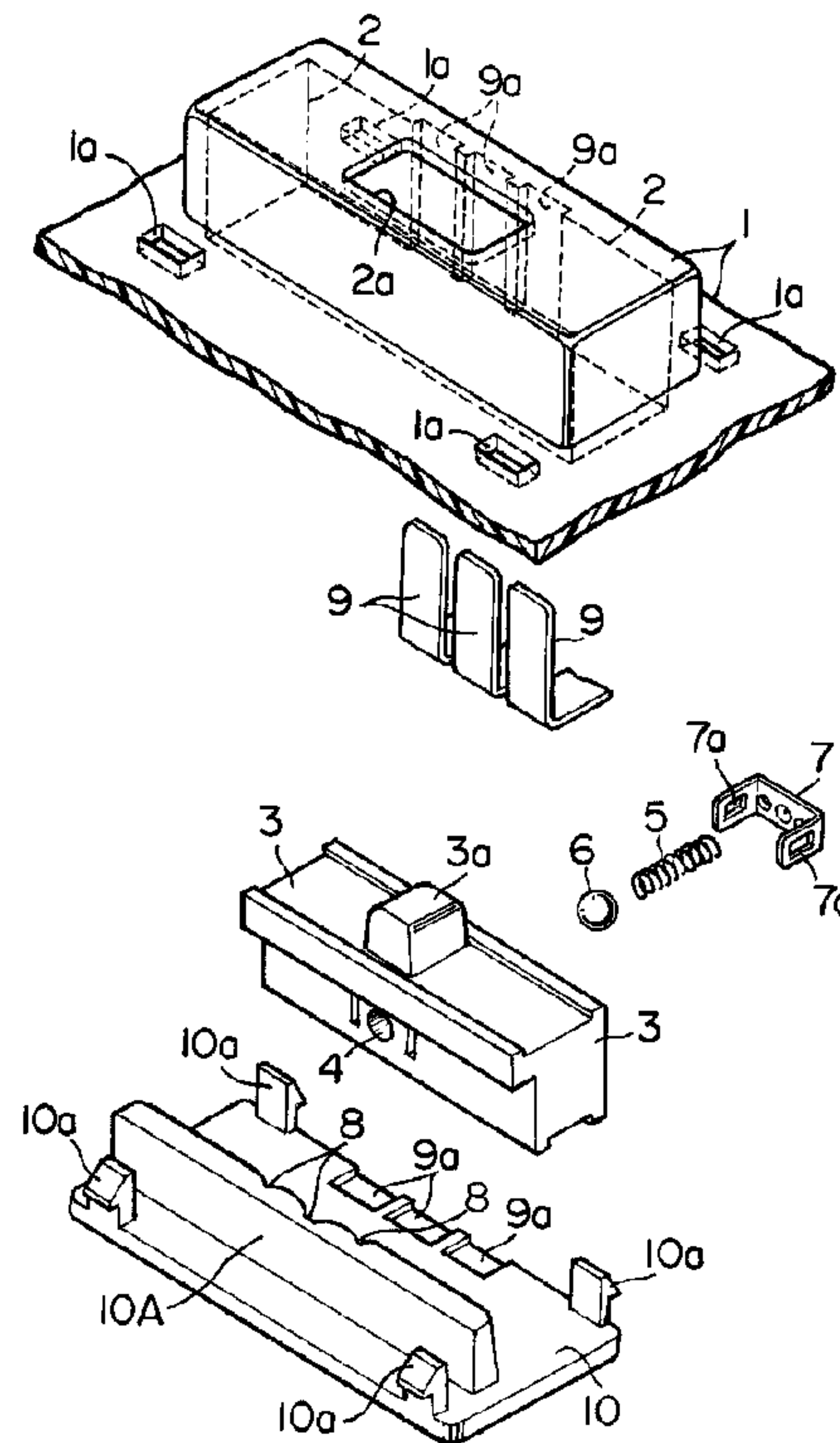




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(54) Titre : **COMMUTATEUR A GLISSIERE A DECLIC**
 (54) Title: **SLIDE SWITCH WITH A CLICKING THRUSTER**



(57) **Abrégé/Abstract:**

The present invention provides an electrical slide switch which includes a moveable contact associated with a slider and providing electrical continuity between a plurality of desired stationary contacts by movement over said stationary contacts. A clicking thruster is biased by a resilient member such that it produces a clicking sensation during switch movement by engagement with recesses during sliding motion of the slider. The slide switch has a through-hole in the slider; the moveable contact being positioned within that through-hole in opposition to the stationary contacts. The clicking thruster is positioned in opposition to the clicking thruster recesses, and the resilient member is fitted between the moving contact and the clicking thruster.

