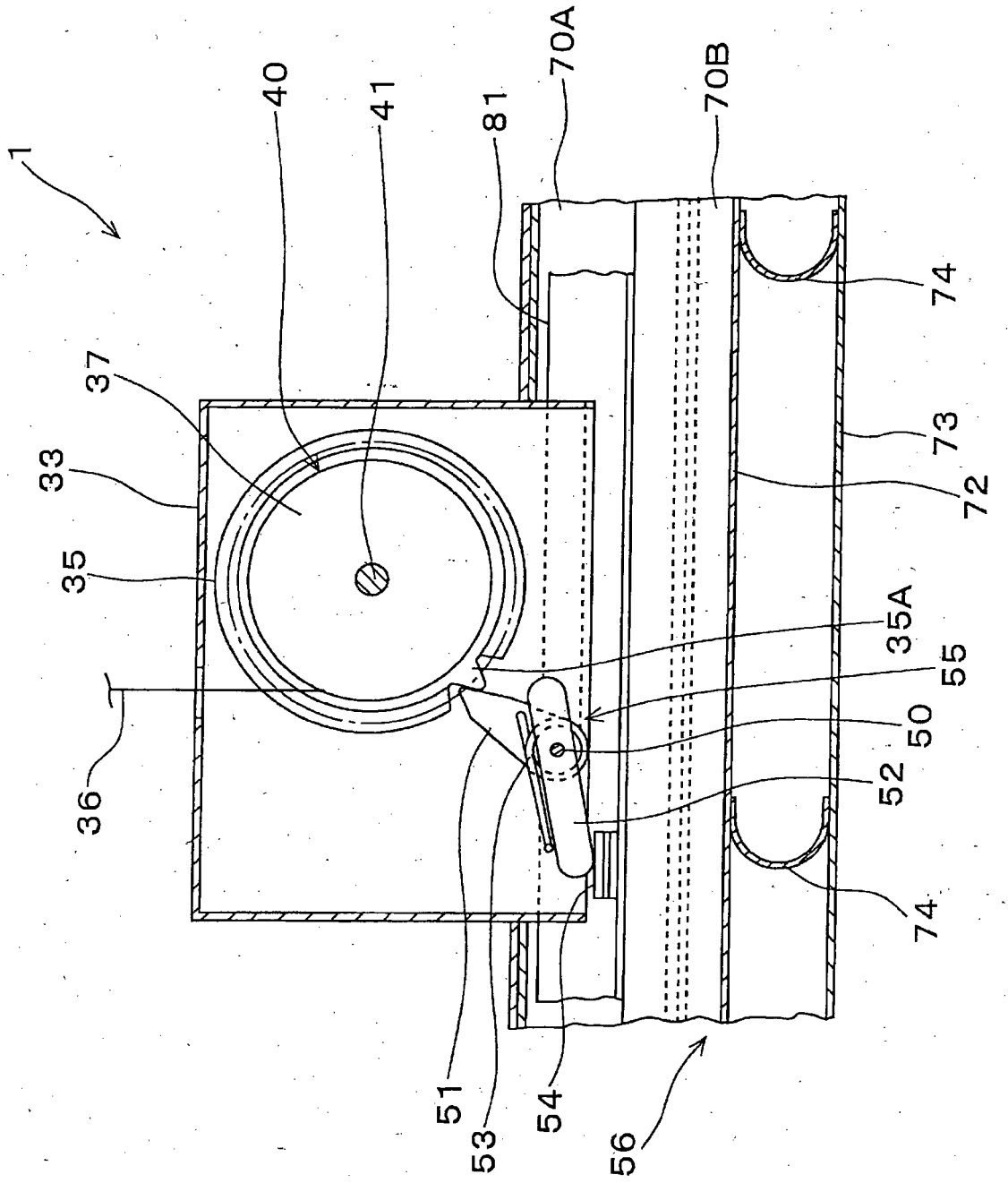
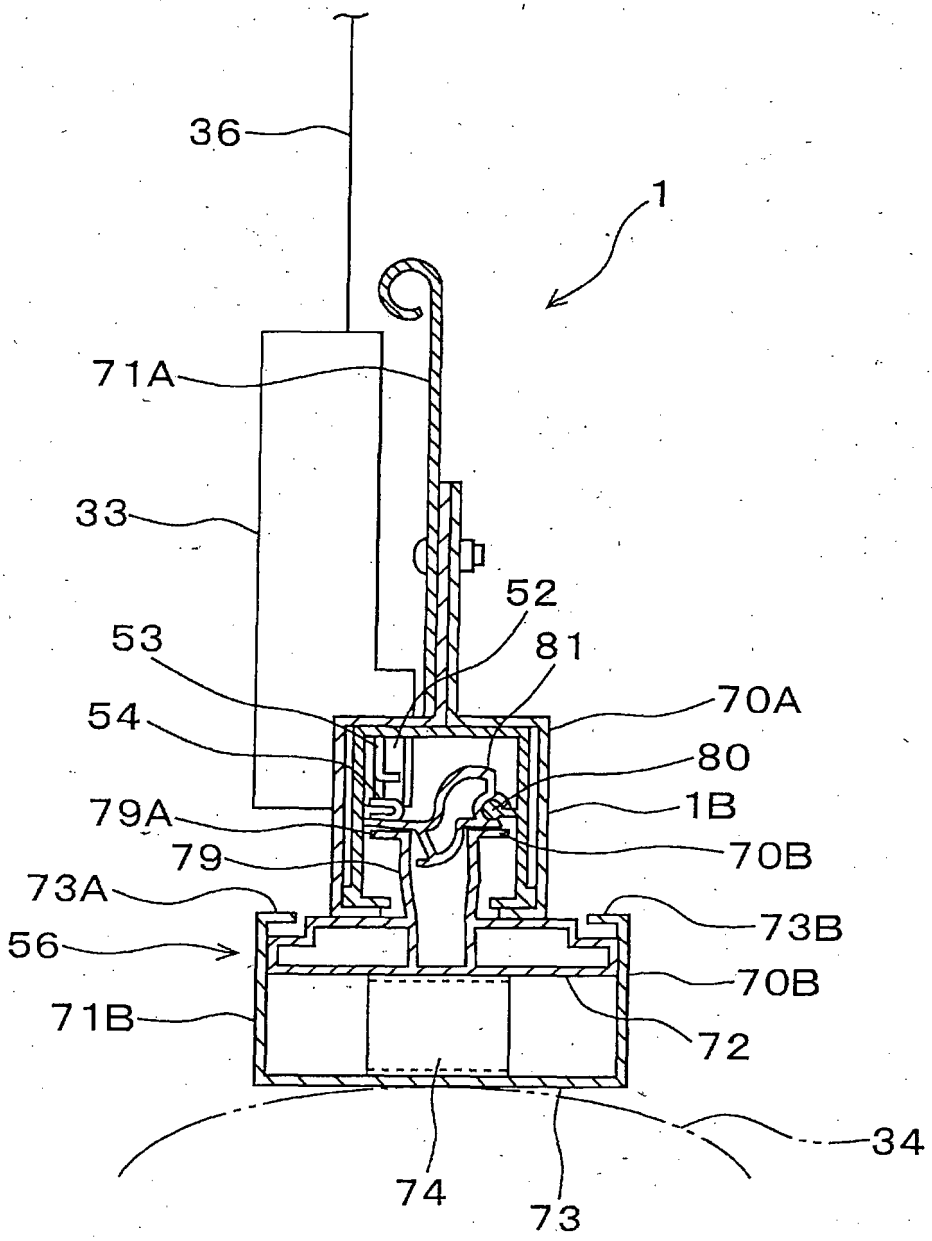


FIG. 8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74
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FIG. 9

