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# (54) MOVING BODY MOVING APPARATUS

(57) A moving device attenuating a velocity of a moving body is obtained. When a sliding door provided with a moving device (16) is moved in a closing direction (arrow A direction), and a rod (74) of a latch unit (28) is pressed by a pin member (52) provided in a door frame, holding members (64) are closed, and both holding portions (70) approach to each other so as to hold the pin member (52). Thus, a lock state between locking pieces (78) and end portions of rails (26) are released, and the latch unit (28) is moved toward a latch unit (30) by an urging force of a tension spring (48). Therefore, the latch unit (28) draws the sliding door in the closing direction via the pin member (52). Here, because a piston rod (44) is connected to the latch unit (28), the piston rod (44) is pressed into a cylinder (42) by a movement of the latch unit (28).

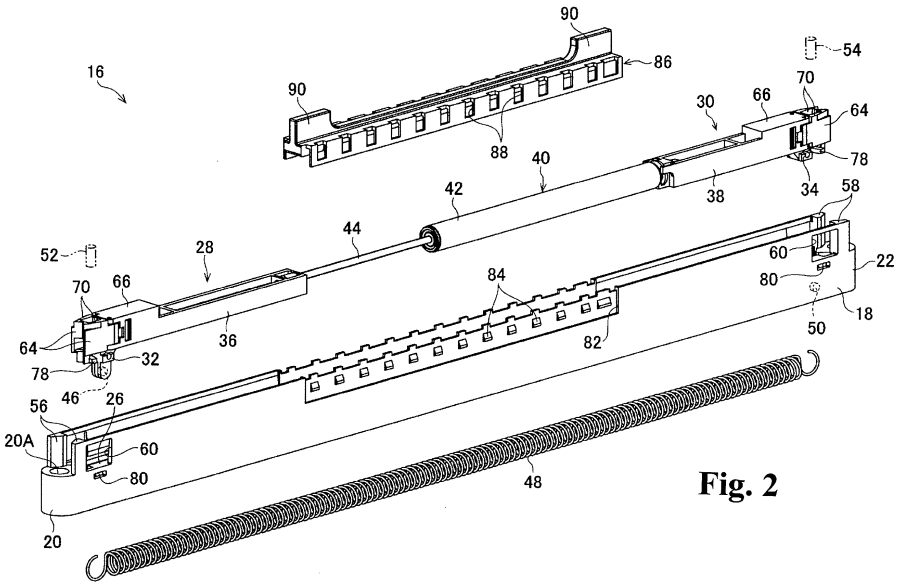


Fig. 2

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## Description

FIELD OF TECHNOLOGY

**[0001]** The present invention relates to a moving device for a moving body such as a sliding door and the like.

BACKGROUND ART

**[0002]** In a moving mechanism closing an opening by the sliding door, in Patent Document 1, for example, a striker is provided in a frame body, and a catcher (holding mechanism) is provided in the moving body. The catcher is held in a standby position against an urging force of an urging mechanism urging the moving body toward a closing direction or an open direction.

**[0003]** When the catcher engages the striker by a movement of the moving body in the closing direction, a holding state of the catcher at the standby position is released, and due to the urging force of the urging mechanism, the moving body is automatically moved up to a stop position through the catcher.

**[0004]** Also, in Patent Document 2, in a case attached to a main body side, a first moving member and a second moving member are respectively slidably provided, and in the first moving member and the second moving member, a latch which can be locked in the case is respectively rotatably provided. Also, the urging mechanism is provided between the first moving member and the second moving member, and urges the respective latches in a direction wherein the latches are approached to each other.

**[0005]** A pin member provided in the moving body engages the latches, and an engagement state with the case is released, so that due to the urging force of the urging mechanism, the moving body moves to a second moving member side through the first moving member, or the moving body moves to a first moving member side through the second moving member. Thereby, when the sliding door is closed and opened, the sliding door is moved automatically.

Patent Document 1: Japanese Unexamined Patent Publication No. 2006-169905

Patent Document 2: Japanese Unexamined Patent Publication No. 2008-144567

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

**[0006]** The present invention provides a moving device which attenuates a velocity of the moving body.

MEANS FOR SOLVING THE PROBLEMS

**[0007]** In a first aspect of the present invention, a moving device, including a case attached to a moving body moving inside a frame body; two sliders slidably housed into the case; holding mechanisms provided in the sliders, locking the sliders in end portions of the case when the holding mechanisms are separated from a striker provided in the frame body, and releasing a lock state of the sliders and the end portions of the case when the striker is held; a damping device attached between the sliders, and attenuating a velocity of the sliders approaching and being separated; and an urging mechanism having one end portion connected to one of the sliders and other end portion connected to the case, and urging one of the sliders to the other slider side, is provided.

**[0008]** In the above-mentioned aspect, the case is attached to the moving body moving inside the frame body, and in the case, the two sliders are housed so as to be capable of sliding inside the case. In the frame body, the striker is provided, when the holding mechanisms are separated from the striker, the holding mechanisms provided in the sliders lock the sliders in the end portions of the case, and when the holding mechanisms hold the striker, the lock state of the sliders and the end portions of the case is released.

**[0009]** Also, the damping device, attenuating the velocity of the sliders approaching and separating, is provided between the sliders. One end portion of the urging mechanism is connected to one of the sliders, and the other end portion of the urging mechanism is connected to the case so as to urge one of the sliders to the other slider side.

**[0010]** Thereby, for example, when the moving body is moved in a closing direction and one of the holding mechanisms engages with the striker, one of the sliders is unlocked so as to be capable of moving. Here, since one of the sliders is urged to the other slider side by the urging mechanism, when the slider is unlocked, one of the sliders attempts to move to the other slider side.

**[0011]** However, since one of the sliders holds the striker, using the striker, one of the sliders, and the case, the moving body moves in the closing direction. Here, since the damping device is provided between one of the sliders and the other slider, when one of the sliders moves, a moving velocity thereof is attenuated. Consequently, a moving velocity of the case moving as a standard of one of the sliders is attenuated, so that when the moving body is completely closed, an impact sound caused by the contact between the moving body and the frame body is prevented.

**[0012]** As for a second aspect of the present invention, in the first aspect of the present invention, the holding mechanism may be structured by including a pair of holding members in which holding portions capable of holding the striker are provided; a supporting portion supporting the holding portions so as to be capable of approaching and being separated; abutted portions provided in the holding members and positioned on an opposite side of the holding portions as a standard of the supporting portion; a rod movably provided between a pair of the holding portions and the abutted portions; an urging member urg-

ing the rod to the holding portion side; and an abutting portion protruding from an outer circumferential surface of the rod, abutting against the abutted portions, moving the abutted portions in a direction separating from each other, and moving the holding portions in a direction approaching each other when the rod moves in a direction against an urging force of the urging member.

**[0013]** In the structure, the holding mechanism comprises a pair of holding members wherein the holding portions which can hold the striker are provided. The holding members are supported by the supporting portion, and allow the holding portions to approach each other and separate from each other. Also, in the holding members, the abutted portions are provided on the opposite side of the holding portions as the standard of the supporting portion, and the rod is movably provided between the pair of the holding portions and the abutted portions.

**[0014]** The rod is urged to the holding portion side by the urging mechanism. Also, the abutting portion abutting against the abutted portions protrudes from the outer circumferential surface of the rod, and when the rod moves in the direction against the urging force of the urging member, the abutted portions are moved in the direction separating from each other, and the holding portions are moved in the direction approaching each other, so that the striker is held by the holding portions.

**[0015]** Here, as the standard of the supporting portion, the holding portions are provided on one end side of the holding members, the abutted portions are provided on the other end side of the holding members, and both the abutted portions are separated from each other through the rod, so that both the holding portions are approached. Thereby, since an amount of external force acting on the abutted portions due to a movement of the rod can be changed, as a supporting point of the supporting portion, an external force separating the abutted portions from each other can be converted to a holding force by the holding portions.

**[0016]** Specifically, by changing a stroke of the rod and a position of the supporting portion of the holding members, a large holding force can be obtained by a small force using the principle of leverage.

**[0017]** As for a third aspect of the present invention, in the second aspect of the present invention, an inclination cam face, converting an amount of movement of the rod into a rotational force allowing the holding portions to approach, may be formed in the abutted portions or the abutting portion.

**[0018]** In the aspect, the inclination cam face is formed in the abutted portions or the abutting portion, and converts the amount of movement of the rod into the rotational force of the holding members so as to allow the holding portions to approach. Specifically, when the rod is pressed in an axis direction, the holding portions approach so as to hold the striker.

**[0019]** As for a fourth aspect of the present invention, in the second aspect of the present invention, a distance between the supporting portion and the holding portions may be made longer than a distance between the supporting portion and a portion of the abutted portion abutted by the abutting portion.

**[0020]** In the aspect, by making the distance between the supporting portion and the holding portions longer than the distance between the supporting portion and the portion of the abutted portions abutted by the abutting portion, the large holding force can be obtained by the small force using the principle of leverage.

**[0021]** As for a fifth aspect of the present invention, in the second aspect of the present invention, protruding portions, protruding in the direction separated from each other, and locked in a hole portion formed in the case in a state wherein the holding portions hold the striker, may be provided in end portions of the abutted portions.