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ABSTRACT

The present invention provides an electrical slide switch which includes a moveable contact associated with a slider and providing electrical continuity between a plurality of desired stationary contacts by movement over said stationary contacts. A clicking thruster is biased by a resilient member such that it produces a clicking sensation during switch movement by engagement with recesses during sliding motion of the slider. The slide switch has a through-hole in the slider; the moveable contact being positioned within that through-hole in opposition to the stationary contacts. The clicking thruster is positioned in opposition to the clicking thruster recesses, and the resilient member is fitted between the moving contact and the clicking thruster.

This invention relates to a slide switch suitable for use in turning on and off an automobile interior lamp.

Examples of this type of slide switch in the prior art are described in Japanese Utility Model Laid-Open Publication No. 3-38833 previously proposed by the present Applicant, as well as those described in Japanese Utility Model Examined Publications No. 57-10032 and No. 55-55469, filed by other Applicants. All of these slide switches employ a coil spring and plate spring, each of which is used independently, as a spring for causing a moving contact to slide and make resilient contact with a stationary contact, and a spring for generating a clicking action during knob operation; the clicking sensation being transmitted to the fingers to make it feel like the switch has been moved to a different position.

However, in these examples of the prior art in which a coil spring and plate spring are used, they are less advantageous than switches which use a single spring and do not produce a clicking sensation because of parts management and ease of assembly, and also increased cost.

As a way of solving the above-mentioned problems, a switch is described in Japanese Utility Model Laid-Open Publication No. 63-137421 that produces a clicking sensation and applies pushing pressure to a moving contact and stationary contact with a single member. It is referred to as a clicking slide switch and uses a single plate of spring

material in which the two short and long pairs of opposing ends of four ends of a flat H-shaped plate spring material respectively are used for producing a clicking sensation and as moving contacts.

However, in that example of the prior art, in addition to having the shortcoming of being susceptible to defective contact and defective clicking due to the inherent "permanent fatigue" of the plate spring, the switch must be quite large in terms of its area, so that there is a problem in making the switch smaller.

In order to lessen the above-mentioned difficulties, an object of the present invention is to inexpensively and with ease of operation provide a slide switch that is compact in terms of its area and is able to provide a clicking sensation during switching, and which is capable of applying pushing pressure to a stationary contact of moving contact using a single resilient member. This is accomplished by employing an assembly in which a clicking thruster and moving contact respectively are arranged in a row on both sides of a coil spring provided in an opening provided in the slider of a slide switch.

According to this invention there is provided a slide switch comprising: a base defining a recess having a first inner surface and a second inner surface opposing said first inner surface; a plurality of stationary contacts attached to said first inner surface; a plurality of clicking recesses formed in said second inner surface; a slider movably disposed in said recess, said slider including a through hole extending between said first and second inner surfaces;

a moving contact attached to said slider and coupleable with one or more of said plurality of stationary contacts based on a position of said slider; a clicking thruster disposed in said through hole facing said second inner surface and being engageable with one of said plurality of clicking recesses based on a position of said slider; and a spring disposed in said through hole and positioned between said moving contact and said clicking thruster, said spring urging said moving contact toward said plurality of stationary contacts and urging said clicking thruster toward said plurality of clicking recesses.

The invention now will be described in more detail with reference to the accompanying drawings, in which:

Fig. 1 is an exploded perspective view of a slide switch according to the present invention, prior to its assembly;

Fig. 2 is a longitudinal cross-sectional view of the above-mentioned slide switch, after assembly;

Fig. 3 is a cross-sectional overhead view of a slide switch after assembly;

Fig. 4 is a cross-sectional overhead view showing the switch in a different position from that shown in Fig. 3;

Fig. 5 is a cross-sectional overhead view showing a different position from that shown in Fig. 4;

Fig. 6 is a cross-sectional overhead view showing another example of that shown in Fig. 3;

Fig. 7 is an exploded perspective view of another embodiment of a slide switch according to this invention, prior to its assembly;

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Fig. 8 is a longitudinal cross-sectional view of the above-mentioned slide switch, after assembly;

Fig. 9 is a cross-sectional overhead view of the slide switch after assembly;

Fig. 10 is a cross-sectional overhead view showing the switch in a different position from that shown in Fig. 9;

Fig. 11 is an exploded perspective view of a slide switch according to a third embodiment, prior to its assembly;

Fig. 12 shows longitudinal cross-sectional views of this
10 above-mentioned slide switch, both during and after assembly;