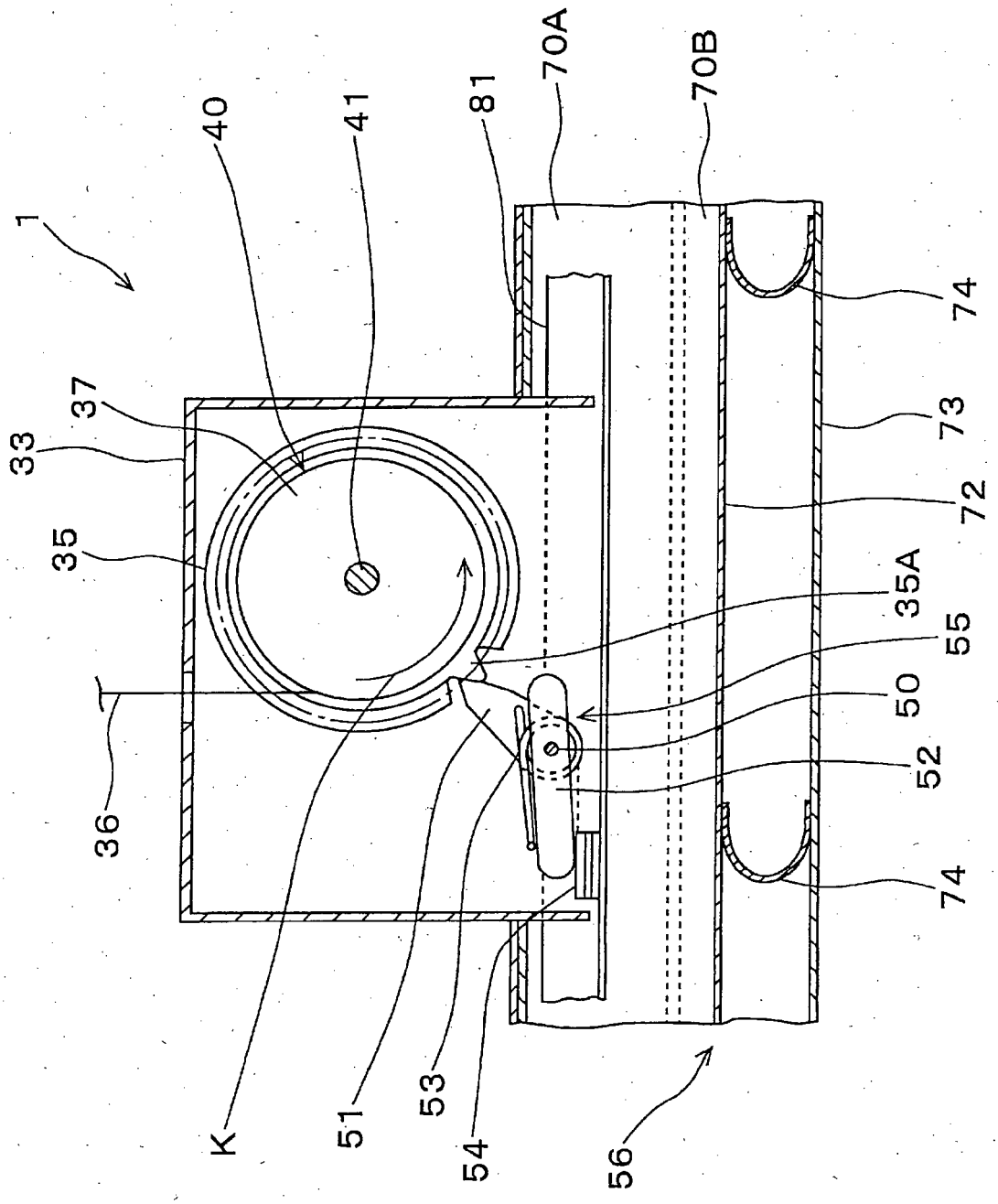

FIG. 10

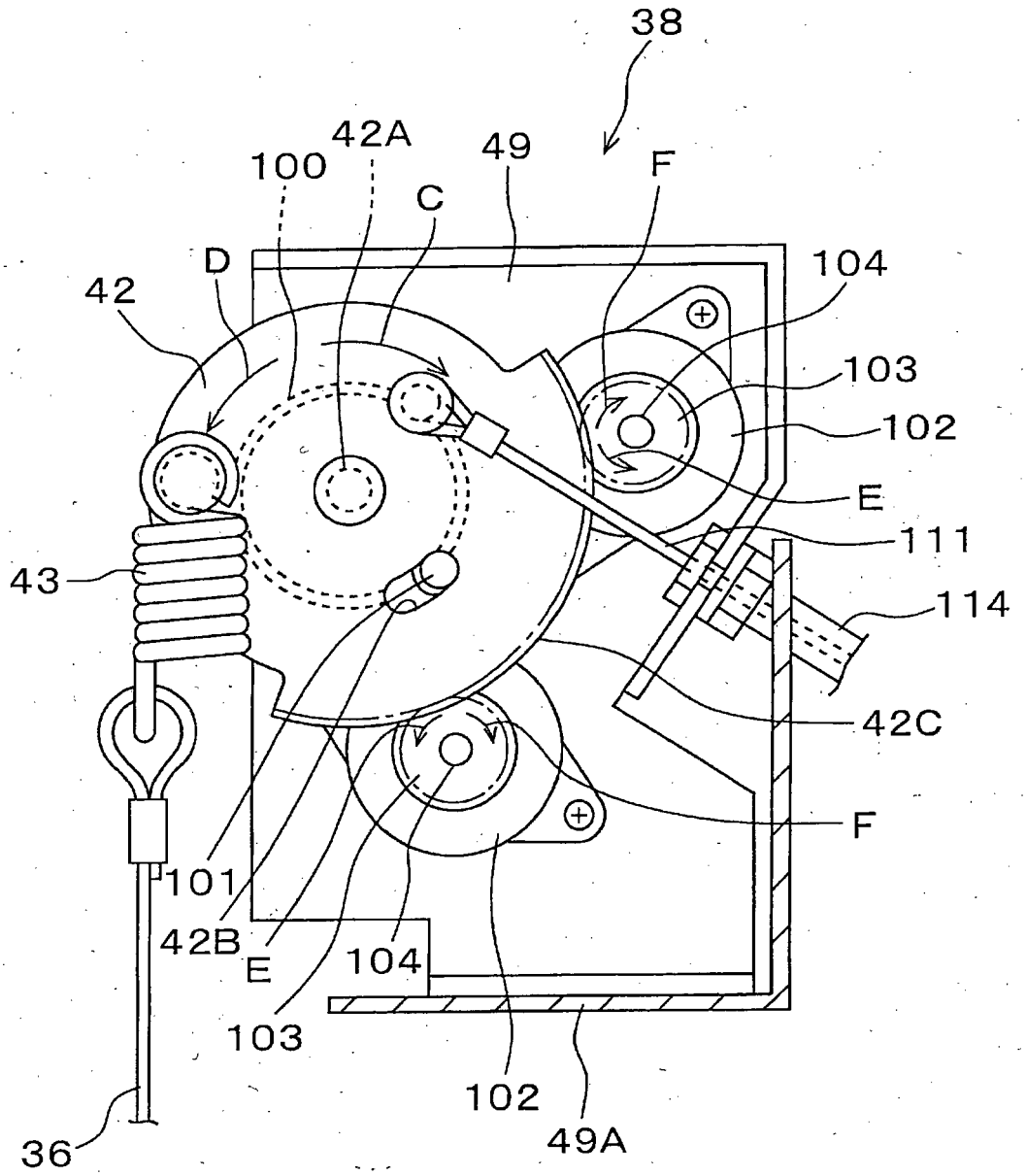
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FIG. 11

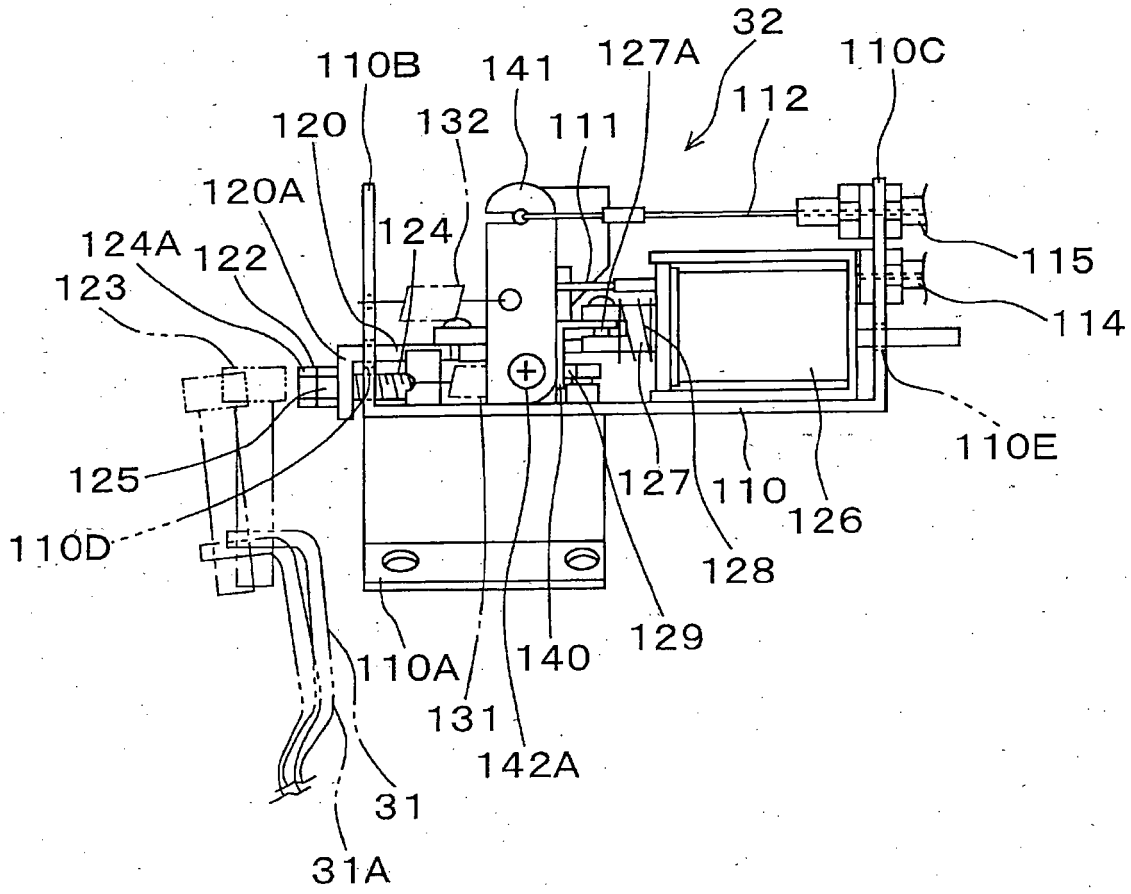
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FIG. 12

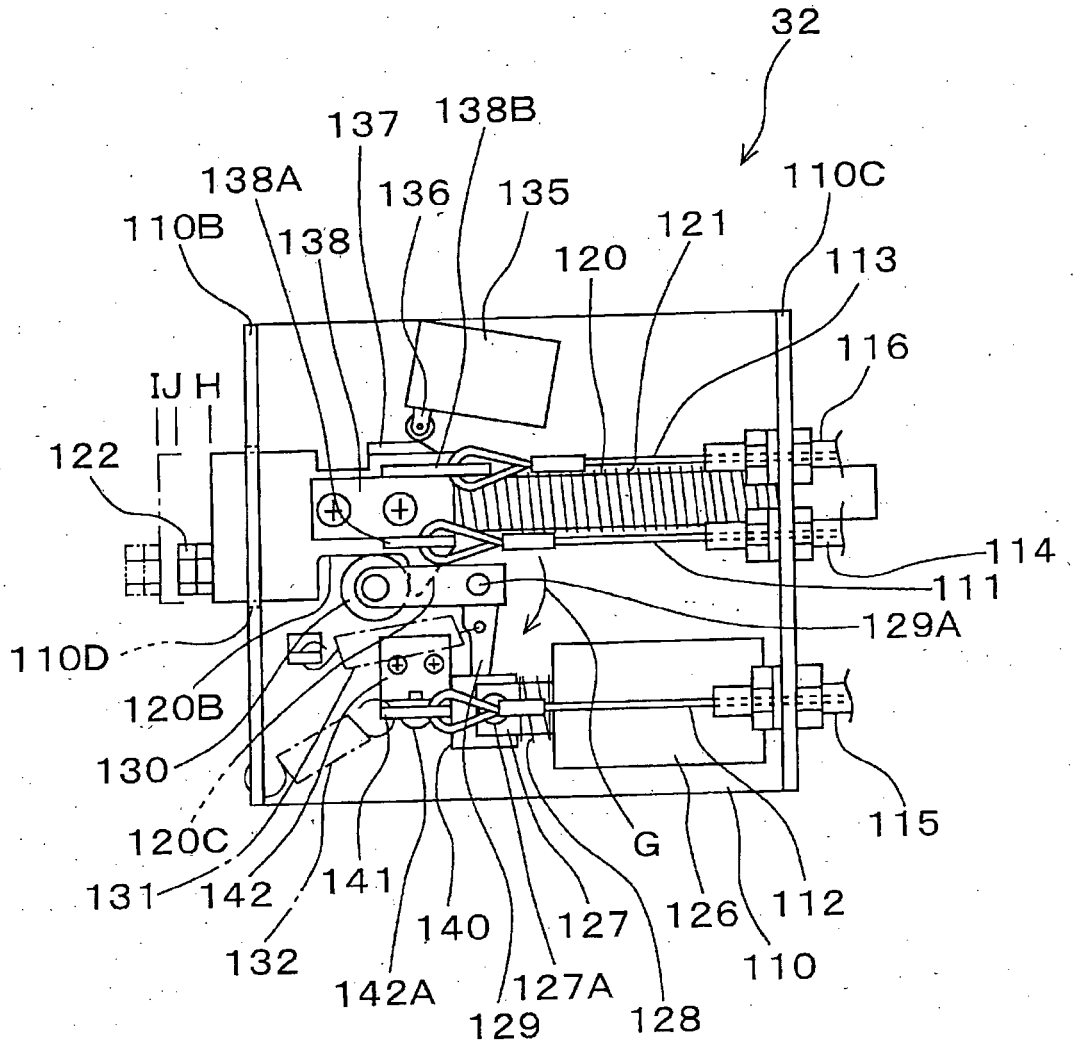
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FIG. 13

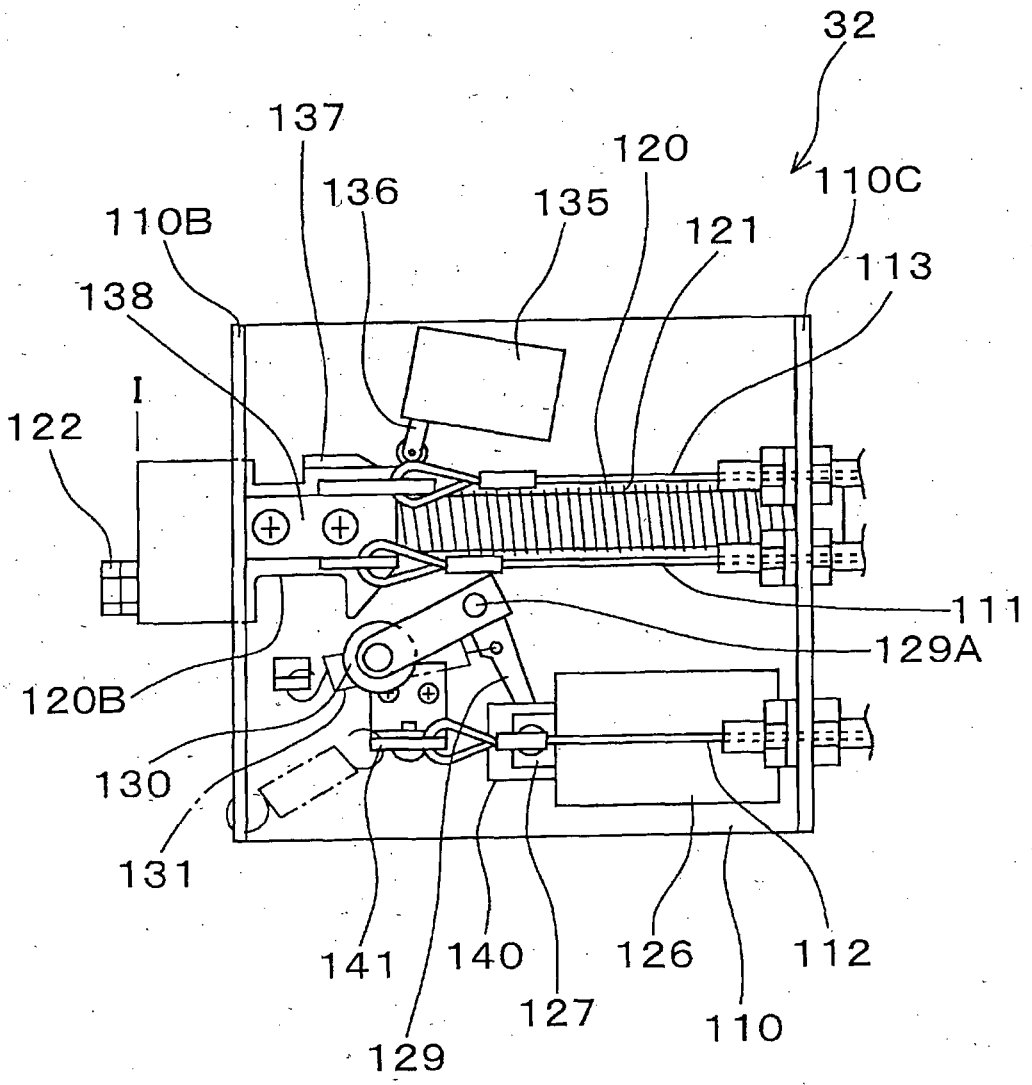
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FIG. 14