**[0022]** In the aspect, the protruding portions are provided in the end portions of the abutted portions, and in the state wherein the holding portions hold the striker, the protruding portions are locked in a hole portion formed in the sliders, so that wobbling of the holding members is prevented.

**[0023]** A sixth aspect of the present invention provides the moving device including the case attached to the frame body; the two sliders slidably housed into the case; the holding mechanisms provided in the sliders, locking the sliders in the end portions of the case when the holding mechanisms are separated from the striker provided in the moving body moving inside the frame body, and releasing the lock state of the sliders and the end portions of the case when the striker is held; the damping device attached between the sliders, and attenuating the velocity of the sliders approaching and being separated; and the urging mechanism having one end portion connected to one of the sliders and other end portion connected to the case, and urging one of the sliders to the other slider side.

**[0024]** In the aspect, the striker is provided on a moving body side, and the case having the holding mechanisms holding the striker is attached to a frame body side, and the approximately same effect of the effect described in the first aspect of the present invention can be obtained. However, in a case when the frame body is formed by aluminum, when the case is attempted to be attached to the frame body side, processing becomes troublesome, therefore, attaching the case according to materials and the like of the moving body and the frame body is selectable.

**[0025]** As for a seventh aspect of the present invention, in the sixth aspect of the present invention, the holding mechanisms are constituted by including the pair of holding members in which the holding portions capable of holding the striker are provided; the supporting portion supporting the holding portions so as to be capable of approaching and being separated; the abutted portions provided in the holding members, and positioned on the opposite side of the holding portions as the standard of the supporting portion; the rod movably provided be-

tween the pair of the holding portions and the abutted portions; the urging member urging the rod to the holding portion side; and the abutting portion protruding from the outer circumferential surface of the rod, abutting against the abutted portions, moving the abutted portions in the direction separated from each other, and moving the holding portions in the direction approaching each other when the rod moves in the direction against the urging force of the urging member.

In the aspect, approximately the same effect of the effect described in the second aspect of the present invention can be obtained.

**[0026]** As for an eighth aspect of the present invention, in the seventh aspect of the present invention, the inclination cam face, converting the moving amount of the rod into the rotational force allowing the holding portions to approach, may be formed in the abutted portions or the abutting portion.

In the aspect, approximately the same effect of the effect described in the third aspect of the present invention can be obtained.

**[0027]** As for a ninth aspect of the present invention, in the seventh aspect of the present invention, the distance between the supporting portion and the holding portions may be made longer than the distance between the supporting portion and the portion in which the abutting portion hits against the abutted portions.

In the aspect, approximately the same effect of the effect described in the fourth aspect of the present invention can be obtained.

**[0028]** As for a tenth aspect of the present invention, in the seventh aspect of the present invention, the protruding portions, protruding in the direction separated from each other, and locked in the hole portion formed in the slider in the state wherein the holding portions hold the striker, may be provided in end portions of the abutted portions.

In the aspect, approximately the same effect of the effect described in the fifth aspect of the present invention can be obtained.

## EFFECT OF THE INVENTION

**[0029]** Since the present invention has the above-mentioned structure, the velocity of the moving body can be attenuated.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0030]** Fig. 1A is an explanatory drawing showing a movement of a sliding door using a moving device according to the present embodiment.

Fig. 1B is an explanatory drawing showing the movement of the sliding door using the moving device according to the present embodiment.

Fig. 2 is a schematic exploded perspective view of the moving device according to the present embodiment.

Fig. 3 is a schematic cross-sectional view of the moving device according to the present embodiment.

Fig. 4A is a perspective view showing a latch unit of the moving device according to the present embodiment, and shows a state wherein holding members are open.

Fig. 4B is a perspective view showing the latch unit of the moving device according to the present embodiment, and shows a state wherein the holding members are closed.

Fig. 5A is a plan view showing the latch unit of the moving device according to the present embodiment, and shows the state wherein the holding members are open.

Fig. 5B is a plan view showing the latch unit of the moving device according to the present embodiment, and shows the state wherein the holding members are closed.

Fig. 6A is a schematic plan view showing an upper portion of a case of the moving device according to the present embodiment and corresponding to Fig. 1A, and Fig. 6B is a schematic cross-sectional view showing a lower portion of the case of the moving device according to the present embodiment and corresponding to Fig. 1A.

Fig. 7A is a schematic plan view showing the upper portion of the case of the moving device according to the present embodiment and corresponding to Fig. 1B, and Fig. 7B is a schematic cross-sectional view showing the lower portion of the case of the moving device according to the present embodiment and corresponding to Fig. 1B.

Fig. 8A is an explanatory drawing showing the movement of the sliding door using the moving device according to the present embodiment.

Fig. 8B is an explanatory drawing showing the movement of the sliding door using the moving device according to the present embodiment.

Fig. 8C is an explanatory drawing showing the movement of the sliding door using the moving device according to the present embodiment.

Fig. 9A is a schematic plan view showing the upper portion of the case of the moving device according to the present embodiment and corresponding to Fig. 8A, and Fig. 9B is a schematic cross-sectional view showing the lower portion of the case of the moving device according to the present embodiment and corresponding to Fig. 8A.

Fig. 10A is a schematic plan view showing the upper portion of the case of the moving device according to the present embodiment and corresponding to Fig. 8B, and Fig. 10B is a schematic cross-sectional view showing the lower portion of the case of the moving device according to the present embodiment and corresponding to Fig. 8B.

Fig. 11A is a schematic plan view showing the upper portion of the case of the moving device according

to the present embodiment and corresponding to Fig. 8C, and Fig. 11B is a schematic cross-sectional view showing the lower portion of the case of the moving device according to the present embodiment and corresponding to Fig. 8C.

## BEST MODES OF CARRYING OUT THE INVENTION

**[0031]** Next, a moving device for a moving body according to an embodiment of the present invention will be explained.
In Figs. 1A and 1B, a sliding door 10 as a moving body is shown, and allowed to move horizontally along rails (omitted in the drawings) provided above and below a door frame 12 as a frame body. By a movement of the sliding door 10, an opening 14 inside the door frame 12 is closed or opened. Here, in a center of an upper end portion of the sliding door 10, a moving device 16 is provided.

(Structure of Moving Device)

**[0032]** Here, a structure of the moving device will be explained.
As shown in Figs. 2 and 3, the moving device 16 comprises an approximately box-like case 18. On both end portions of a longitudinal direction of the case 18, attachment portions 20, 22 are provided in a lower portion of a height direction of the case 18. In a central portion of the attachment portions 20, 22, through-bores 20A, 22A wherein a fixation screw (not shown in the drawings) can pass through are respectively formed.
**[0033]** The case 18 is housed in a housing bore 24 (see Figs. 1A, 1B) provided on an upper end face of the sliding door 10 (see Figs. 1A, 1B), and the fixation screw passes through the through-bores 20A, 22A, and is screwed into a bottom portion of the housing bore 24 so as to fix the case 18 to the sliding door 10.
**[0034]** Also, in the central portion of the height direction of the case 18, a pair of rails 26 is provided on an inner wall surface of the case 18 along the longitudinal direction of the case 18. In the rails 26, latch units 28, 30 disposed on both ends of the longitudinal direction of the case 18 are placed.
**[0035]** The latch units 28, 30 are structured by including sliders 36, 38 sliding along the rails 26 inside the case 18, and latch cases (holding mechanisms) 66 provided in end portions of the sliders 36, 38.
**[0036]** Also, in lower portions of the sliders 36, 38, retaining pieces 32, 34, exposed from lower portions of the rails 26, located in the lower portion of the height direction of the case 18, and retaining the sliders 36, 38, are respectively provided so as to be capable of clamping the rails 26 between the sliders 36, 38 and the retaining pieces 32, 34. Then, when the latch units 28, 30 move inside the case 18, the latch units 28, 30 move inside the case 18 through the sliders 36, 38, so that the latch units 28, 30 do not wobble.