Fig. 13 is a cross-sectional overhead view of the slide switch after assembly;

Fig. 14 is a cross-sectional overhead view showing the switch in a different position from that shown in Fig. 13;

Fig. 15 is a cross-sectional overhead view showing a different position from that shown in Fig. 14;

Fig. 16 is a cross-sectional overhead view showing another different position from that shown in Fig. 15;

20 Fig. 17 is an exploded perspective view of an oscillating switch according to a fourth embodiment, prior to its assembly;

Fig. 18 is a longitudinal cross-sectional view of that above-mentioned switch, during and after assembly;

Fig. 19 is a cross-sectional overhead view useful for explaining the operation of the oscillating switch of this fourth embodiment;

Fig. 20 is a cross-sectional overhead view showing the switch in a different position from that shown in Fig. 19;

Fig. 21 is a cross-sectional overhead view showing a different position from that shown in Fig. 20;

Fig. 22 is an exploded perspective view of an oscillating switch according to yet another embodiment, prior to its
10 assembly;

Fig. 23 is a side view of the pivoting support portion of the operating lever of the above-mentioned switch; and

Fig. 24 is a longitudinal cross-sectional view of the switch of Fig. 22 after assembly.

The following provides an explanation of a first embodiment of the slide switch according to the present invention, with reference to Figs. 1 through 5.

In the assembly of a slide switch equipped with a moving contact and clicking thruster on a slider as shown in
20 Figs. 1 and 2 (in the first embodiment), a relatively small hole 4, which is nearly perpendicular to the direction of sliding, is formed in advance in slider 3, which itself is arranged so as to be able to slide as shown in Fig. 2 through slot 2a, with knob 3a facing to the outside, within recess 2 of insulating base 1 formed from plastic into the shape of a rectangular frame.

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Within this hole 4, clicking thruster 6, in the form of a steel ball and so forth, and moving contact 7 respectively are arranged on both sides of coil spring 5 inserted as shown in Fig. 2 so as to tend to respectively protrude as shown in Fig. 3.

The basic structure of a slide switch according to the present invention is provided by clicking thruster 6 and moving contact 7 respectively making resilient contact (as shown in each of the above-mentioned drawings) with clicking
10 recess 8 and a plurality of stationary contacts 9 provided as shown in Figs. 2 and 3 on the respective opposing inner surfaces of the above-mentioned recess 2. The above-mentioned slider 3 is arranged within the recess 2 so as to be able to move as shown in Fig. 2, and the opening edge of this recess 2 is covered with cover plate 10 as shown in Fig. 2 by using its locking hooks 10a and so forth.

In order to assemble this slide switch automatically, in addition to making one end of hole 4 of slider 3 smaller than clicking thruster 6 to form a narrow end as shown in
20 Fig. 3 so that clicking thruster 6 partially protrudes but does not come out, outward facing locking-holes 7a are formed in moving contact 7 as shown in Fig. 1. This allows these locking holes 7a to engage with the end hooks of resilient locking tabs 4a provided in opposition on the outside of hole 4 of slider 3 as shown in Fig. 3, in opposition to the resiliency of coil spring 5 as is also

shown in Fig. 3. This prevents them from coming out, making automation of the assembly of this slide switch easier.

Clicking thruster 6 and moving contact 7 tend to protrude at all times due to the resiliency of coil spring 5, and the dimensions and so forth of contact locking holes 7a are set so that they can be pushed in to the outer surface of slider 3 in opposition to the resiliency of coil spring 5.

As a result of the slide switch having the construction
10 as described above, in order to use this slide switch, in the slider position of Fig. 3 moving contact 7 is juxtaposed against two adjacent stationary contacts 9, and makes resilient contact due to resiliency of coil spring 5. Both of these stationary contacts 9 are in a state of electrical continuity, and clicking thruster 6 drops into clicking recess 8 of base recess 2 due to the resiliency of coil spring 5. As a result, the above state of electrical continuity can be easily maintained without inadvertently moving slider 3.

20 Next, when slider 3 is moved with the fingers to the position shown in Fig. 5, through the position of Fig. 4 and along slot 2a, moving contact 7 is juxtaposed against two adjacent stationary contacts 9 that are different from those described above, and makes resilient contact with these stationary contacts 9. Thus, two stationary contacts 9 that are different from those of Fig. 3 are in a state of

electrical continuity. Clicking plunger 6 drops into another clicking recess 8 of base recess 1a that is different from that shown in Fig. 3 (as shown in Fig. 5) due to the resiliency of coil spring 5, which together with providing the fingers and so forth with a sensation of changing position, namely a clicking action, also enables slider 3 to easily maintain a state of electrical continuity as shown in Fig. 5 after the clicking plunger 6 drops into clicking recess 8 without moving inadvertently.