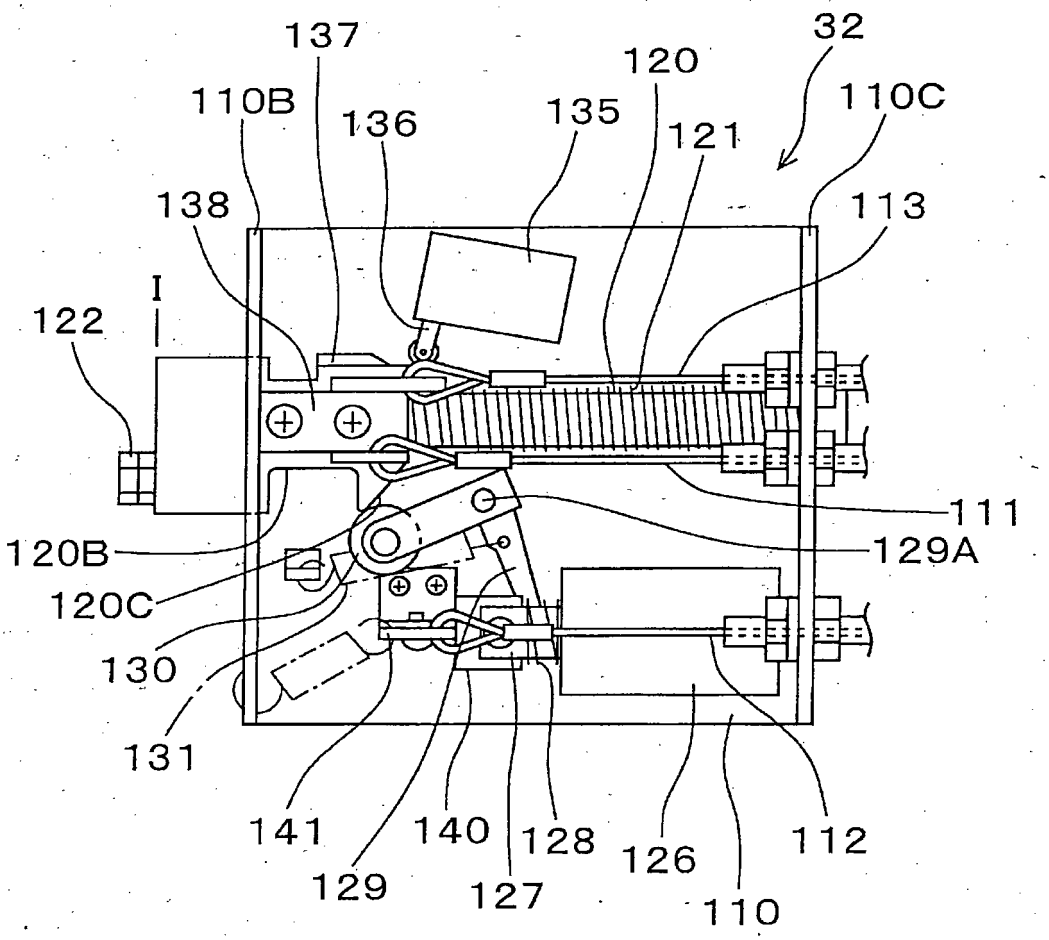
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FIG. 15

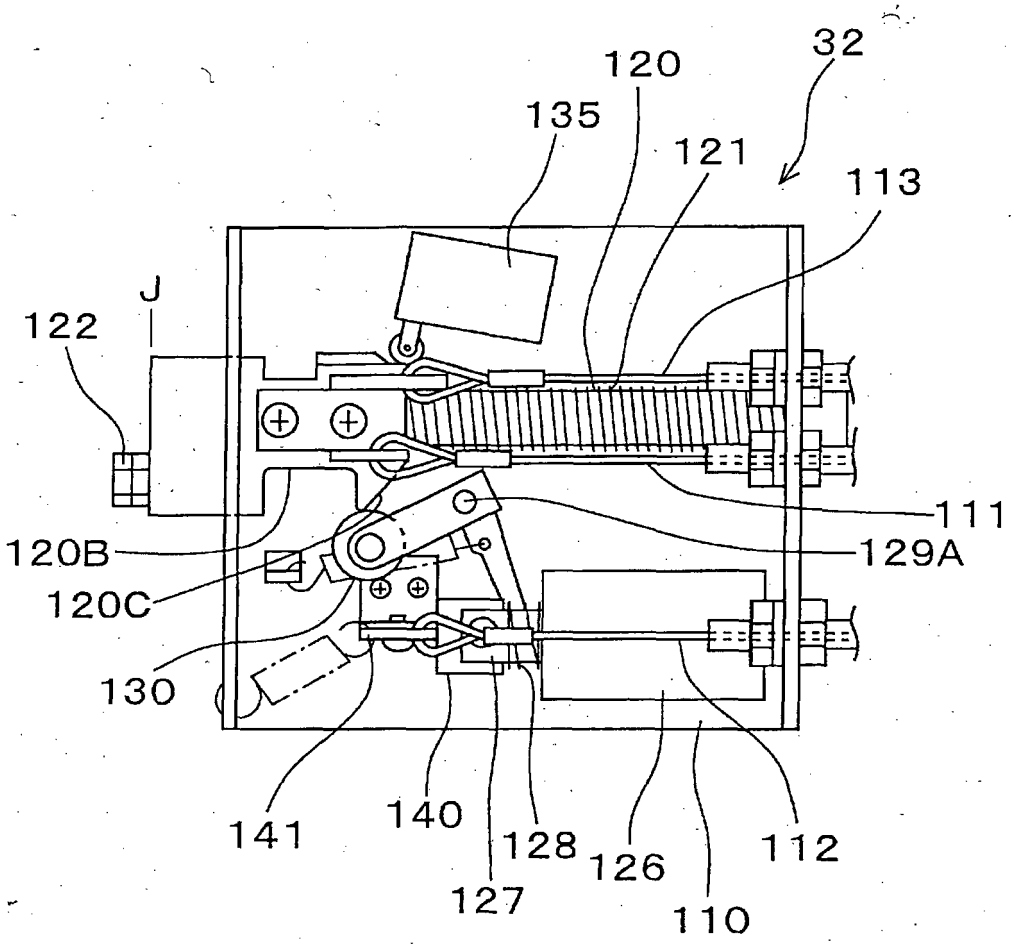
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FIG. 16

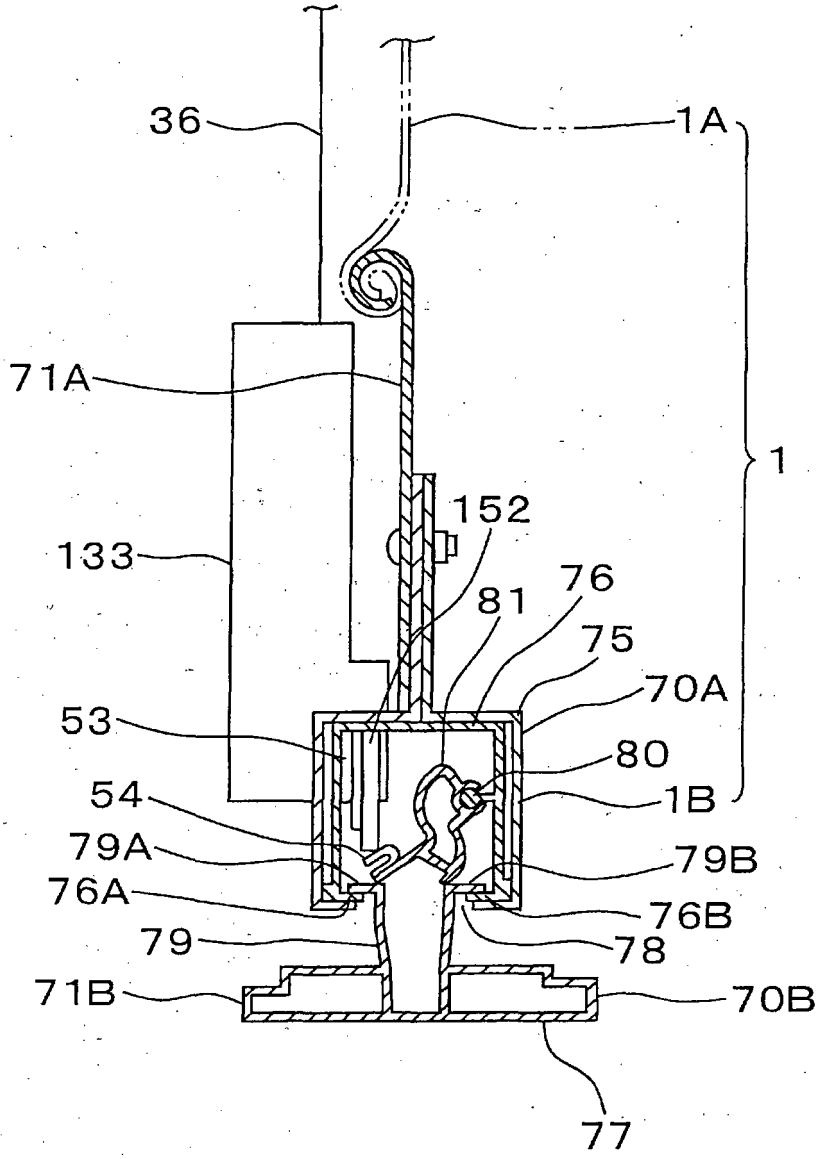
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FIG. 17

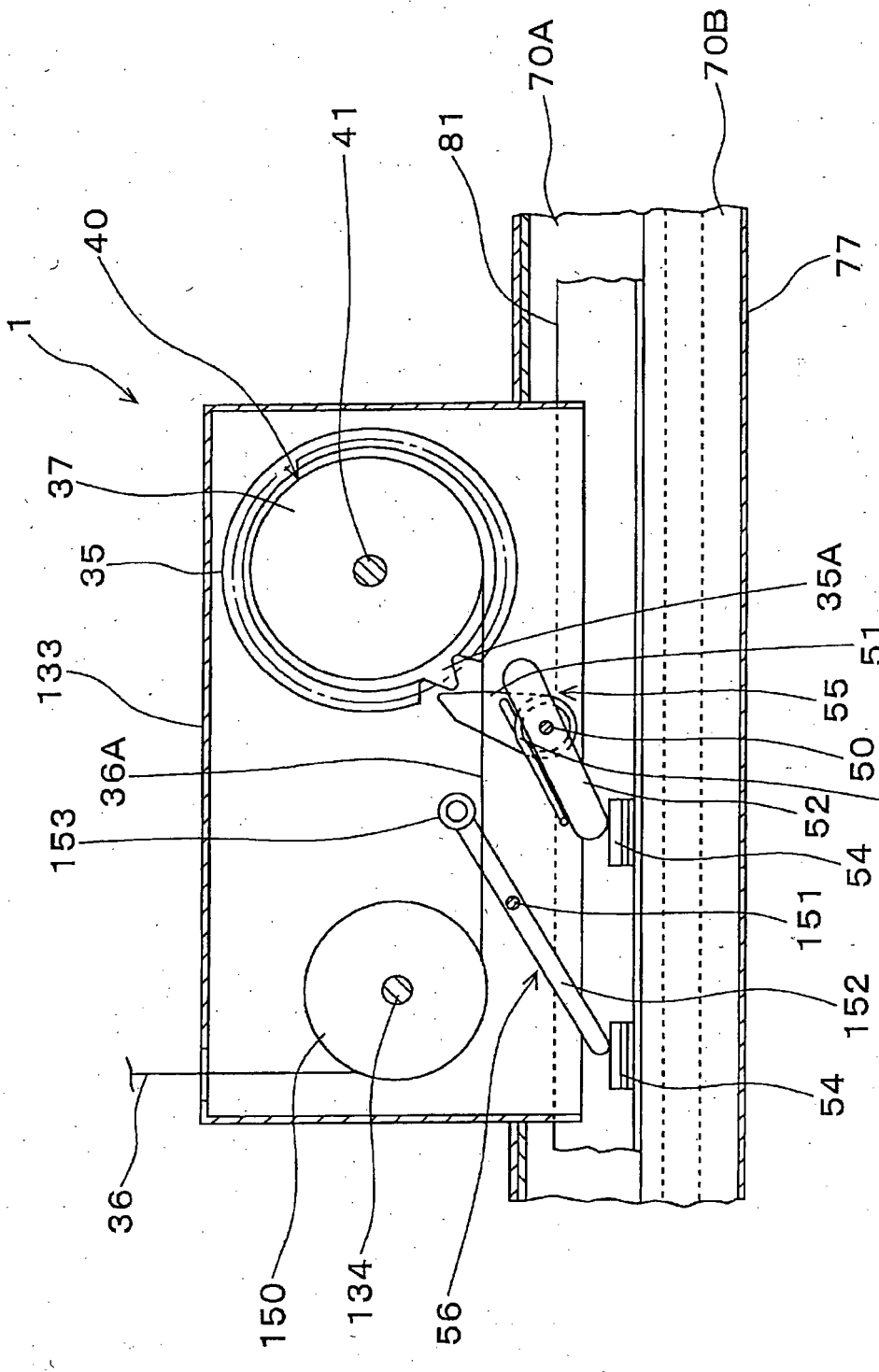
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FIG. 18