**[0037]** Also, a damper (damping device) 40 is provided between the slider 36 and the slider 38. The damper 40 comprises a cylinder 42, and inside the cylinder 42, a viscose fluid is filled. Also, inside the cylinder 42, a piston (omitted in the drawings) is provided so as to be capable of reciprocating inside the cylinder 42. Due to the piston, the volume of the viscose fluid is compressed, and an attenuation force acts on a piston rod 44 provided in the piston.
**[0038]** The piston rod 44 is connected to the slider 36, and the cylinder 42 is connected to the slider 38, and at a time of a movement of the slider 36 (latch unit 28) or the slider 38 (latch unit 30), a moving velocity thereof is attenuated.
**[0039]** Incidentally, here, although the damper 40 constituted by including the cylinder 42 and the piston is cited as an example, the damper is not specially limited provided that the moving velocity of the slider 36 (latch unit 28) or the slider 38 (latch unit 30) can be attenuated. For example, the damper may be constituted by including a rack and a damper gear.
**[0040]** On the other hand, on a lower portion of the retaining piece 32 on a latch unit 28 side, a connecting portion 46 is provided, and one end portion of a tension spring (urging mechanism) 48 is connected. On an attachment portion 22 side of the case 18, a connecting portion 50 is provided, and the other end portion of the tension spring 48 is connected to the connecting portion 50.
**[0041]** Then, in a state wherein the latch unit 28 is disposed on an attachment portion 20 side of the case 18 (see Fig. 3), the tension spring 48 becomes a state wherein elastic energies (urging forces) are accumulated. Consequently, even if an attenuation force by the damper 40 acts on the latch unit 28, due to the elastic energies accumulated in the tension spring 48, the sliding door 10 (mentioned hereinafter) is drawn up to the end.
**[0042]** However, both the end portions of the longitudinal direction of the case 18 located in an upper portion of the height direction of the case 18 have openings so that pin members (strikers) 52, 54 provided in the door frame 12 can be entered. On both the end portions of the longitudinal direction of the case 18, pairs of guide pieces 56, 58 are respectively provided so as to have inclined surfaces mutually gradually approaching as the guide pieces 56, 58 go into the case 18. Due to the guide pieces 56, 58, the pin members 52, 54 are reliably guided into the latch units 28, 30 respectively.
**[0043]** Also, in the upper portion of the height direction of the case 18, short-shaped window bores 60 are respectively formed by abutting against the guide pieces 56, 58. As described hereinafter, in a state wherein a movement of the latch units 28, 30 is controlled relative to the case 18 (i.e., a lock state), holding members 64 provided in the latch units 28, 30 can protrude to an outside through the window bores 60.
**[0044]** Furthermore, in a center of the upper portion of the height direction of the case 18, a pair of engaging

concave portions 82 is formed along the longitudinal direction of the case 18. On a surface of the engaging concave portions 82, a plurality of claw portions 84 is provided at predetermined intervals along the longitudinal direction of the case 18. A cover 86 in which cross-sectional surface has an approximately inverted U-shape is allowed to be engaged with the engaging concave portions 82.

**[0045]** On side walls of the cover 86, short-shaped bores 88 are formed wherein the claw portions 84 are engaged, and the cover 86 is fitted in the short-shaped bores 88 from an upper portion of the engaging concave portions 82, so that the claw portions 84 are locked in the short-shaped bores 88. In this state, the damper 40 is retained, and upward floating of the damper 40 is controlled. Then, on an upper surface of the cover 86, engaging pieces 90 are respectively provided on both end portions of the longitudinal direction, and the engaging pieces 90 engage the rails (omitted in the drawings) provided in the door frame 12.

(Latch Units)

**[0046]** Here, the latch units 28, 30 will be explained. Incidentally, since the latch unit 28 and the latch unit 30 have only a difference depending on the presence or absence of the connecting portion 46 provided in the lower portion of the retaining piece 32, and have the same other structure, the latch unit 28 will be explained on behalf of the latch units.

**[0047]** As shown in Figs. 2, 4A, 4B, in one end portion of the slider 36 structuring the latch unit 28 (a guide piece 56 side of the case 18), the approximately box-like latch case 66 is provided.

**[0048]** In both end portions in a width direction, supporting portions 68, which are positioned in one end portion of the latch case 66 (the guide piece 56 side of the case 18), are provided along a height direction of the latch case 66, and an approximately central portion of the holding members 64 is supported by the supporting portions 68, so that the holding members 64 are allowed to sway.

**[0049]** On the other hand, as shown in Figs. 5A, 5B, in the holding members 64, holding portions 70 holding the pin member 52 are provided on one end side, and cam portions (abutted portions) 72 described hereinafter are provided on the other end side. Also, a rod 74 passing through the latch case 66 is provided between the holding member 64 and the holding member 64.

**[0050]** The rod 74 is allowed to protrude from an inside of the latch case 66, and urged in a direction protruding from the latch case 66 by a latch spring (urging member) 76 provided between a stopper 75 formed on an outer circumferential surface of the rod 74 and the latch case 66.

**[0051]** Also, from the outer circumferential surface of the rod 74, an abutting portion 74A abutting against the cam portions 72 of the holding members 64 protrudes. As shown in Fig. 5A, in a state wherein the holding members 64 are open, the holding portions 70 head in a direction separated from each other as they go in a direction separated from the supporting portions 68. On the other hand, the cam portions 72 head in a direction approaching each other as they go in the direction separated from the supporting portions 68.

**[0052]** Consequently, as shown in Fig. 5B, when the rod 74 is moved in a direction against an urging force of the latch spring 76, a position wherein the abutting portion 74A abuts against the cam portions 72 becomes out of alignment, and as the abutting portion 74A goes to end portions of the cam portions 72, both the cam portions 72 are separated. Thereby, as a center of the supporting portions 68, the holding members 64 rotate, and move in a direction wherein both the holding portions 70 approach each other.

**[0053]** Specifically, the cam portions 72 are provided on the other end side of the holding members 64, and an amount of movement of the rod 74 is converted into a rotational force rotating the holding members 64 so as to allow the holding portions 70 to approach. Thereby, when the rod 74 is pressed in an axis direction, the holding portions 70 approach so as to hold the pin member 52.

**[0054]** As mentioned above, as a standard of the supporting portions 68 of the holding members 64, the holding portions 70 are provided on one end side of the holding members 64, and the cam portions 72 are provided on the other end side of the holding members 64. By separating both the cam portions 72 through the rod 74, both the holding portions 70 are allowed to approach.

**[0055]** Specifically, since the amount of external force acting on the cam portions 72 due to a movement of the rod 74 can be changed, as a supporting point of the supporting portions 68, a holding force by the holding portions 70 can be changed. Specifically, by changing a stroke of the rod 74, and a position of the supporting portions 68 of the holding members 64, and by making a distance between the supporting portions 68 and the holding portions 70 longer than a distance between the supporting portions 68 and portions of the cam portions 72 is abutted by the abutting portion 74A, a large holding force can be obtained by a small force using the principle of leverage.

**[0056]** Here, as shown in Fig. 4A, on an upper surface side of the holding portions 70, engaging concave portions 70A are formed in a state wherein inner surfaces are hollowed out. As shown in Fig. 4B, in a state wherein the holding members 64 are closed, a gap is provided between the holding portion 70 and the holding portion 70. Inside the gap, the pin member 52 is allowed to be engaged.

**[0057]** On the other hand, in the state wherein the holding members 64 are closed, a gap is almost never provided on a lower surface side of the holding portions 70. In a state wherein the pin member 52 is engaged with an inside of the holding portions 70, a lower surface portion of the holding portions 70 receives an end portion of the

pin member 52, so that wobbling between the pin member 52 and the holding members 64 are prevented.

**[0058]** Also, as shown in Figs. 5A, 5B, in the end portions of the cam portions 72, protruding portions 72A mutually protruding toward an outside are provided. On the other hand, as shown in Figs. 4A, 4B, in a side wall of the latch case 66, a through-bore (hole portion) 66A is formed, and in the state wherein the holding members 64 are closed, the protruding portions 72A pass through the through-bore 66A, and in a state wherein the holding members 64 hold the pin member 52, wobbling of the holding members 64 is prevented.

**[0059]** However, in a lower portion of the holding members 64, a locking piece 78 exposed from the lower portion of the rails 26 and located in the lower portion of the height direction of the case 18, is provided. A gap is provided between the rails 26 and the attachment portion 20 (see Fig. 3), and as shown in Fig. 4A, in the state wherein the holding members 64 are open, the locking piece 78 is locked in the end portions of the rails 26. At that time, the holding members 64 protrude to the outside through the window bore 60.

**[0060]** Here, as shown in Fig. 2, in the case 18, a locking bore 80 is formed in a lower portion of the window bore 60, and in a state wherein the locking piece 78 is locked in the end portions of the rails 26, an end portion of the locking piece 78 is inserted into the locking bore 80. In this state, the latch unit 28 is locked.

**[0061]** Then, when the pin member 52 abuts against the rod 74 of the latch unit 28, and the rod 74 is pressed in the direction against the urging force of the latch spring 76, as shown in Fig. 4B, the holding members 64 are closed. However, at that time, the end portion of the locking piece 78 is slipped out of the locking bore 80, and also the locking piece 78 is released from a lock state with the end portions of the rails 26 (i.e., unlocking).

(Operation of Moving Device for Moving Body)

**[0062]** Next, an operation of the moving device according to the present embodiment will be explained.
As shown in Figs. 1A, 6A, 6B, the sliding door 10 is moved in a closing direction (arrow A direction). Incidentally, Fig. 6A is a schematic plan view showing an upper portion of the case 18, and corresponding to Fig. 1A, and Fig. 6B is a schematic cross-sectional view showing a lower portion of the case 18 and corresponding to Fig. 1A.

**[0063]** When the guide piece 56 (see Fig. 2) of the moving device 16 passes through the pin member 52, as shown in Figs. 5A, 5B, the pin member 52 abuts against the rod 74 of the latch unit 28, and the rod 74 is pressed in the direction against the urging force of the latch spring 76, both the cam portions 72 of the holding members 64 are pressed apart due to a movement of the abutting portion 74A provided in the rod 74 so as to be separated from each other. Thereby, the holding members 64 rotate at the center of the supporting portions 68, and the holding members 64 are closed, so that both the holding portions 70 approach each other so as to hold the pin member 52.