10 Furthermore, in this embodiment, although locking holes 7a are shown to prevent the end hooks of resilient locking tabs 4 from coming out as a means of containing moving contact 7 in hole 4 of slider 3, Fig. 6 shows an example of mounting moving contact 7 to slider 3 to prevent it from coming out. Locking flanges 7A of moving contact 7 are made to engage with and lock onto locking tabs 4A provided, which protrude into hole 4 of slider 3 due to the inherent resiliency of the contact.

20 A simple sphere, hemisphere or bowl-shaped plunger can be used for clicking plunger 6. In addition, instead of aligning and arranging stationary contacts 9 with positioning grooves 9a provided in the inner surface of the above-mentioned recess 2, they also may be aligned and fixed in position with a known fixing means such as fastening with screws or adhesion. Moreover, instead of attaching mounting cover plate 10 as described above by aligning with the edges

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of base locking holes 1a by its locking hooks 10a, it can be made to cover the opening edge of base recess 1a with a known means such as fastening with screws.

Next, an explanation is provided of a second embodiment, with reference to Figs. 7 through 10. Those reference numerals which are the same as in the above-mentioned first embodiment indicate the same members, and their explanation is omitted.

In this embodiment, relatively small hole 4, which is nearly perpendicular to the direction of sliding, is formed in advance (as shown in Figs. 7 and 9) in slider 3, which is arranged so as to be able to slide (as shown in Fig. 8) through slot 2a with knob 3a facing the outside, within recess 2 of insulating base 1.

Within this hole 4, clicking thruster 6 and moving contact 7 respectively are arranged on both sides of coil spring 5 inserted as shown in Fig. 8 so as to tend to protrude as shown in Fig. 3.

Clicking thruster 6 and moving contact 7 respectively make resilient contact as shown in Figs. 7 and 9 with clicking recesses 8, respectively provided as shown in Figs. 7 and 9 in the inner surface to the side of slot 2a of the above-mentioned recess 2. A plurality of narrow electrically-conductive strips in the form of stationary contacts 9 are arranged in opposition to these recesses 8. The above-mentioned slider 3 is placed within the above-

mentioned recess 2 so as to be able to move, and the opening edge of this recess 2 is covered with cover plate 10 with the above-mentioned stationary contacts 9 inbetween, through base locking holes 1a (as shown in Fig. 8) and using its locking hooks 10a and so forth.

As a result of the slide switch employing a construction like that described above, in the slider position shown in Fig. 9, moving contact 7 is juxtaposed against two adjacent stationary contacts 9 on the right side, and makes resilient contact to form a state of electrical continuity. Clicking thruster 6 drops into center clicking recess 8 of base recess 2 due to the resiliency of coil spring 5. In addition to this producing a clicking action to the fingers and so forth, the position of electrical continuity can be easily maintained in accordance with Fig. 9 without inadvertent movement of slider 3, after clicking plunger 6 has dropped into clicking recess 8.

Next, an explanation is provided of a third embodiment, with reference to Figs. 11 through 16. Those reference numerals which are the same as in each of the above-described embodiments indicate the same members, and their explanation is omitted.

In this embodiment, relatively small hole 4, which is nearly perpendicular to the direction of sliding, is formed in advance (as shown in Figs. 11 and 12) in slider 3, which

is arranged so as to be able to move (as shown in Fig. 12) through slot 2a with knob 3a facing the outside, within recess 2 of insulating base 1. Within this hole 4, coil spring 5, clicking thruster 6 and moving contact 7, which is inserted into contact insertion holes 7a, are arranged in a row on both sides of coil spring 5.

By containing slider 3 within recess 2, when slider 3 is first pushed into recess 2 while juxtaposing the lower portion of slider 3 about the inside inclined surfaces of locking tabs 2A which are provided and protrude towards the opposing inner surfaces near the opening edge of recess 2 as shown in Fig. 12(a), opposing frame pieces 1A are deflected to the outside in opposition to their resiliency due to this pushing force.

As a result, together with the gap between the above-mentioned locking tabs 2A increasing to the width of the slider as shown in Fig. 12(a), slider 3 can be pushed inward in the order of Figs. 12 (b) and (c) by going through the space between the widened locking tabs 2A. When the upper edge of slider 3 has passed locking tabs 2A, opposing frame pieces 1A return to their original shape due to their own resiliency as shown in Fig. 12(d) thereby locking slider 3 in position.