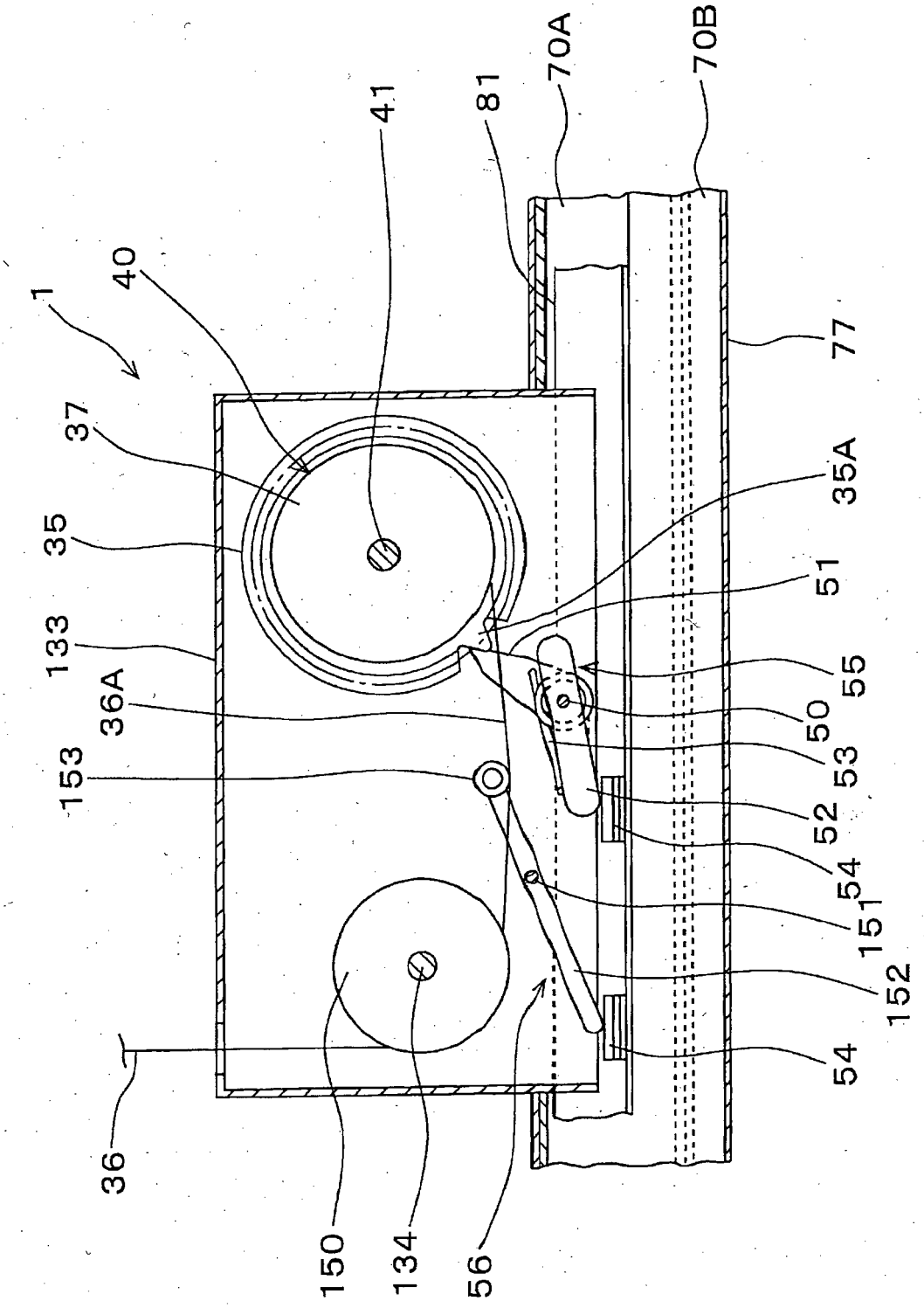
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FIG. 19

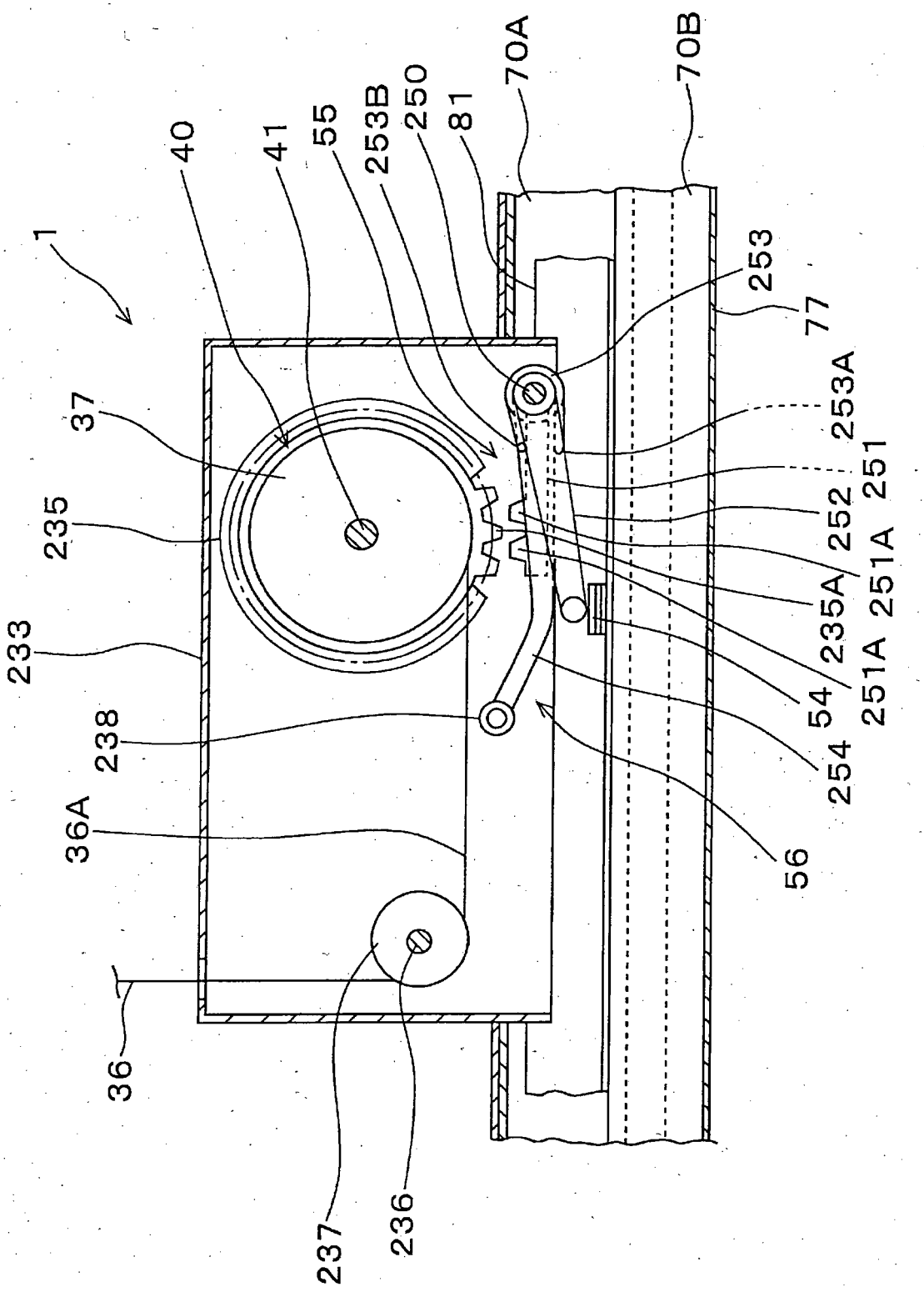
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FIG. 20

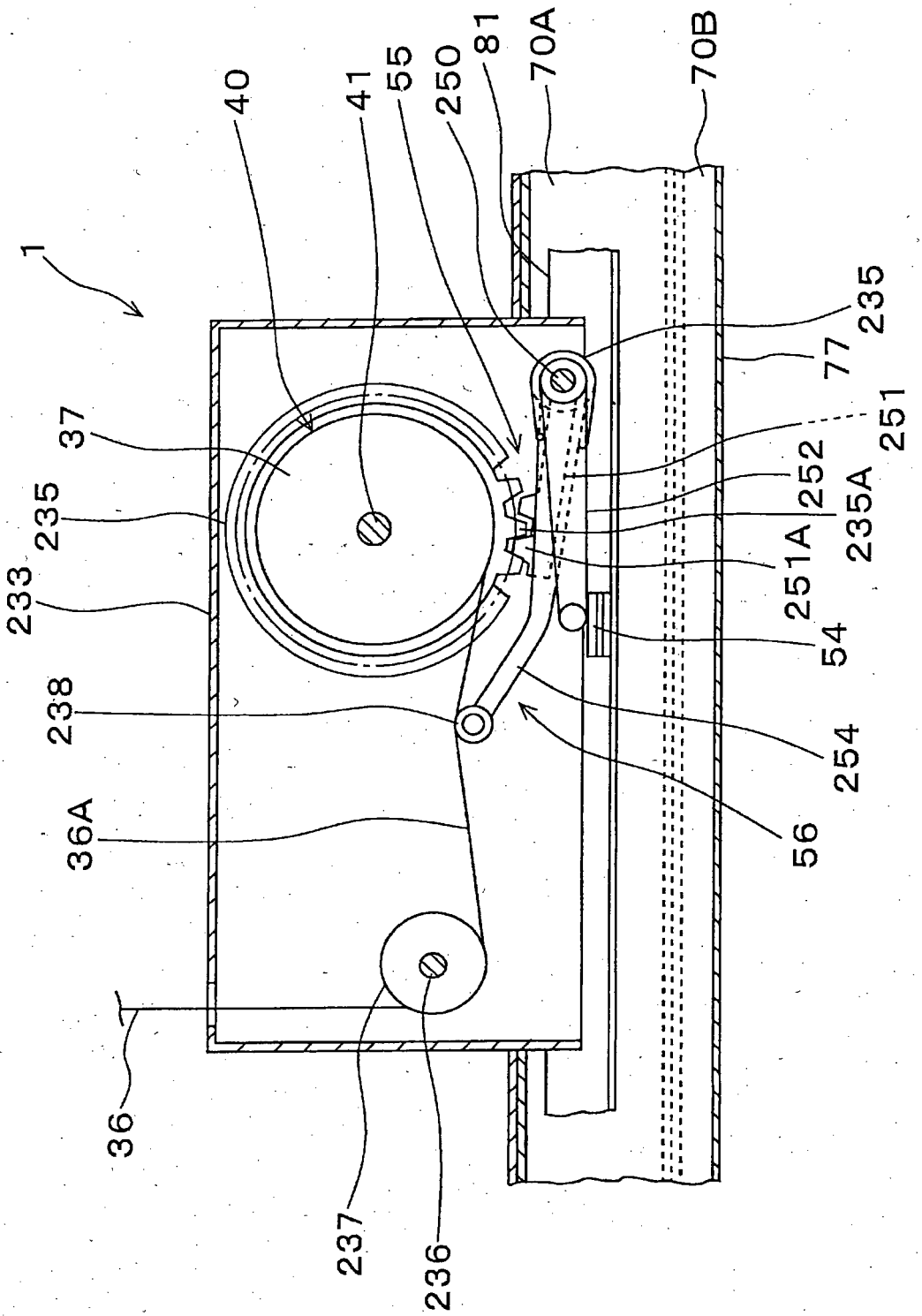
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FIG. 21

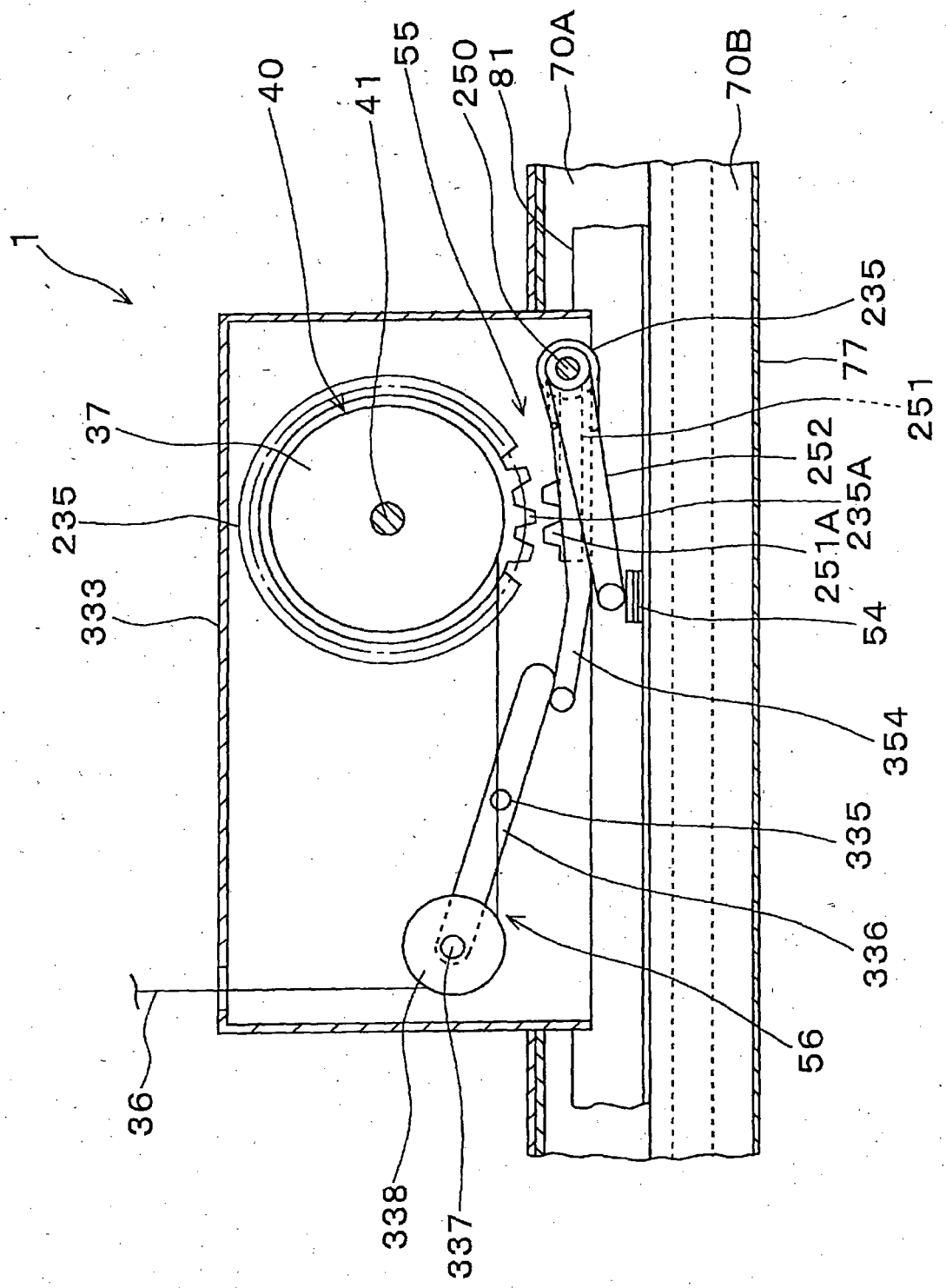
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FIG. 22