**[0064]** At that time, the end portion of the locking piece 78 shown in Fig. 4A slips out of the locking bore 80 (see Fig. 2), and also the locking piece 78 is released from the lock state with the end portions of the rails 26 (unlocked). As shown in Fig. 6B, in a state wherein the latch unit 28 is locked, due to a state wherein the elastic energies (urging forces) are accumulated by the tension spring 48, when the latch unit 28 is unlocked, an urging force of the tension spring 48 acts.

**[0065]** Since the movement of the latch unit 28 is controlled by the pin member 52, as shown in Figs. 1B, 7A, 7B, the urging force of the tension spring 48 acts on the case 18. Specifically, as a standard of the latch unit 28, the case 18 moves in the arrow A direction, and the sliding door 10 moves in the closing direction through the case 18. Incidentally, Fig. 7A is a schematic plan view showing the upper portion of the case 18 and corresponding to Fig. 1B, and Fig. 7B is a schematic cross-sectional view showing the lower portion of the case 18 and corresponding to Fig. 1B.

**[0066]** Here, when the case 18 moves in the arrow A direction as the standard of the latch unit 28, as shown in Figs. 6A, 7A, the piston rod 44 is pushed into the cylinder 42. Consequently, an attenuation force by the damper 40 acts on the case 18. Therefore, the sliding door 10 moves in the closing direction quietly. When the sliding door 10 is completely closed, the sliding door 10 contacts the door frame 12. However, an impact sound at that time is prevented.

**[0067]** On the other hand, from a state shown in Figs. 7A, 7B, the sliding door 10 is moved in an open direction (opposite direction of the arrow A direction). At that time, through the sliding door 10 and the pin member 52, the latch unit 28 is moved. However, since the latch unit 28 is moved in a direction (arrow A direction) against the urging force of the tension spring 48, the sliding door 10 receives a load for that rate. Thereby, the sliding door 10 is prevented from opening frequently.

**[0068]** Also, by the movement of the latch unit 28, the piston rod 44 is pulled out of the cylinder 42. Consequently, the so-called drag (< attenuation force) produced when the piston moves inside the cylinder 42 acts on the latch unit 28.

**[0069]** Then, through the pin member 52, the latch unit 28 is moved, and when the locking piece 78 of the holding members 64 reaches the end portions of the rails 26, the locking piece 78 is locked in the end portions of the rails 26, the end portion of the locking piece 78 is inserted into the locking bore 80, and the holding members 64 protrude to the outside through the window bore 60. In this state, the movement of the latch unit 28 is controlled (the lock state).

**[0070]** Then, as shown in Fig. 9A, the pin member 52 is released from an engagement state with the holding members 64. However, this state is the state wherein the elastic energies (urging forces) by the tension spring 48

are accumulated as shown in Fig. 9B. Incidentally, Fig. 9A is a schematic plan view showing the upper portion of the case 18 and corresponding to Fig. 8A, and Fig. 9B is a schematic cross-sectional view showing the lower portion of the case 18 and corresponding to Fig. 8A.

**[0071]** In this state, as shown in Figs. 8A, 8B, when the sliding door 10 is moved in the open direction (arrow B direction), since the drag due to the tension spring 48 and the damper 40 does not act, the sliding door 10 is lightened for that rate.

**[0072]** Then, the sliding door 10 is moved further in the open direction (arrow B direction), the guide piece 58 (see Fig. 2) of the moving device 16 passes through the pin member 54, and as shown in Figs. 5A, 5B, the pin member 54 abuts against the rod 74 of the latch unit 30, so that the rod 74 is pressed in the direction against the urging force of the latch spring 76.

**[0073]** Then, due to the movement of the abutting portion 74A provided in the rod 74, both the cam portions 72 of the holding members 64 are pressed apart so as to be separated from each other. Thereby, the holding members 64 rotate at the center of the supporting portions 68, and the holding members 64 are closed, so that both the holding portions 70 approach each other so as to hold the pin member 54.

**[0074]** At that time, the end portion of the locking piece 78 shown in Fig. 4A is slipped out of the locking bore 80 (see Fig. 2), and also the locking piece 78 is released from the lock state with the end portions of the rails 26 (unlocked). Then, as shown in Figs. 10A, 11A, through the latch unit 30, the case 18 moves, so that the piston rod 44 is pushed into the cylinder 42.

**[0075]** Consequently, through the latch unit 30, the attenuation force by the damper 40 acts on the case 18. Incidentally, Fig. 10A is a schematic plan view showing the upper portion of the case 18, and corresponding to Fig. 8B, and Fig. 11A is a schematic plan view showing the upper portion of the case 18 and corresponding to Fig. 8C.

**[0076]** Here, as shown in Figs. 10B, 11B, since the tension spring 48 is connected to the latch unit 28 and the case 18, even if the latch unit 30 is unlocked, the urging force by the tension spring 48 does not act on the latch unit 30. Incidentally, Fig. 10B is a schematic cross-sectional view showing the lower portion of the case 18 and corresponding to Fig. 8B, and Fig. 11B is a schematic cross-sectional view showing the lower portion of the case 18 and corresponding to Fig. 8C.

**[0077]** As mentioned above, in the present embodiment, although the moving device is provided in the sliding door, the moving device may be provided on a door frame side. In this case, the pin member is provided on a sliding door side. Also, in the present embodiment, although the single-sliding-type sliding door was explained, the present embodiment may be applied to double-sliding-type sliding doors. In this case, two moving devices are required. Furthermore, here, although the sliding door which is moved in a horizontal direction was explained, the present embodiment may be applied to a sliding door which is moved in a vertical direction, and also the moving device may be applied to a drawer and the like.

## Claims

**1.** A moving device, comprising:

a case to be attached to a moving body moving within a frame body;
two sliders slidably housed in the case;
holding mechanisms provided in the sliders, the holding mechanisms locking the sliders in end portions of the case when the holding mechanisms are separated from strikers provided in the frame body, and releasing a lock state of the sliders and the end portions of the case when the strikers are held;
a damping device attached between the sliders, and attenuating a velocity of the sliders approaching and separating; and
an urging mechanism having one end portion connected to one of the sliders and another end portion connected to the case, and urging one of the sliders to the a side of other slider.

**2.** A moving device according to claim 1, wherein the holding mechanism comprises:

a pair of holding members having holding portions for holding the strikers;
supporting portions supporting the holding portions so as to be capable of approaching and separating;
abutted portions provided on the holding members, and positioned on an opposite side of the holding portions relative to the supporting portions;
a rod movable between a pair of the holding portions and the abutted portions;
an urging member urging the rod to the side of holding portion; and
an abutting portion protruding from an outer circumferential surface of the rod, abutting against the abutted portions, and moving the abutted portions in a direction separating from each other and moving the holding portions in a direction approaching each other when the rod moves in a direction against an urging force of the urging member.

**3.** A moving device according to claim 2, wherein an inclination cam face, converting an amount of movement of the rod into a rotational force allowing the holding portions to approach, is provided in the abutted portions or the abutting portion.

4. A moving device according to claim 2, wherein a distance between the supporting portions and the holding portions is longer than a distance between the supporting portions and portions of the abutted portions abutted by the abutting portion.

5. A moving device according to claim 2, wherein end portions of the abutted portions comprise protruding portions protruding in the direction separating from each other, and locked in a hole portion provided in the sliders in a state in which the holding portions hold the strikers.

6. A moving device, comprising:

a case attached to a frame body;
two sliders slidably housed into the case;
holding mechanisms provided in the sliders, the holding mechanisms locking the sliders in end portions of the case when the holding mechanisms are separated from strikers provided in a moving body moving inside a frame body, and releasing a lock state of the sliders and the end portions of the case when the strikers are held;
a damping device attached between the sliders, and attenuating a velocity of the sliders approaching and separating; and
an urging mechanism having one end portion connected to one of the sliders and another end portion connected to the case, and urging one of the sliders to a side of other slider.

7. A moving device according to claim 6, wherein the holding mechanism comprises:

a pair of holding members having holding portions for holding the strikers;
supporting portions supporting the holding portions so as to be capable of approaching and separating;
abutted portions provided on the holding members, and positioned on an opposite side of the holding portions relative to the supporting portions;
a rod movable between a pair of the holding portions and the abutted portions;
an urging member urging the rod to the side of holding portion; and
an abutting portion protruding from an outer circumferential surface of the rod, abutting against the abutted portions, and moving the abutted portions in a direction separating from each other and moving the holding portions in a direction approaching each other when the rod moves in a direction against an urging force of the urging member.

8. A moving device according to claim 7, wherein an inclination cam face, converting an amount of movement of the rod into a rotational force allowing the holding portions to approach, is provided in the abutted portions or the abutting portion.

9. A moving device according to claim 7, wherein a distance between the supporting portions and the holding portions is longer than a distance between the supporting portions and portions of the abutted portions abutted by the abutting portion.

10. A moving device according to claim 7, wherein end portions of the abutted portions comprise protruding portions protruding in the direction separating from each other, and locked in a hole portion provided in the sliders in a state in which the holding portions hold the strikers.