After insertion in this manner, slider 3 can be contained in recess 2 while being allowed to move along slot 2a. In addition, together with the above-mentioned locking

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tabs 2A preventing slider 3 from coming out as shown in Fig. 12(d), the above-mentioned clicking thruster 6 and moving contact 7 respectively make resilient contact as is shown in Figs. 12(d) and 13 with clicking recesses 8 provided in the opposing inner surfaces of the above-mentioned recess 2. A plurality of stationary contacts 9 are arranged in positioning grooves 9a formed in opposition to this recess.

As a result of this slide switch employing a construction as described above, in the slider position of Fig. 13, moving contact 7 is juxtaposed against two adjacent stationary contacts 9 on the right side, and makes resilient contact to form a state of electrical continuity between these stationary contacts 9, due to the resiliency of coil spring 5. Clicking thruster 6 drops into clicking recess 8 of base recess 2 due to the resiliency of coil spring 5, thus enabling the slide switch to easily maintain the above-mentioned state of electrical continuity without inadvertent movement of slider 3.

When slider 3 is moved with the fingers to the position shown in Fig. 15, through the position of Fig. 14, along slot 2a and in opposition to the resiliency of coil spring 5, moving contact 7 is juxtaposed against two adjacent stationary contacts 9 on the right side and makes resilient contact with those said stationary contacts 9. Thus, a state of electrical continuity is formed between the two stationary contacts 9 on the left side in Fig. 15 that

differ from those shown in Fig. 13. Clicking plunger 6 drops into clicking recess 8 shown in Fig. 15 that differs from that of Fig. 13 of frame recess 2 due to the resiliency of coil spring 5, which together with providing the fingers and so forth with the feel of a clicking action, enables slider 3 easily to maintain a state of electrical continuity after clicking plunger 6 drops into clicking recess 8, without inadvertent movement.

When slider 3 is moved further to the left to the
10 position shown in Fig. 16, moving contact 7 forms an all-off state in that it only makes contact with a single stationary contact 9, and this position can easily be maintained by recess 8.

Next, an explanation is provided of a fourth embodiment, with reference to Figs. 17 through 21. Those reference numerals that are the same as in each of the above-mentioned embodiments indicate the same members, and their explanation is omitted.

In contrast to the above-mentioned embodiments which
20 perform switching of a switch by moving slider 3 in the horizontal direction, this embodiment performs switching of a switch by oscillation while using slider 3 as a fulcrum.

In this embodiment, within recess 2 of frame 1, operating lever 3 is pivotally arranged allowing it to tilt back and forth through opening edge 2a with knob 3a facing to the outside. Hole 4 is preformed nearly perpendicular to

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the direction of tilting of this operating lever 3 by plastic molding. Clicking thruster 6 and moving contact 7 are arranged in a row on both sides of coil spring 5 inserted into this hole 4.

In addition to pivotally supporting the above-mentioned operating lever 3 by pivoting support projections 3A which are provided protruding from its sides while able to tilt as shown in Fig. 18(b) on pivot support portions 2A of the above-mentioned frame 1 by deflecting to the inside as shown
10 in Fig. 18(a) in opposition to its resiliency. Clicking thruster 6 and moving contact 7 respectively make resilient contact with clicking recesses 8, respectively provided on the opposing inner surfaces of the recess 2, and a plurality of stationary contacts 9, arranged in opposition to the recess, due to the resiliency of the coil spring 5.

Furthermore, clicking thruster 6 and moving contact 7 tend to protrude at all times due to the resiliency of coil spring 5, and the depth of contact insertion holes 7a is set so that they can be pushed in to the outer surface of
20 operating lever 3 in opposition to the resiliency of coil spring 5. In addition, as one example of a means of pivotally supporting operating lever 3, operating lever 3 is pivotally supported within frame recess 2 by engaging hinge bosses 2B of the inner surface of frame recess 2 in hinge recesses (holes) 3B formed on pivoting support projections 3A by deflection to the inside (as shown in Fig. 18(a)) in

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opposition to the resiliency of the above-mentioned pivoting support projections 3A. Pivoting support projections 3A are allowed to resiliently return as shown in Fig. 18(b).

Moreover, in addition to being in the form of a hollow rectangle as in the previous example, frame 1 may also be in the form of a combination of opposing plate pieces arranged so as to leave an opening in the middle.