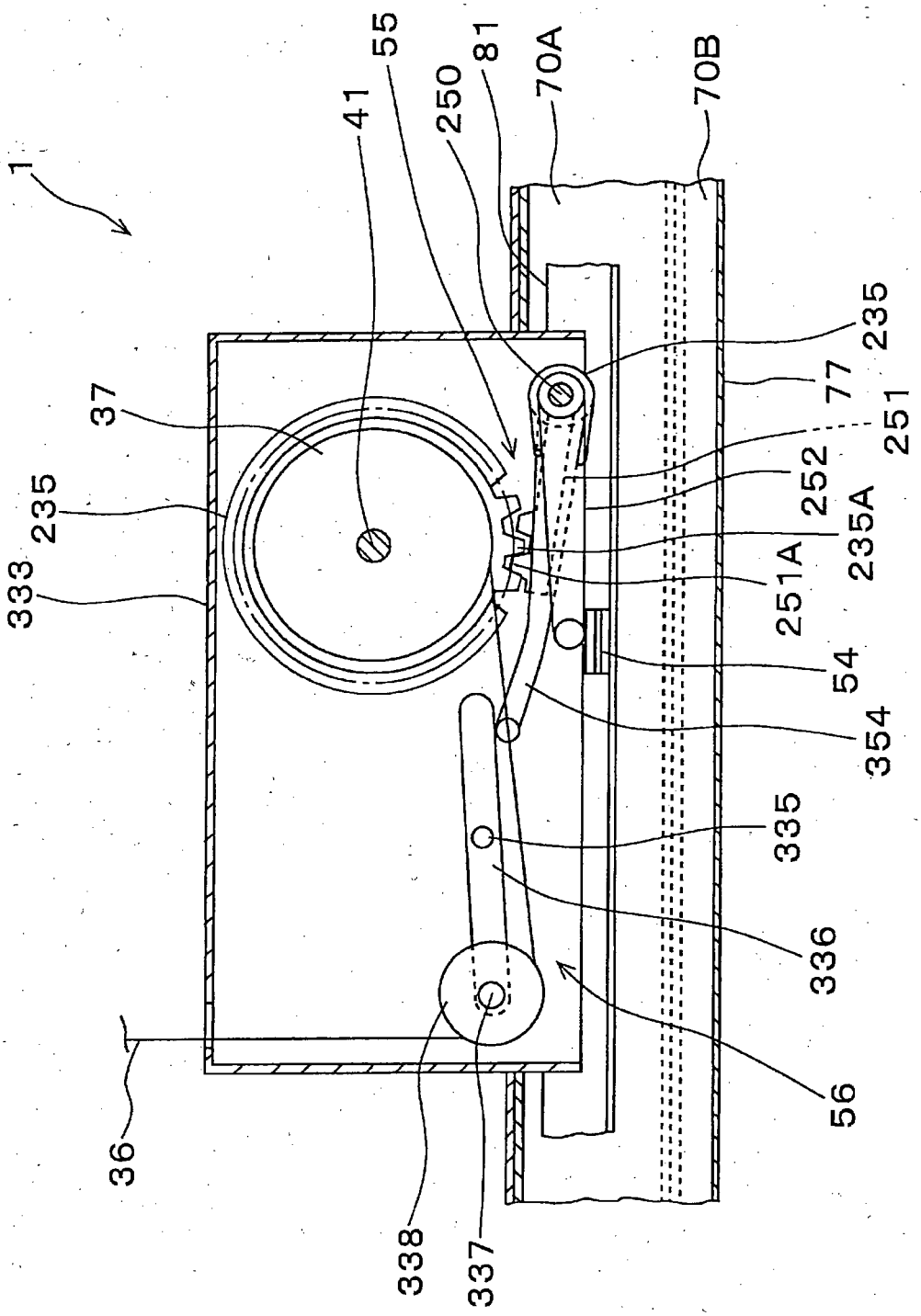
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FIG. 23

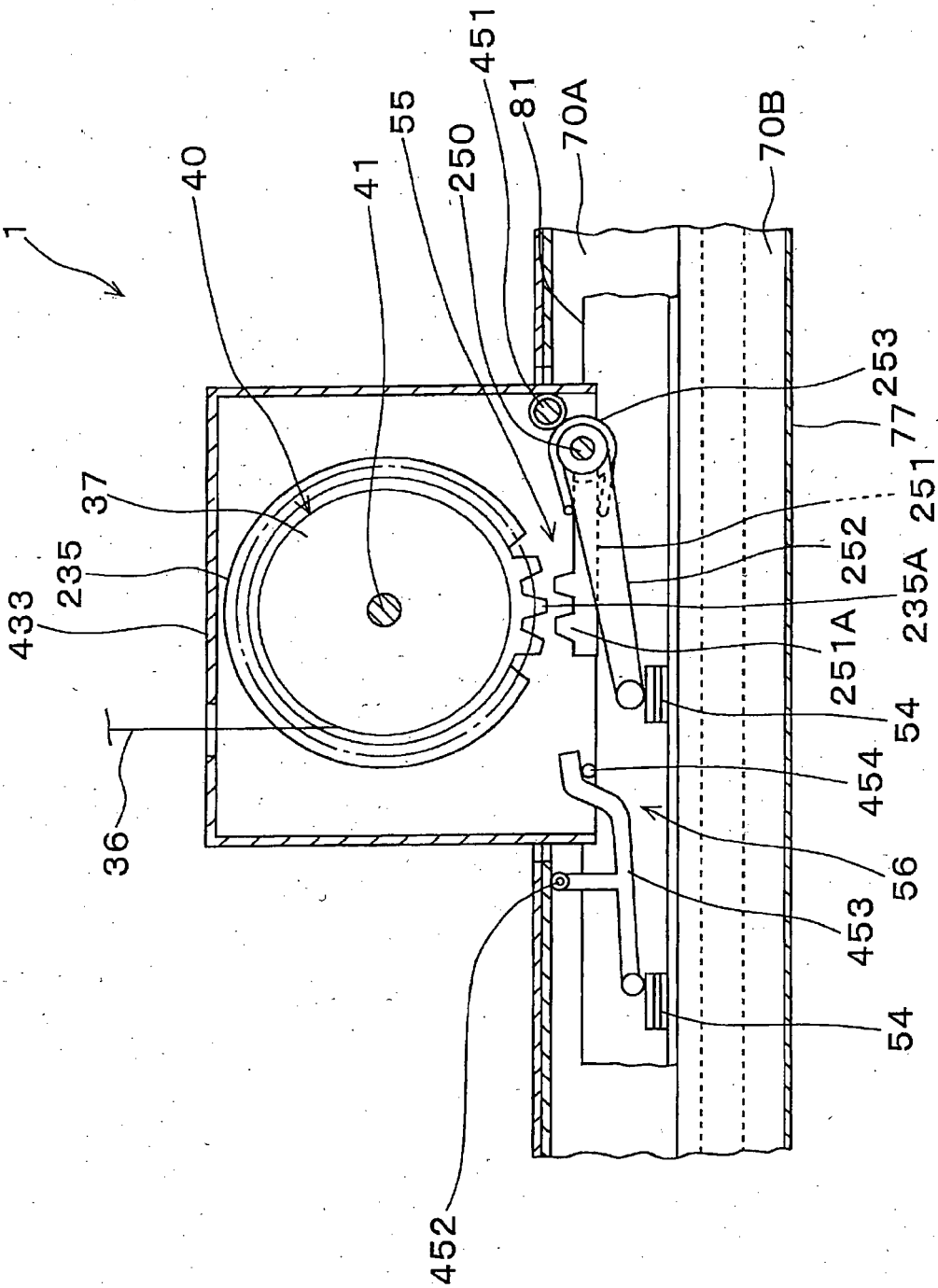
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FIG. 24

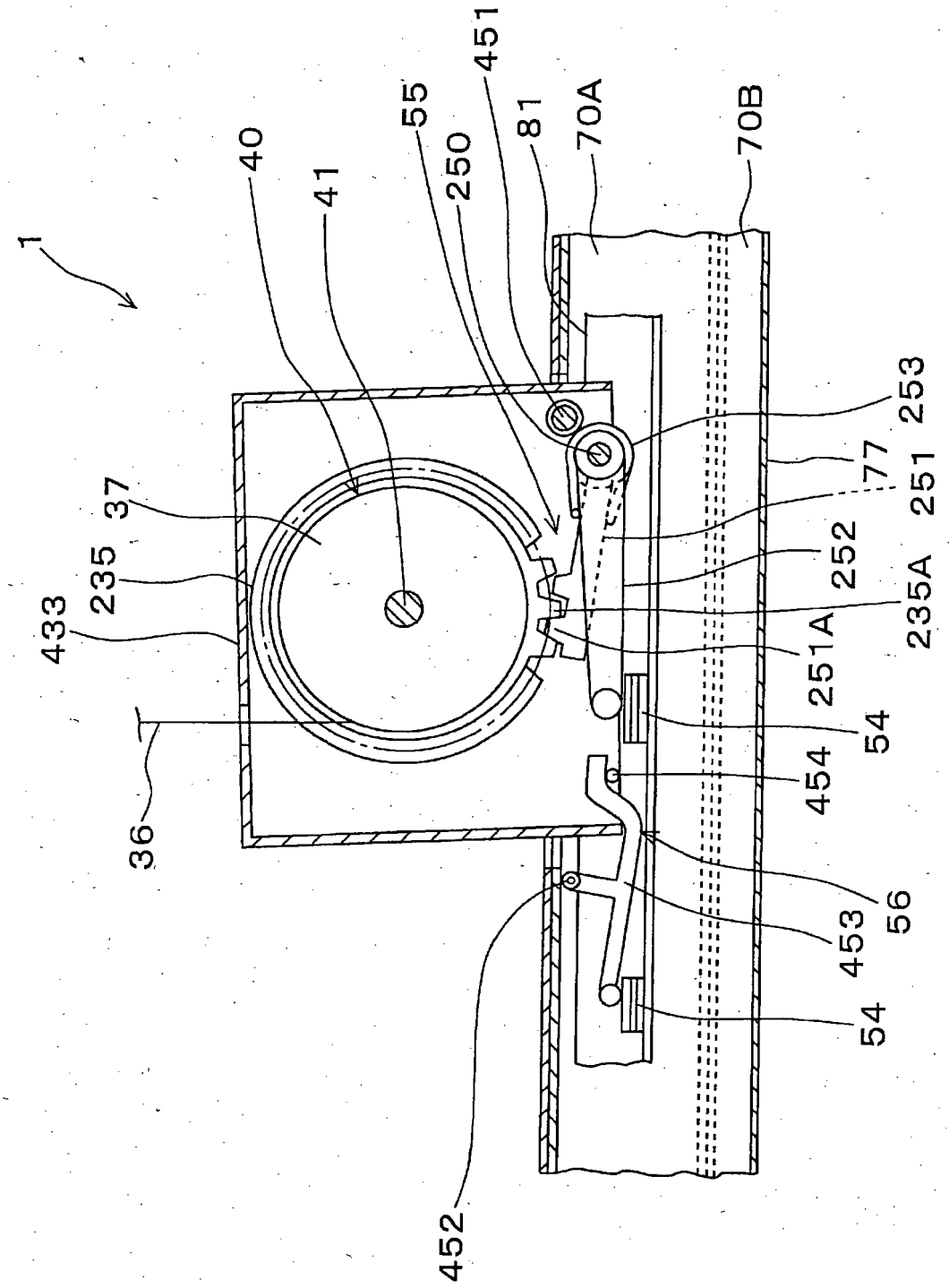
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FIG. 25