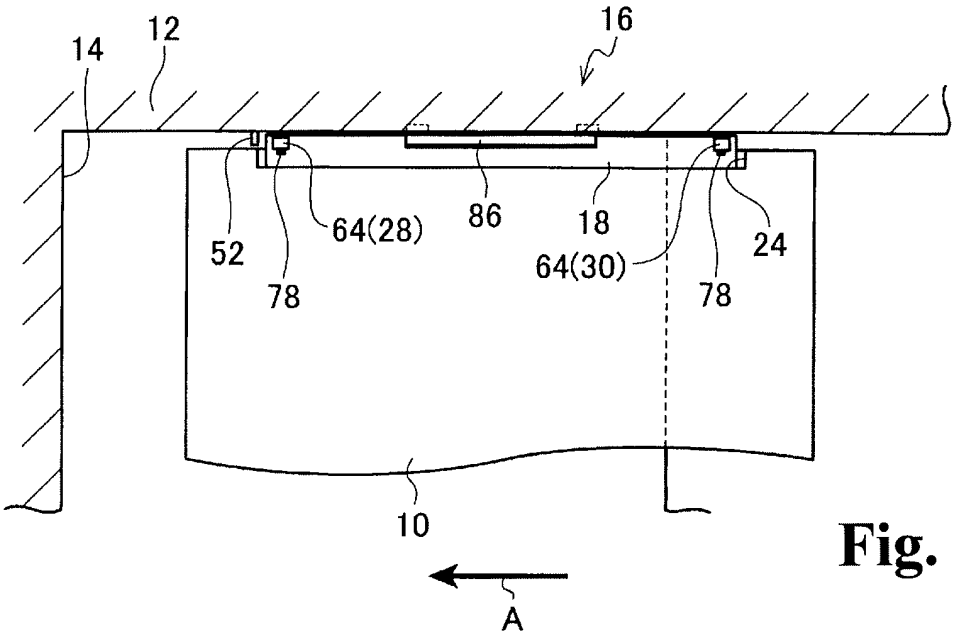
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Fig. 1(A)

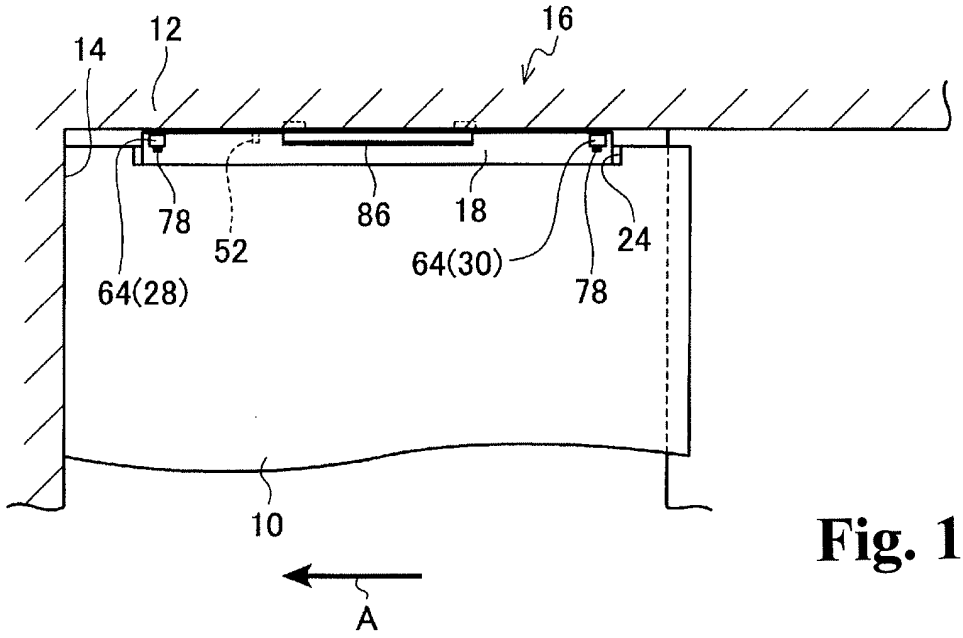
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Fig. 1(B)

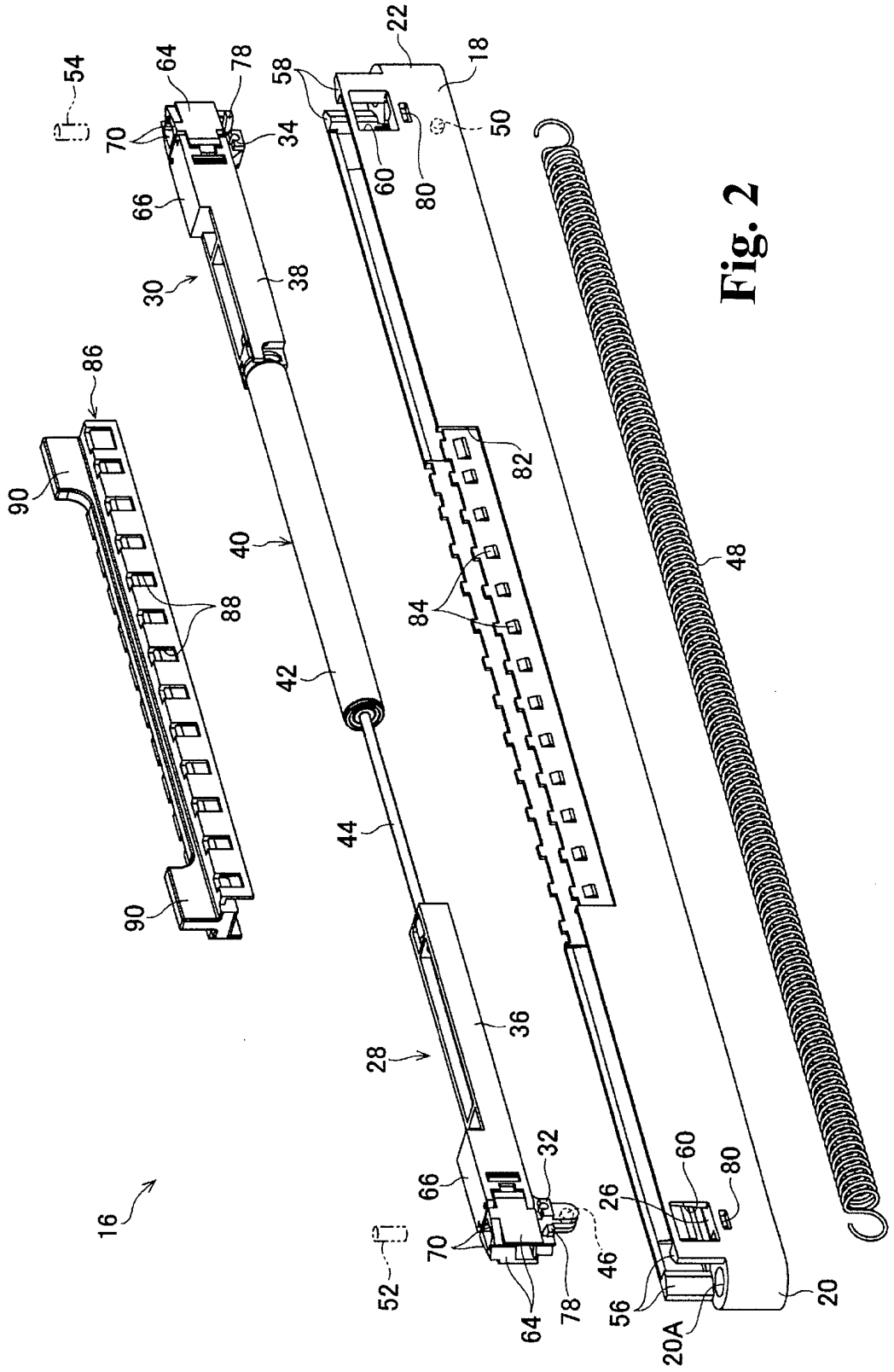
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Fig. 2

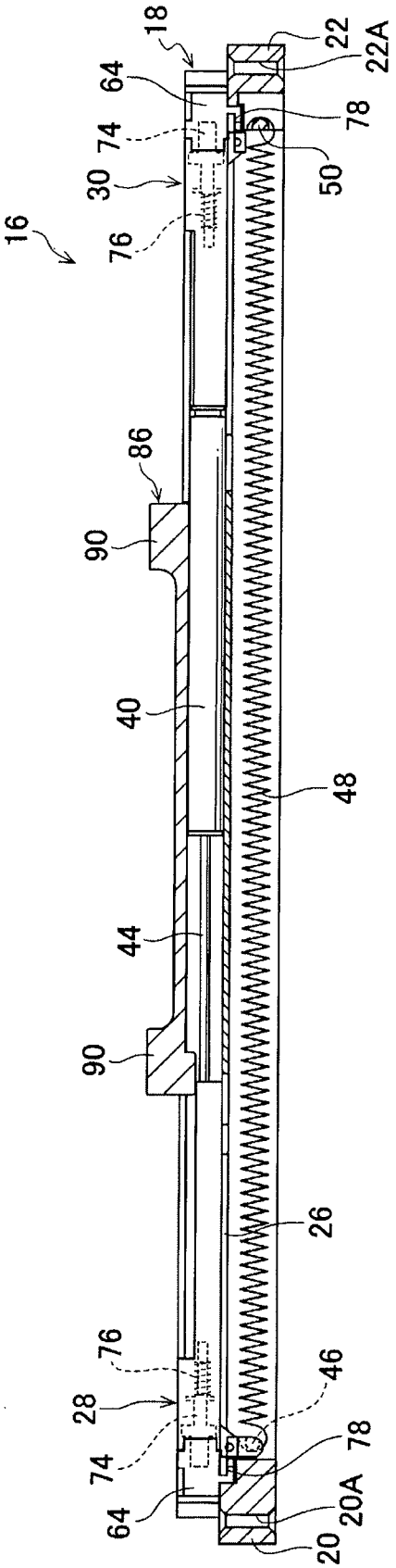
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Fig. 3