In the case of a lever switch constructed in the manner described above, in the lever position of Fig. 19, moving
10 contact 7 is juxtaposed against two adjacent stationary contacts 9, and makes resilient contact to form a state of electrical continuity between these stationary contacts 9 due to the resiliency of coil spring 5. Clicking thruster 6 drops into clicking recess 8 of base recess 2 due to the resiliency of coil spring 5, thus enabling the slide switch to easily maintain the above-mentioned state of electrical continuity, without inadvertent movement of slider 3.

When operating lever 3 is tilted with the fingers by grabbing onto knob 3a using hinge bosses 2B as a fulcrum,
20 and is tilted in opposition to the spring force of coil spring 5 (as shown in Fig. 21) after-going through the position shown in Fig. 20, clicking thruster then drops into recess 8 on the left side in opposition to the resiliency of coil spring 5. In addition to this creating a clicking sensation, moving contact 7 is in the off state when it is

in contact with only a single stationary contact 9, and this position can easily be maintained by recess 8.

Furthermore, in this fourth embodiment, although operating lever 3 is shown to be able to oscillate freely as a result of inserting pivoting support projections 3A into hinge bosses 2B formed within recess 2 of frame 1, as another embodiment of this, hinge bosses 3C formed on operating lever 3 may resiliently fit into hinge recesses 2C of frame 1 as shown in Figs. 22 through 24.

10 Notches 2D, which are slightly narrower than the diameter of hinge bosses 3C, are formed with guiding tapered portions 2E in the upper portion of hinge recesses 2C of frame 1. By inserting hinge bosses 3C by sliding over guiding tapered portions 2E, and fitting into hinge recesses 2C by means of notches 2D, hinge bosses 3C are able to rotate freely.

 Furthermore, although it is easier to fit hinge bosses 3C into the above-mentioned notches 2D by providing deflection relief grooves b in said notches 2D, these relief
20 grooves b are not necessary.

 As has been described above, since the present invention provides a through hole in a slider, positions a moving contact within said through hole in opposition to stationary contacts, positions a clicking thruster in opposition to clicking thruster recesses, and fits a resilient member between the above-mentioned moving contact

and the above-mentioned clicking thruster; the resilient member being used both for clicking and for resilient contact of the moving contact with the stationary contacts. Since it does provide a clicking sensation during switching, the present invention offers a simple structure, easy of operation, and can be constructed inexpensively.

In addition, by forming a containment means for the clicking thruster while also forming a containment for the moving contact, the clicking thruster and moving contact can
10 be mounted reliably and easily to the slider, thus improving ease of assembly of the slide switch which is conducive to automated assembly.

Moreover, since the stationary contacts are positioned at a uniform level by fitting them into the grooves in the insulating base, the moving contact is able to move smoothly during sliding and oscillation of the slider, offering the advantage of a smooth switching motion of the switch.

CLAIMS:

1. A slide switch comprising:

a base defining a recess having a first inner surface and a second inner surface opposing said first inner surface;

a plurality of stationary contacts on said first inner surface;

a plurality of clicking recesses formed in said second inner surface;

a slider movably disposed in said recess, said slider including a through hole extending between said first and second inner surfaces;

a moving contact on said slider and coupleable with one or more of said plurality of stationary contacts based on a position of said slider;

a clicking thruster disposed in said through hole facing said second inner surface and being engageable with one of said plurality of clicking recesses based on a position of said slider; and

a spring disposed in said through hole and positioned between said moving contact and said clicking thruster, said spring urging said moving contact toward said plurality of stationary contacts and urging said clicking thruster toward said plurality of clicking recesses.

2. A slide switch as set forth in claim 1 wherein a containment member that contains said clicking thruster is formed in one end of said through hole.

3. A slide switch as set forth in claim 2 wherein said containment member comprises an end diameter of said through

hole which is smaller than said clicking thruster.

4. A slide switch as set forth in claim 1 wherein a containment structure is formed in said through hole and on said moving contact.

5. A slide switch as set forth in claim 4 wherein said containment structure comprises locking holes, formed in bent portions bent at roughly a right angle from ends of said moving contact engaging with resilient locking tabs formed in said through hole.

6. A slide switch as set forth in claim 4 wherein said containment structure comprises locking projections, formed in bent portions of said moving contact, being locked in locking flanges formed in said through hole.

7. A slide switch as set forth in any one of claims 1 to 6 wherein said through hole is formed in a direction perpendicular to a sliding direction of said slider.

8. A slide switch as set forth in any one of claims 1 to 6 wherein said through hole is formed in a direction parallel to a sliding direction of said slider.

9. A slide switch as set forth in any one of claims 1 to 8 wherein said stationary contacts are maintained uniformly level by fitting into grooves of said base.

10. A slide switch as set forth in claim 1 further comprising a hinge, wherein said slider is axially supported by said hinge so that said slider oscillates relative to said base.