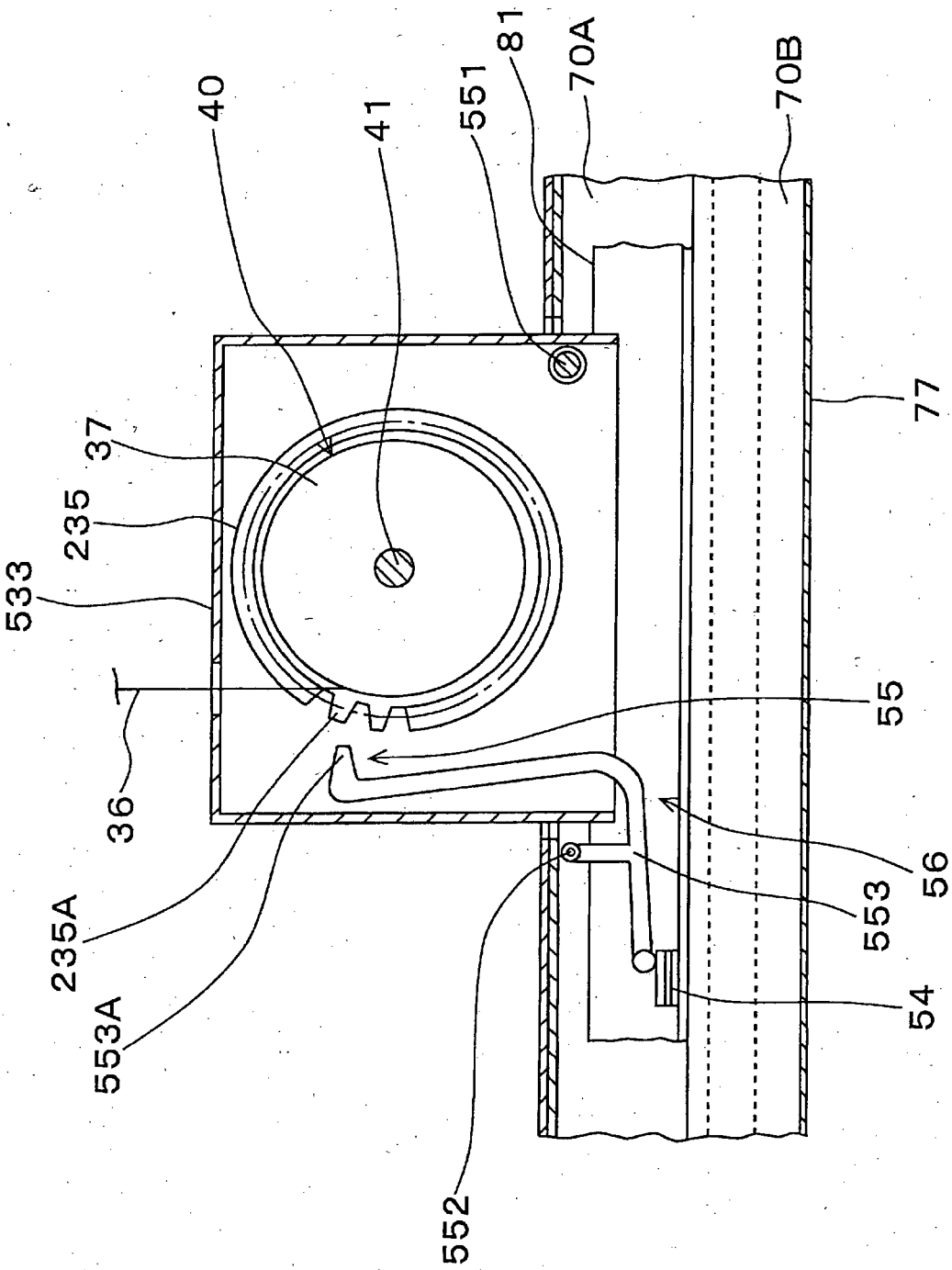

FIG. 26

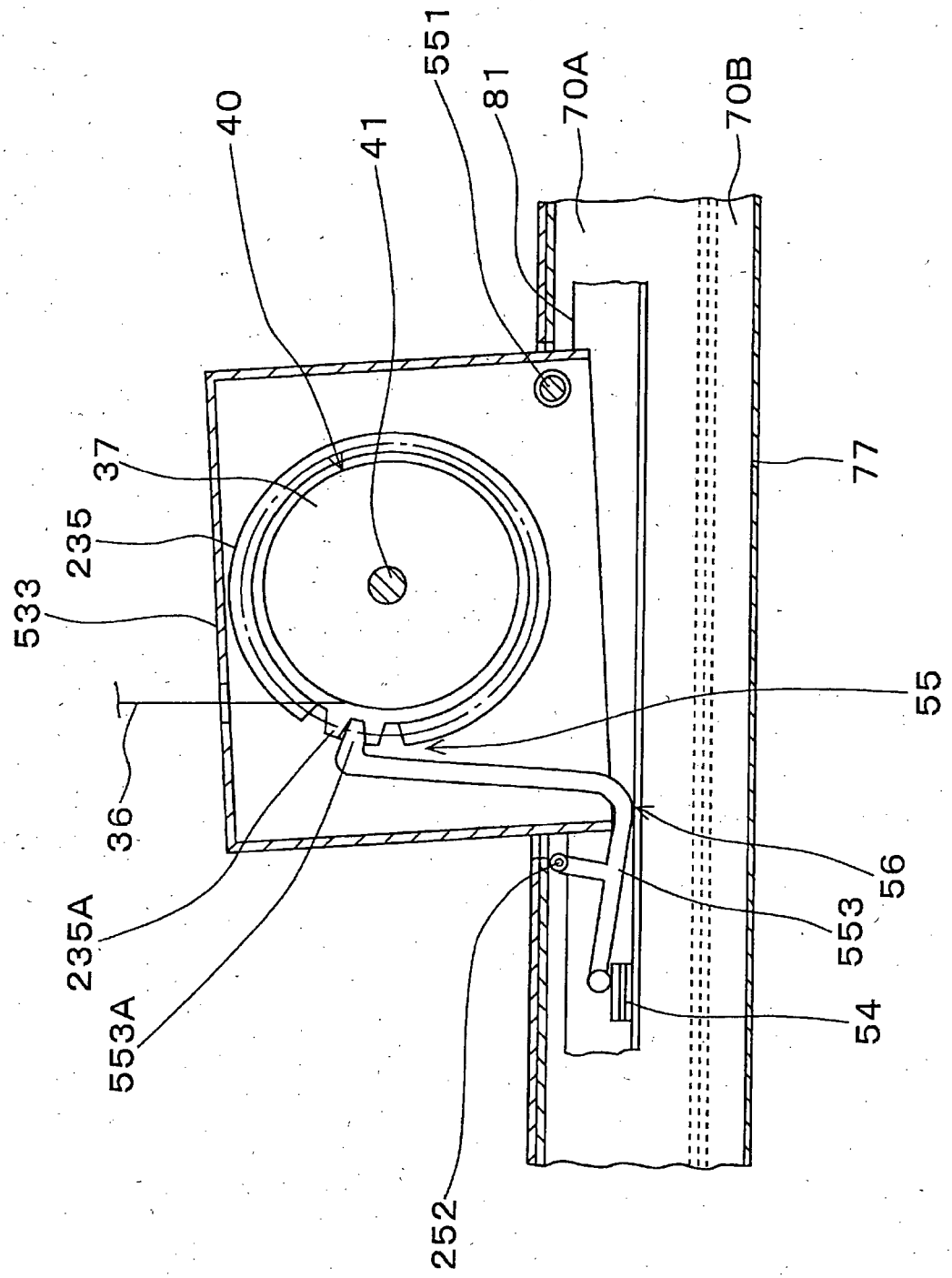

FIG. 27

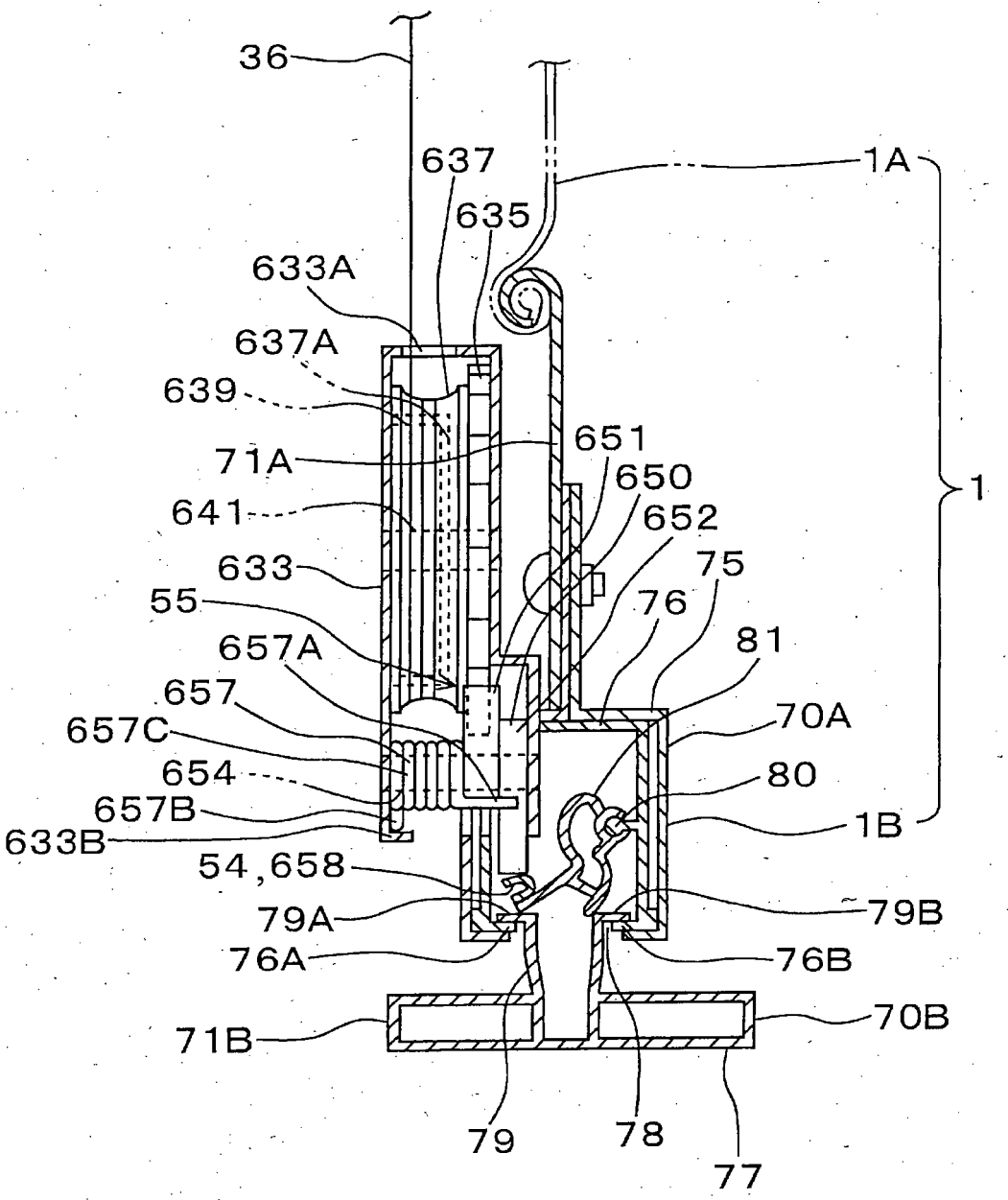
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FIG. 28

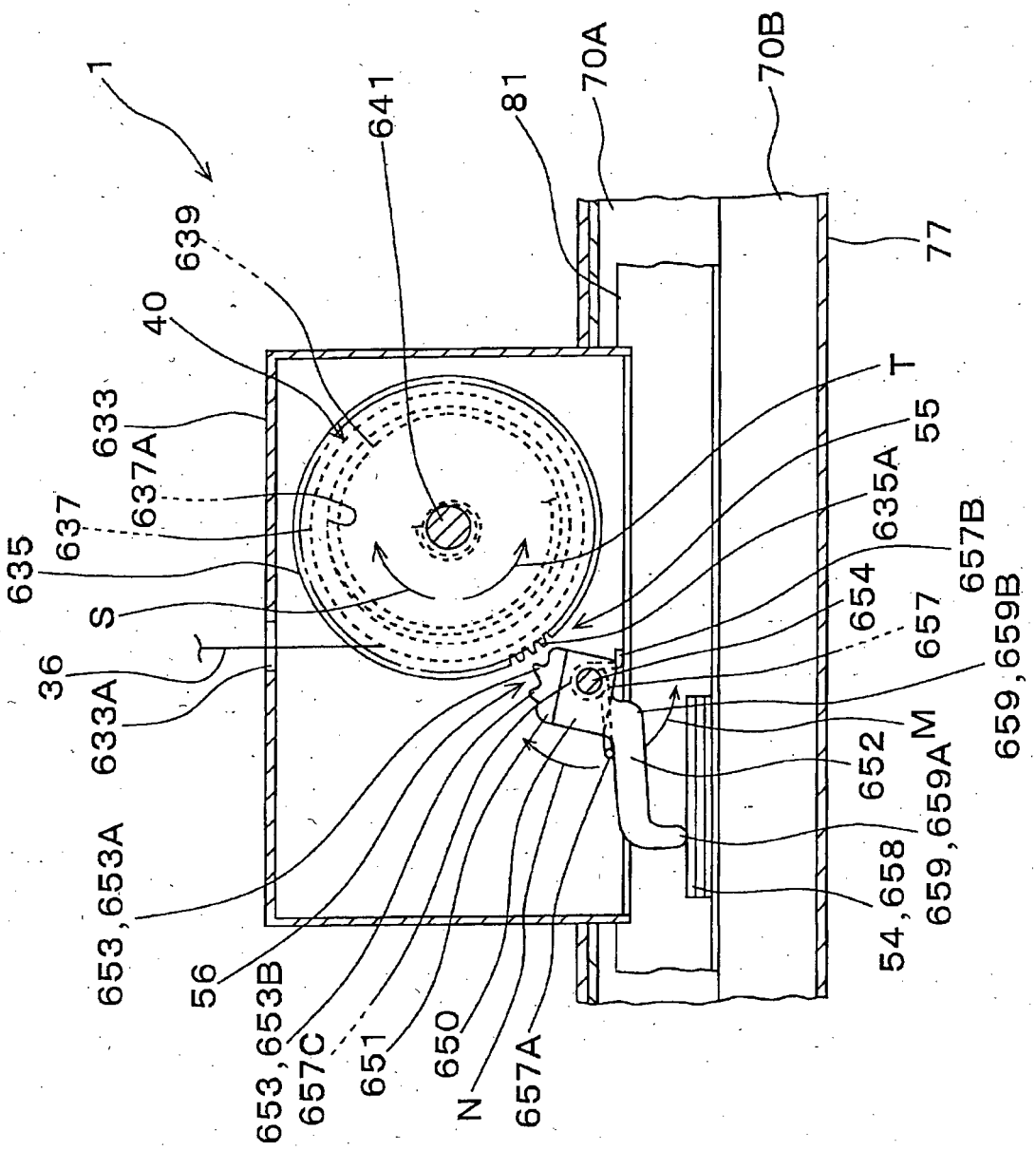
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FIG. 29