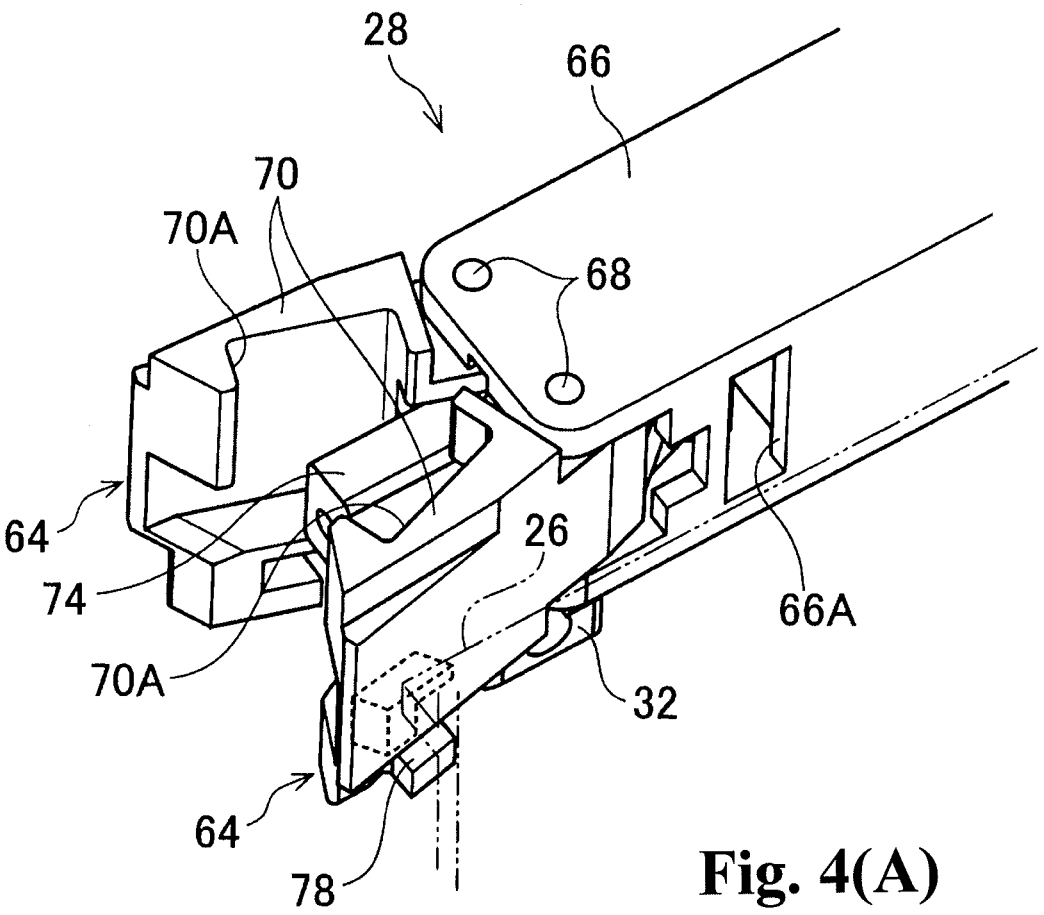


Fig. 4(A)

Fig. 4(B)

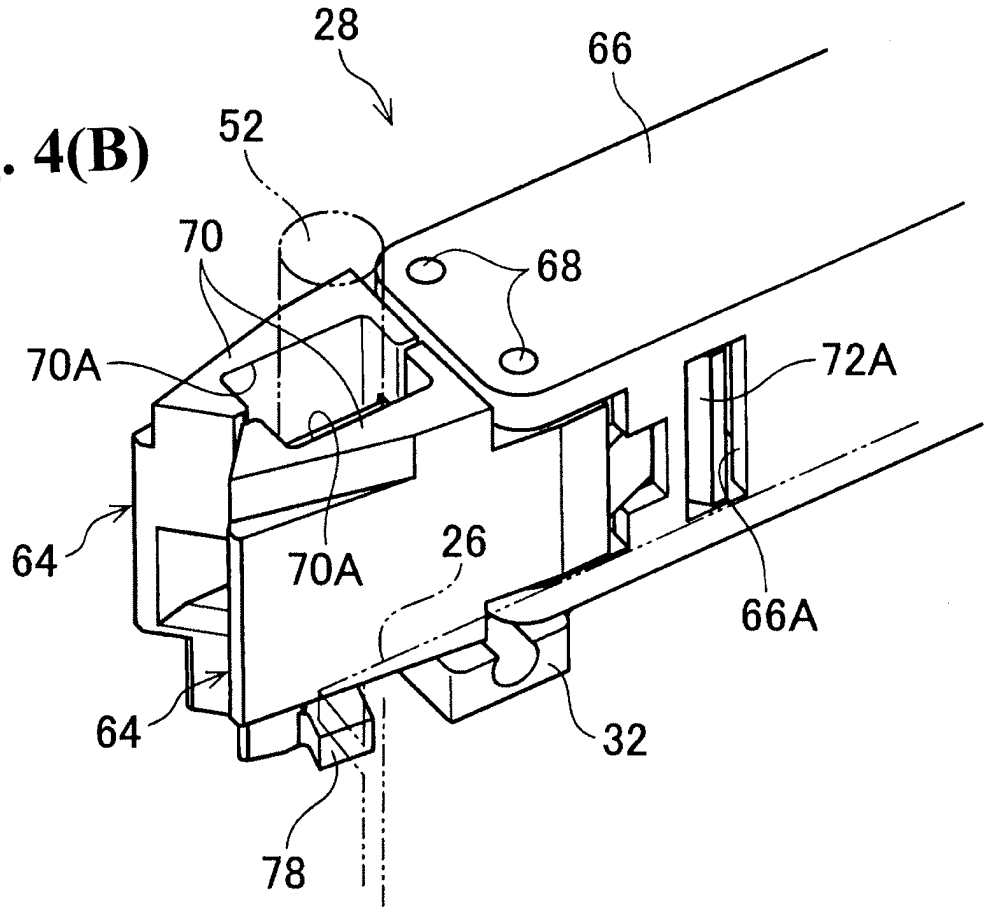
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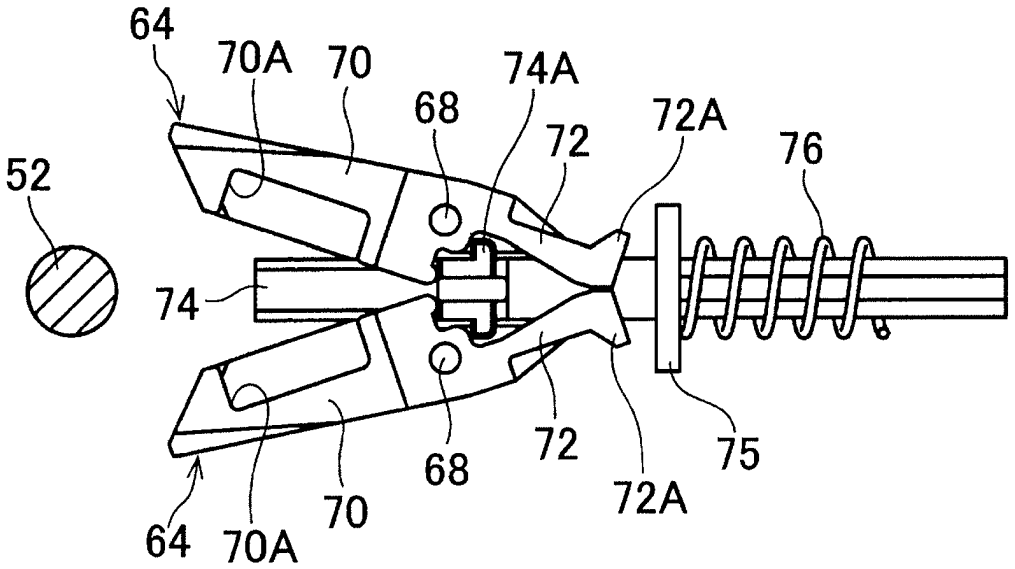
Fig. 5(A)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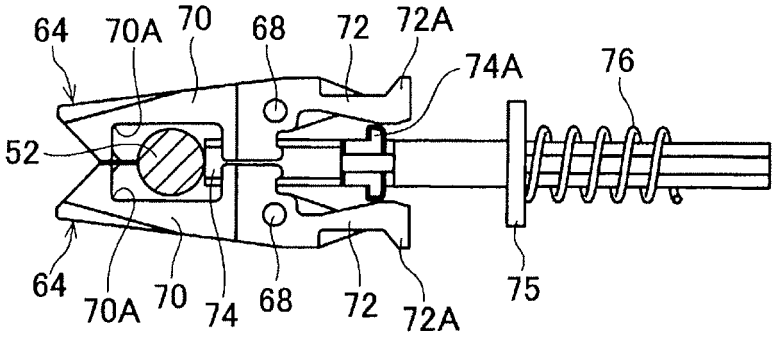
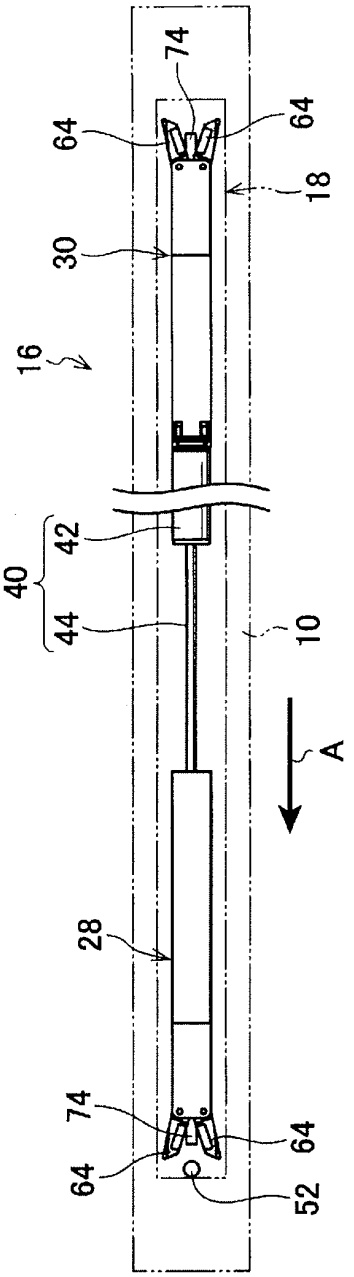