11. A slide switch as set forth in any one of claims 1 to 10 wherein said clicking thruster is a metal ball.

12. A slide switch as set forth in claim 1, wherein a containment means of said clicking thruster is formed in one end of said through hole.

13. A slide switch comprising:

a base defining a recess having a first inner surface, a second inner surface opposing said first inner surface, and a slot disposed between the first and second inner surfaces and opening to outside of said recess;

a plurality of stationary contacts attached to said first inner surface;

a plurality of clicking recesses formed in said second inner surface;

a slider movably disposed in said recess, said slider including a through hole extending between said first and second inner surfaces and a knob extending through said slot;

a moving contact attached to said slider and coupleable with one or more of said plurality of stationary contacts based on a position of said slider;

a clicking thruster disposed in said through hole facing said second inner surface and being engageable with one of said plurality of clicking recesses based on a position of

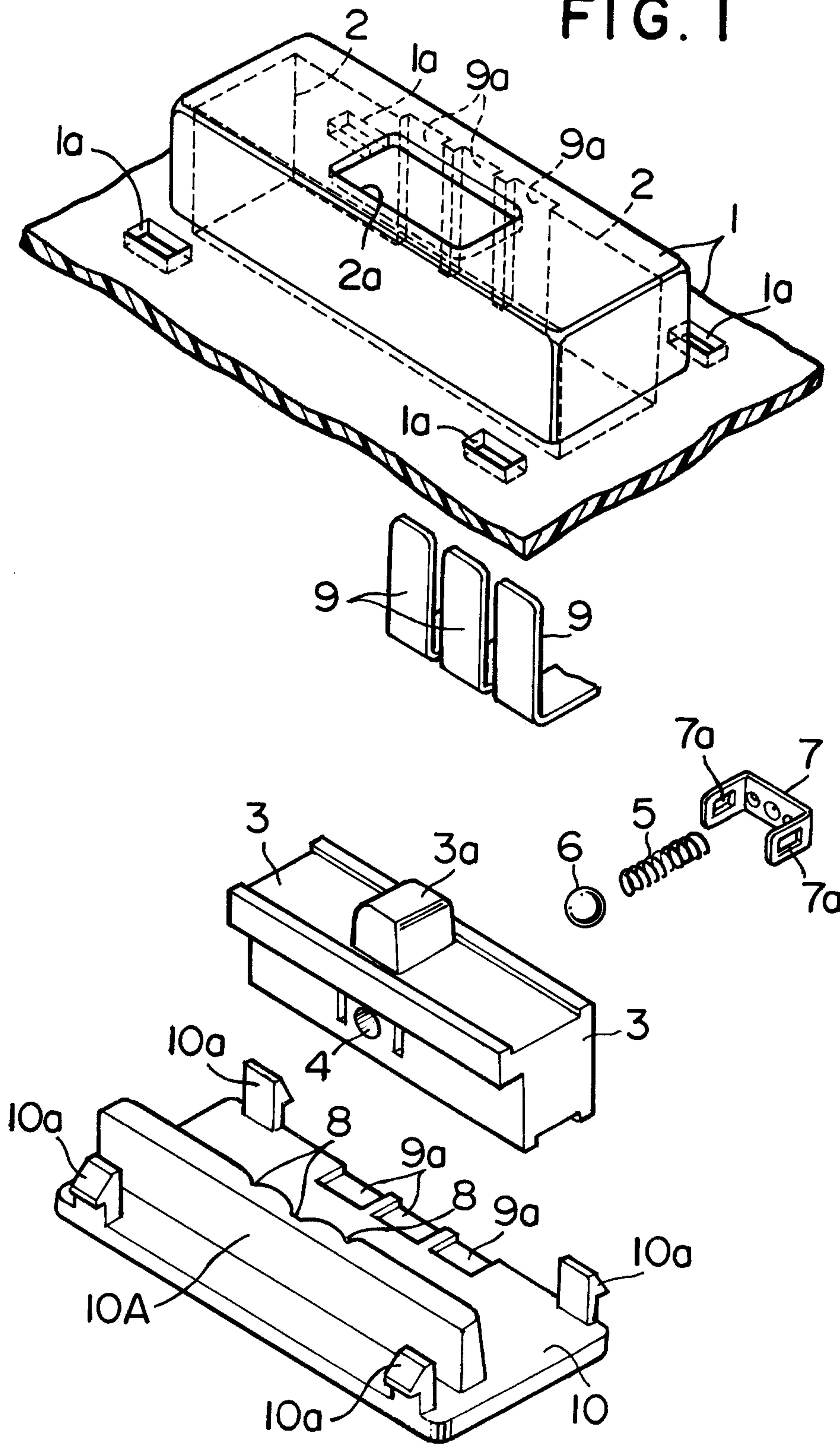
said slider;

a spring disposed in said through hole and positioned between said moving contact and said clicking thruster, said spring urging said moving contact toward said plurality of stationary contacts and urging said clicking thruster toward said plurality of clicking recesses; and

a cover plate secured to said base and covering an opening in a side of said recess opposite from said slot.