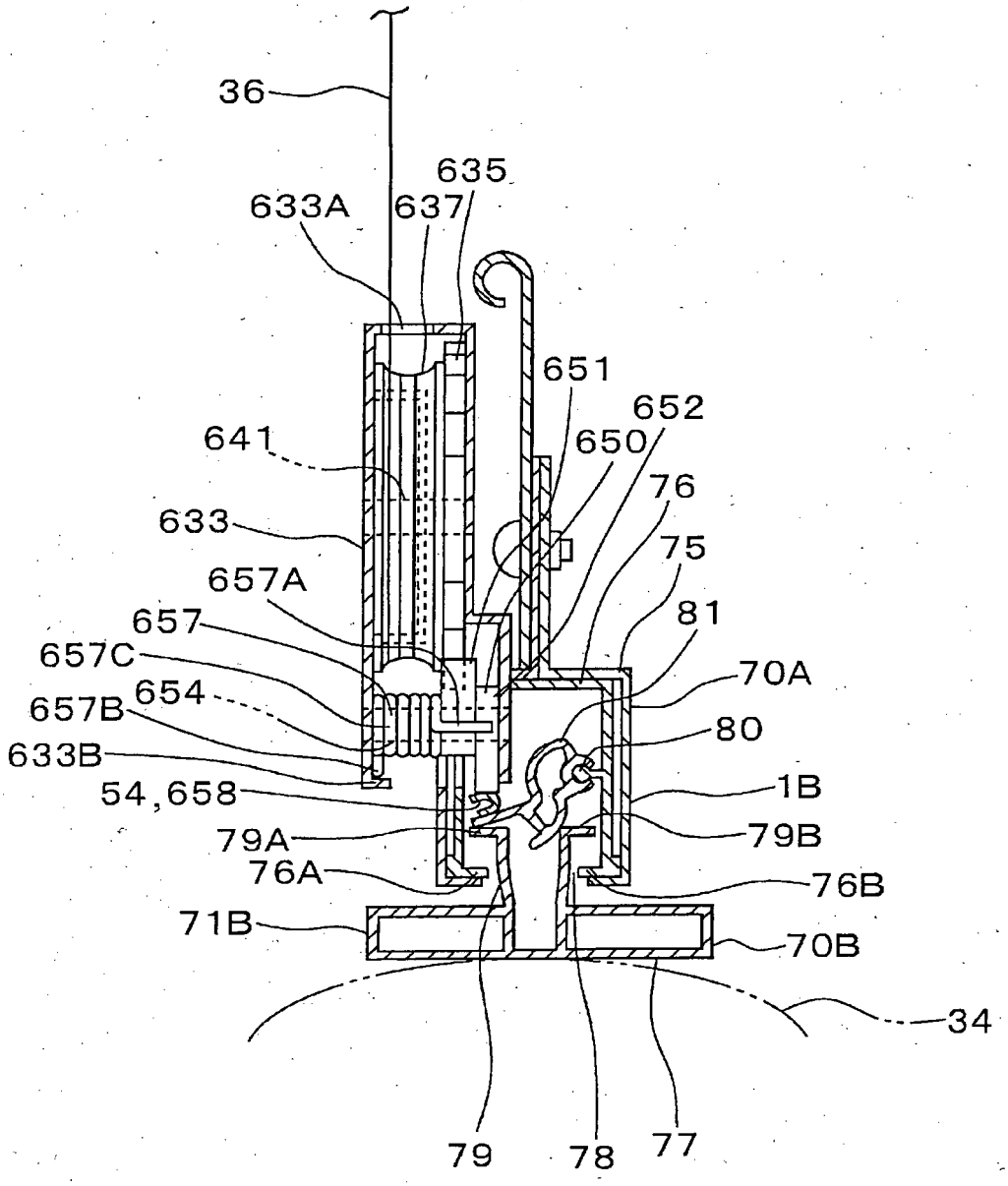
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FIG. 30

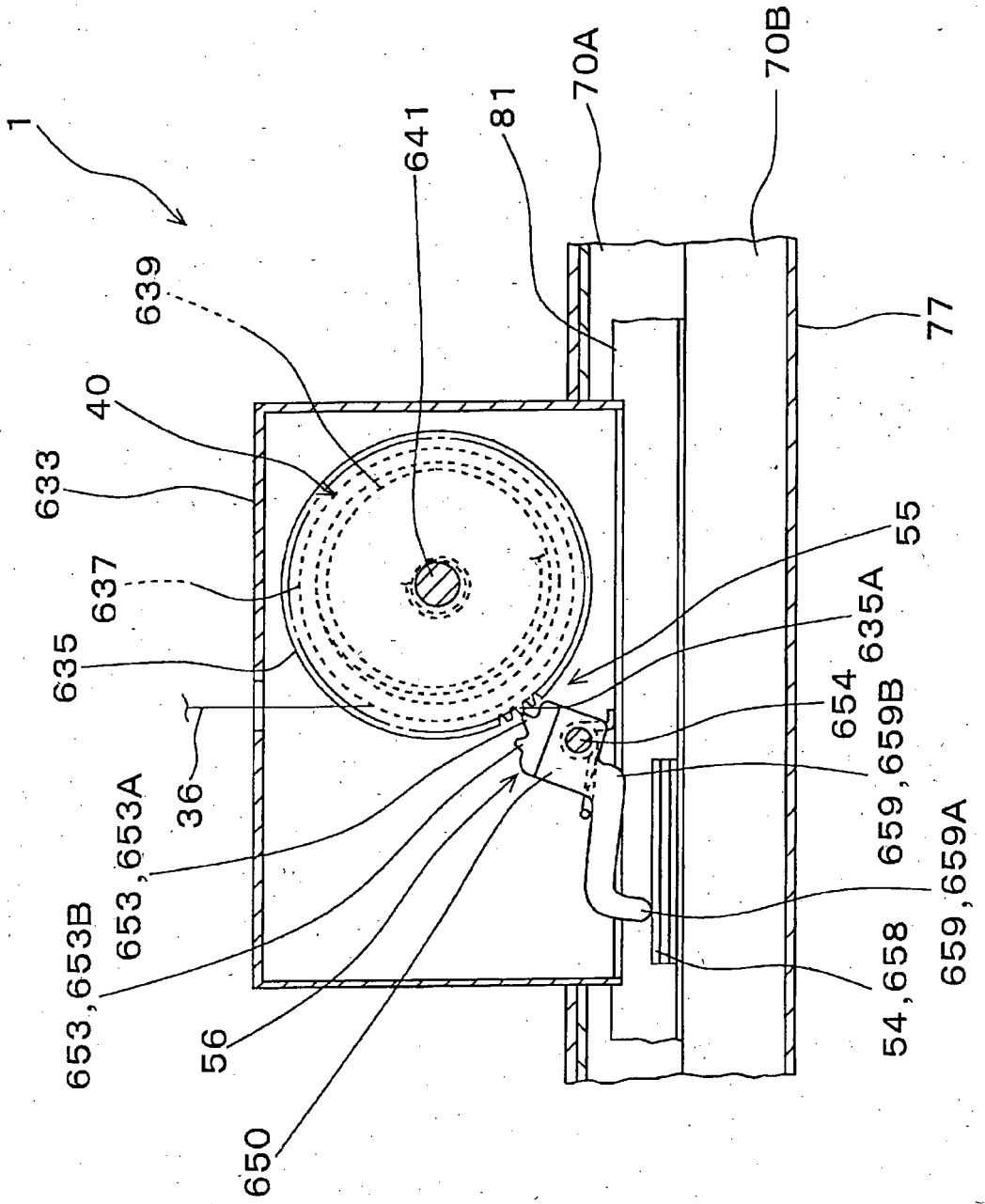
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FIG. 31

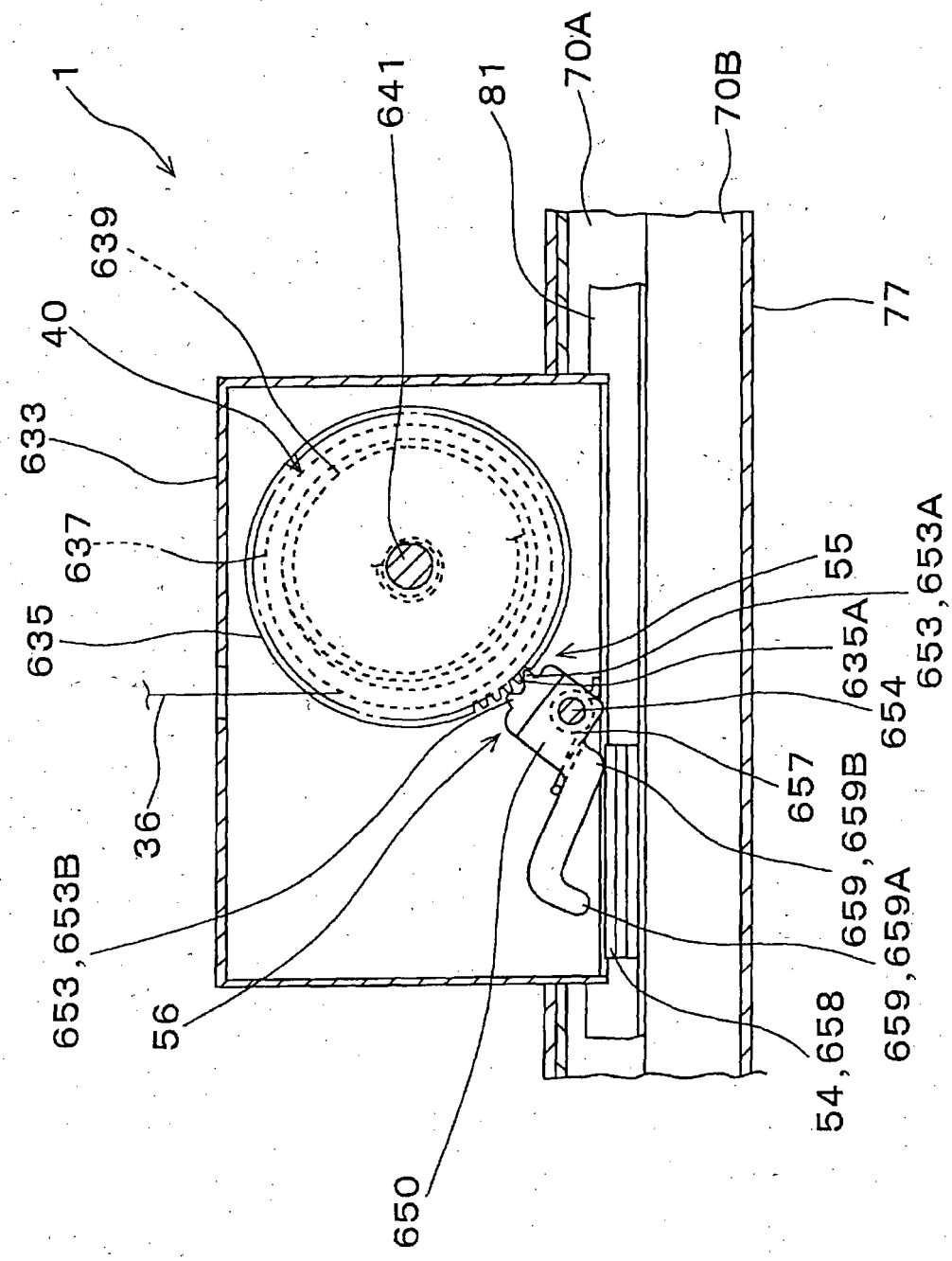
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FIG. 32