Fig. 5(B)

Fig. 6(A)



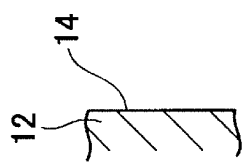




Fig. 6(B)

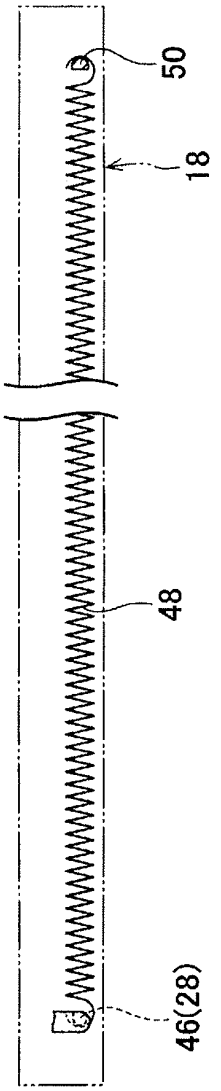


Fig. 7(A)

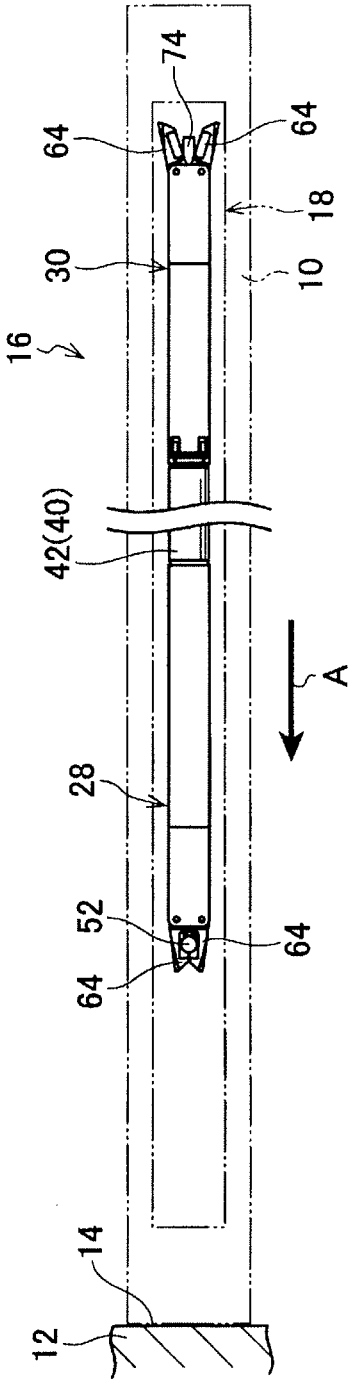



Fig. 7(B)

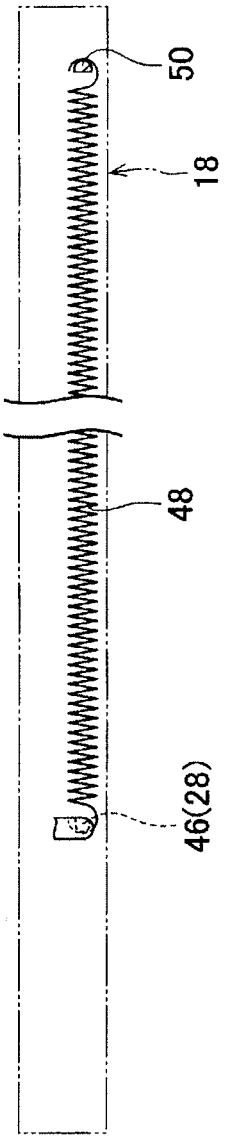


Fig. 8(A)

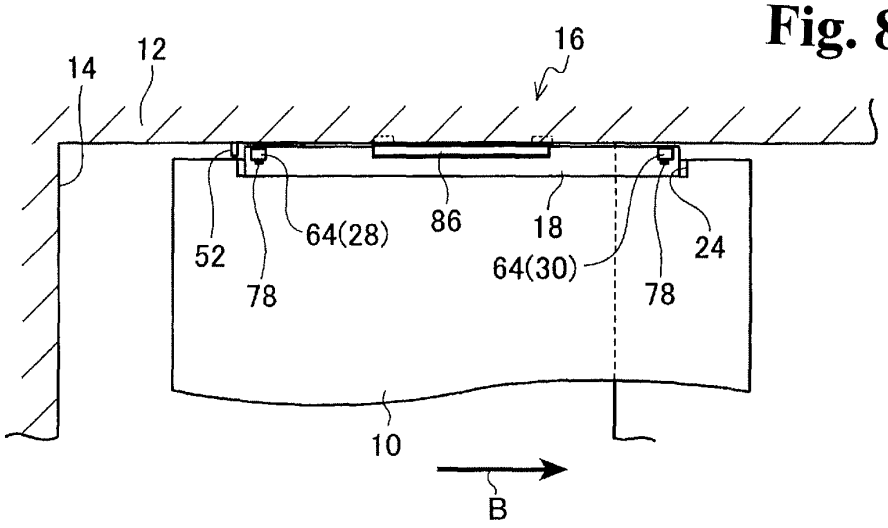



Fig. 8(B)

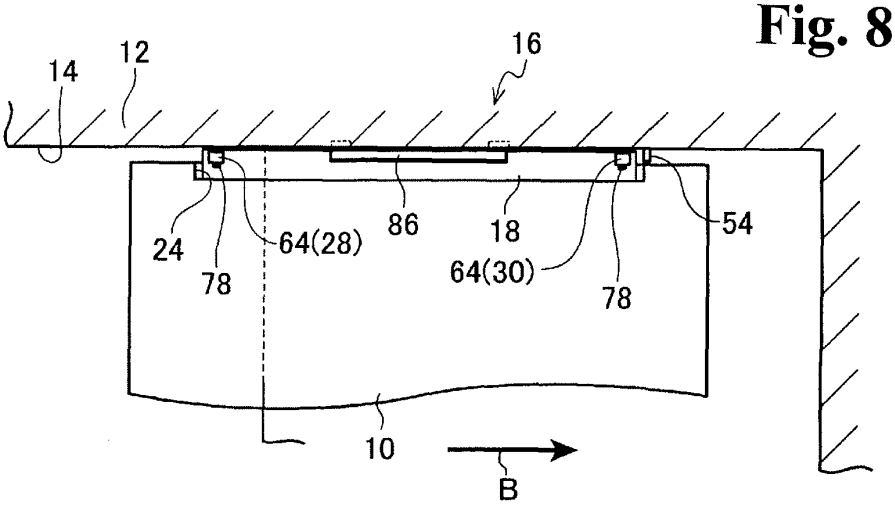



Fig. 8(C)

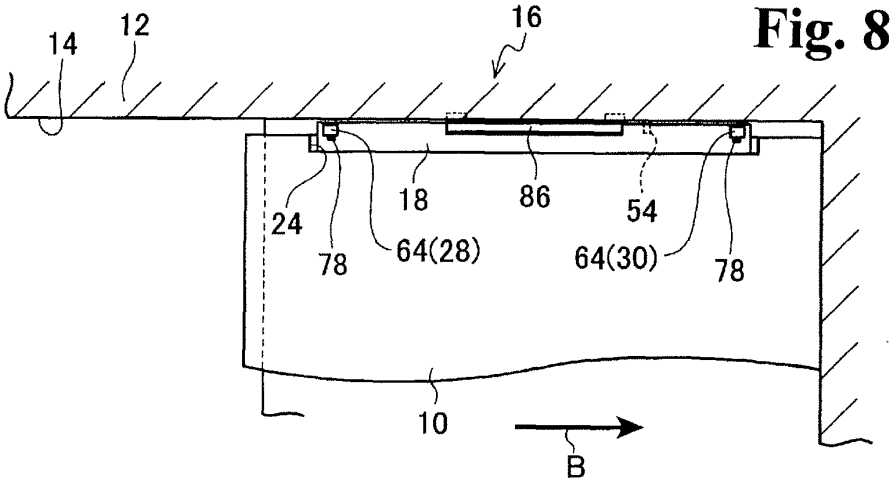


Fig. 9(A)