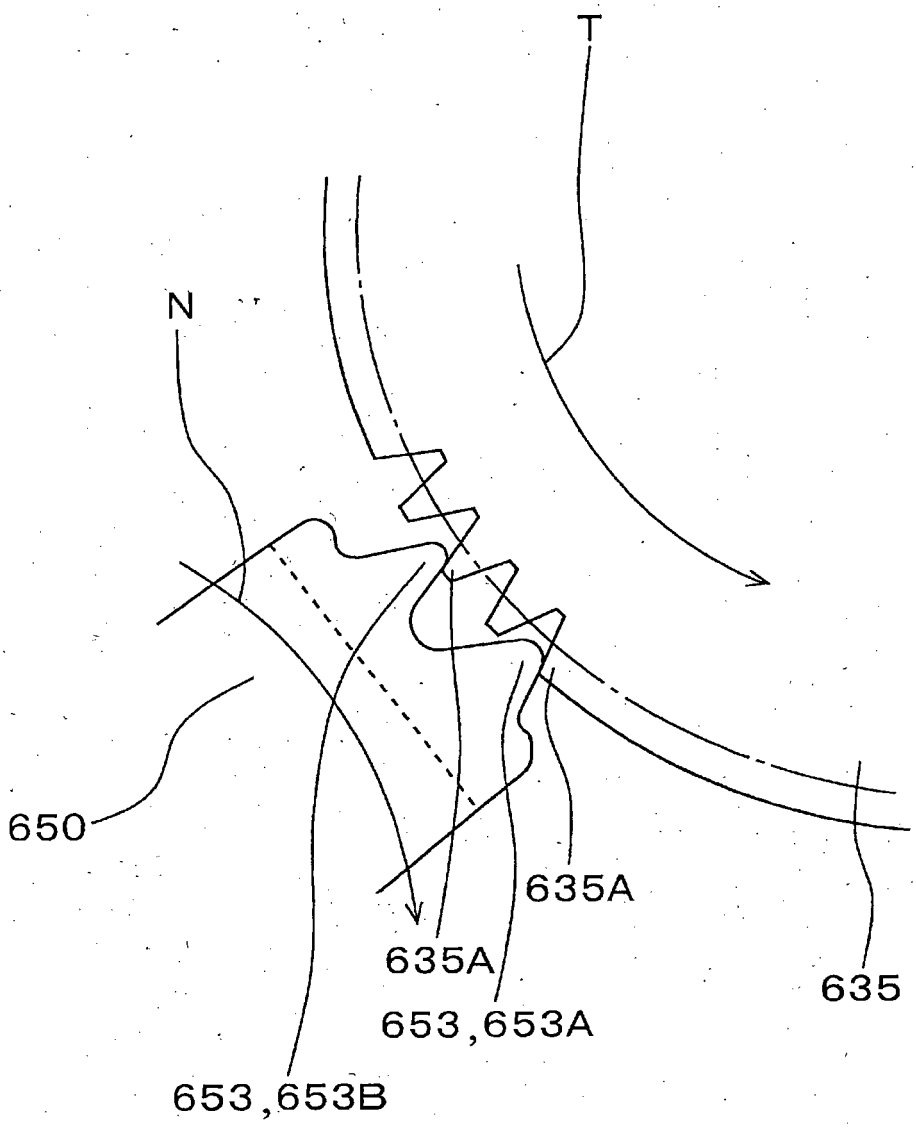

FIG. 33

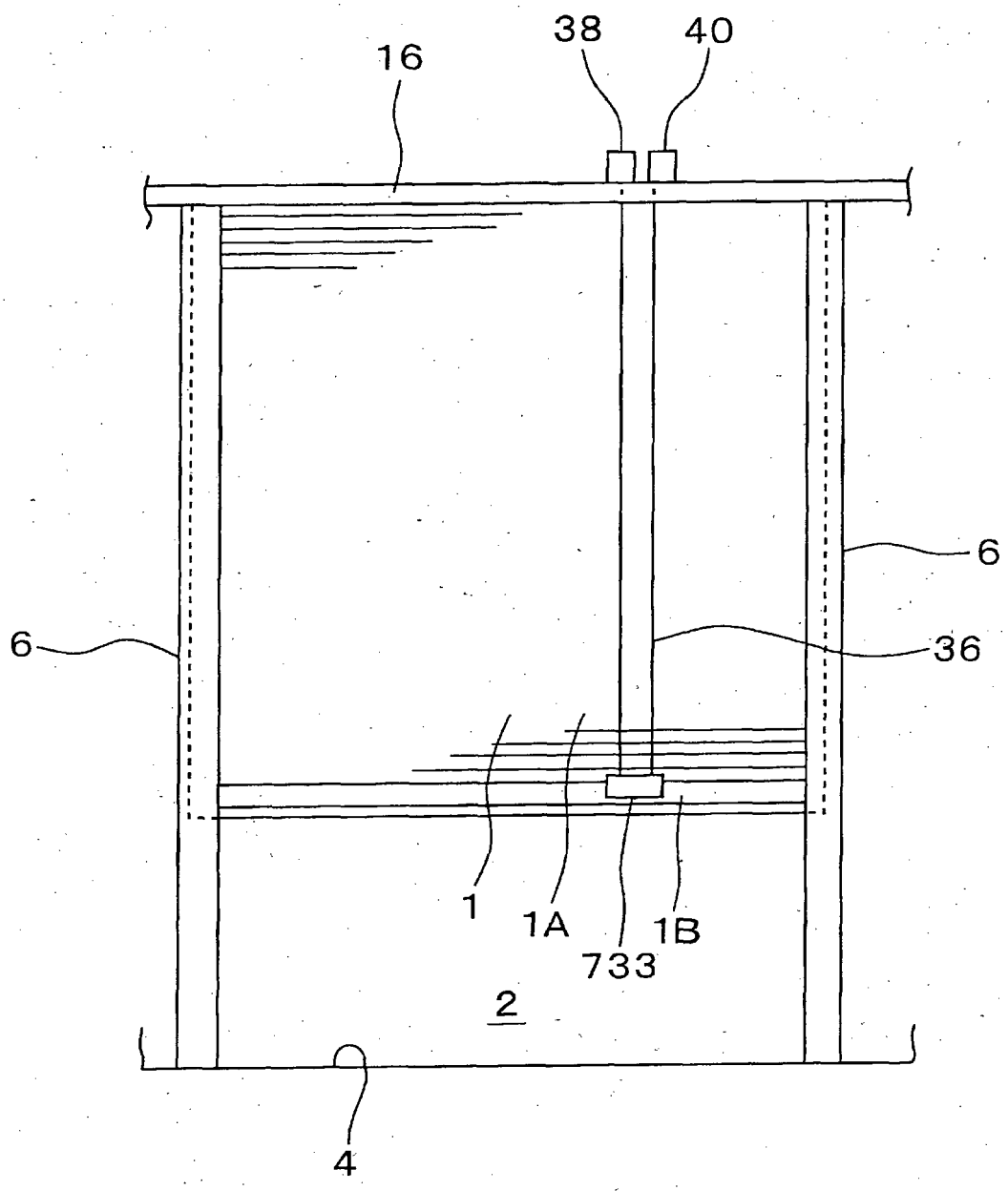

FIG. 34

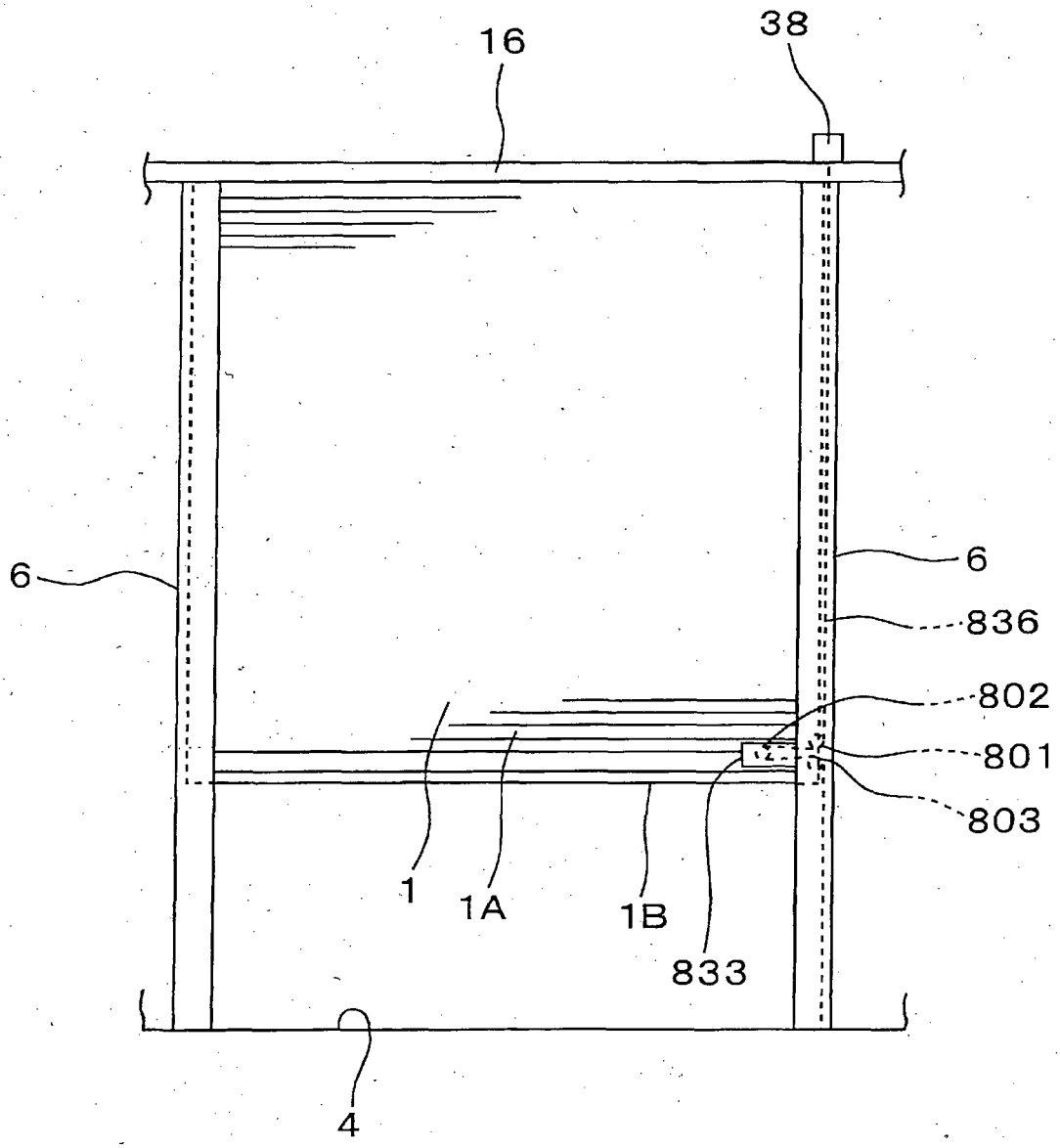

FIG. 35

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/067549

A. CLASSIFICATION OF SUBJECT MATTER
E06B9/84(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E06B9/00-9/92

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2012
Kokai Jitsuyo Shinan Koho	1971-2012	Toroku Jitsuyo Shinan Koho	1994-2012

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2008-25189 A (Nihon Shutter Manufacturing Co., Ltd.), 07 February 2008 (07.02.2008), paragraphs [0045] to [0051]; fig. 9 to 11 (Family: none)	1,2 3-14
A	JP 2009-13647 A (Sanwa Shutter Corp.), 22 January 2009 (22.01.2009), paragraphs [0032] to [0039]; fig. 12 to 13 (Family: none)	1-14
A	JP 2010-59767 A (Bunka Shutter Co., Ltd.), 18 March 2010 (18.03.2010), paragraphs [0133] to [0144]; fig. 15 (Family: none)	1-14

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 September, 2012 (20.09.12)	02 October, 2012 (02.10.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/067549

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-96961 A (Sanwa Shutter Corp.), 04 April 2000 (04.04.2000), paragraphs [0015] to [0020]; fig. 4 to 5 (Family: none)	1-14

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/067549

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Document 1 (JP 2008-25189 A (Nihon Shutter Manufacturing Co., Ltd.), 07 February 2008 (07.02.2008), paragraphs [0045] to [0051]; fig. 9 to 11) discloses that a winding device is caused to wind up a cord-like member. Accordingly, the invention of claim 1 has no novelty in relation to the invention disclosed in document 1 and has no special technical feature.

Accordingly, the following four invention groups are involved in claims.

(Continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/067549

Continuation of Box No.III of continuation of first sheet(2)

(Invention 1) Claims 1 to 10: An opening/closing body stop device in which an engagement member is engaged with the teeth of the rotating member of a winding device in order to cause the winding device to wind up a cord-like member.

(Invention 2) Claims 11 and 12: An opening/closing body stop device in which the rectilinear portion of a cord-like member is pressed in order to pull the cord-like member.

(Invention 3) Claim 13: An opening/closing body stop device in which a guide member is moved in order to pull a cord-like member.

(Invention 4) Claim 14: An opening/closing device stop device in which a winding device is moved in order to pull a cord-like member.

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REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2000096961 A **[0005]**
- JP 2009013647 A **[0005]**
- JP 2010059767 A **[0005]**