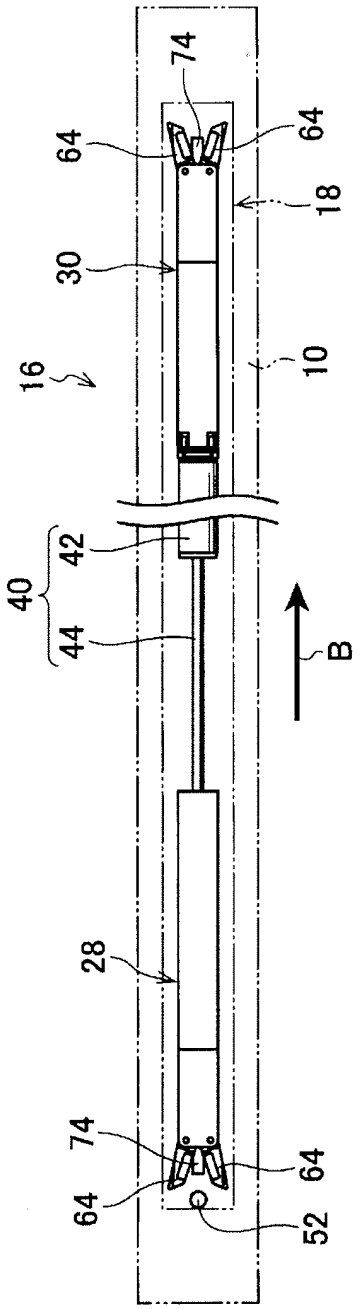
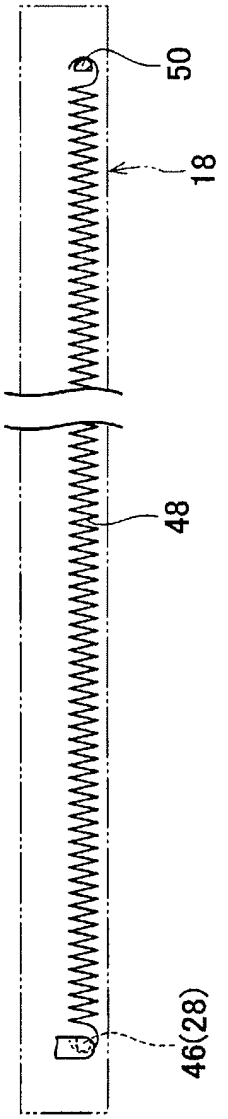



Fig. 9(B)



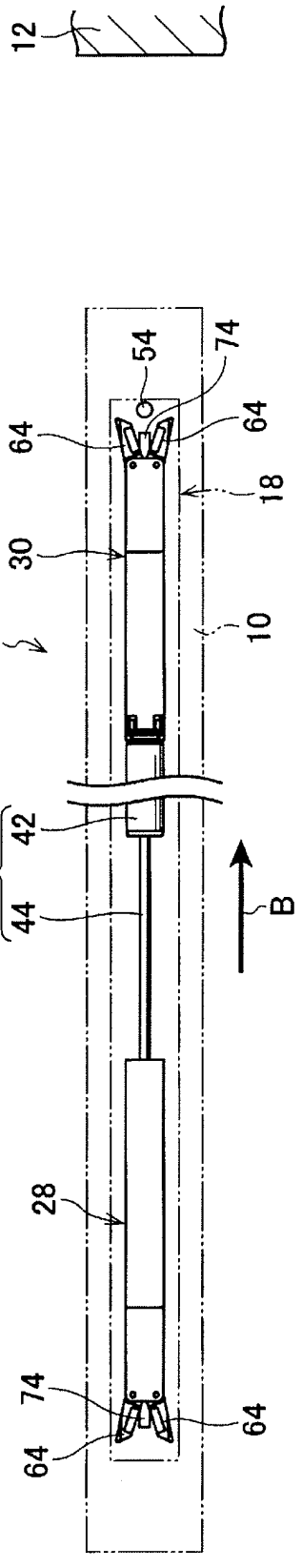



Fig. 10(A)

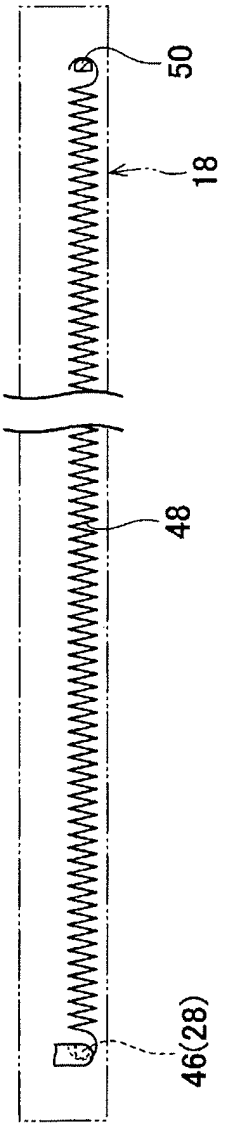



Fig. 10(B)

Fig. 11(A)

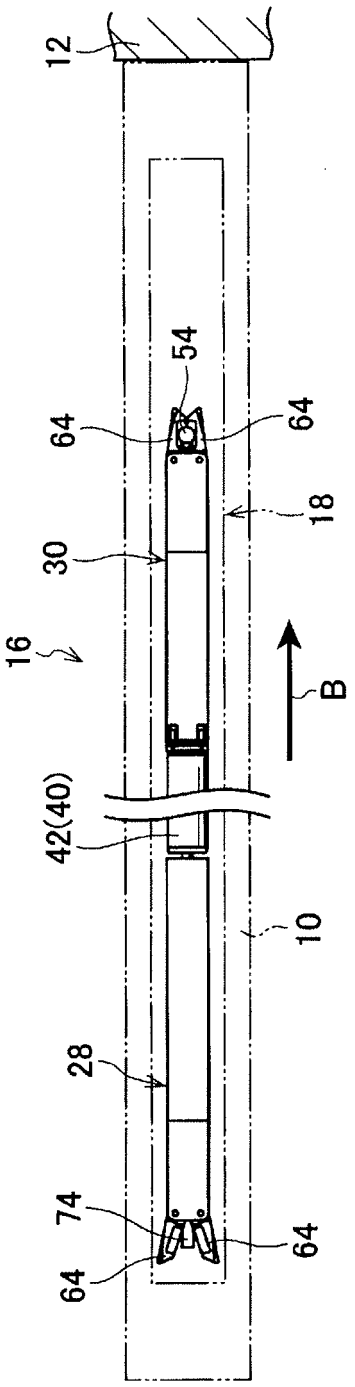
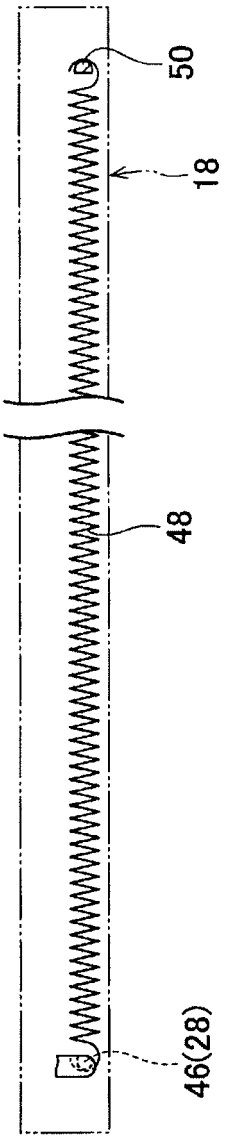



Fig. 11(B)



**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2009/052584

A. CLASSIFICATION OF SUBJECT MATTER
*E05F1/16*(2006.01)i, *E05C19/02*(2006.01)i, *E05F5/00*(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)
E05F1/16, E05C19/02, E05F5/00

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 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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. |
|---|---|---|
| Y<br>A | JP 2009-13772 A (SKB Co., Ltd.),<br>22 January, 2009 (22.01.09),<br>Par. Nos. [0025] to [0062]; all drawings<br>(Family: none) | 1,6<br>2-5,7-10 |
| Y<br>A | JP 2006-169905 A (Nifco Inc.),<br>29 June, 2006 (29.06.06),<br>Par. No. [0041]<br>& US 2007/0186481 A1 | 1,6<br>2-5,7-10 |

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

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 02 March, 2009 (02.03.09) | 10 March, 2009 (10.03.09) |
| Name and mailing address of the ISA/<br>Japanese Patent Office<br><br>Facsimile No. | Authorized officer<br><br>Telephone No. |

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## REFERENCES CITED IN THE DESCRIPTION

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- JP 2006169905 A **[0005]**
- JP 2008144567 A **[0005]**