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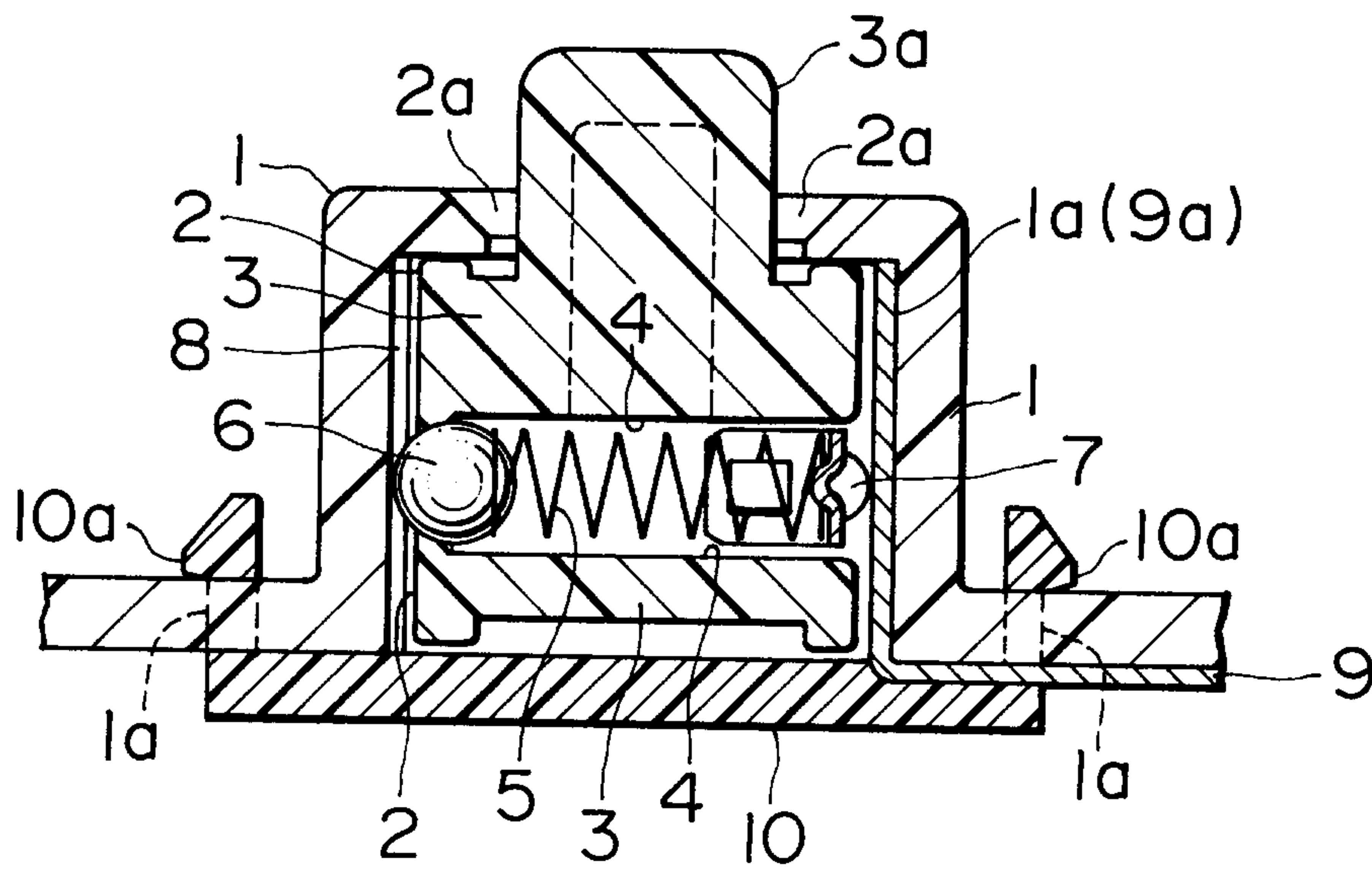
FIG. 1



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FIG. 2



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FIG. 3

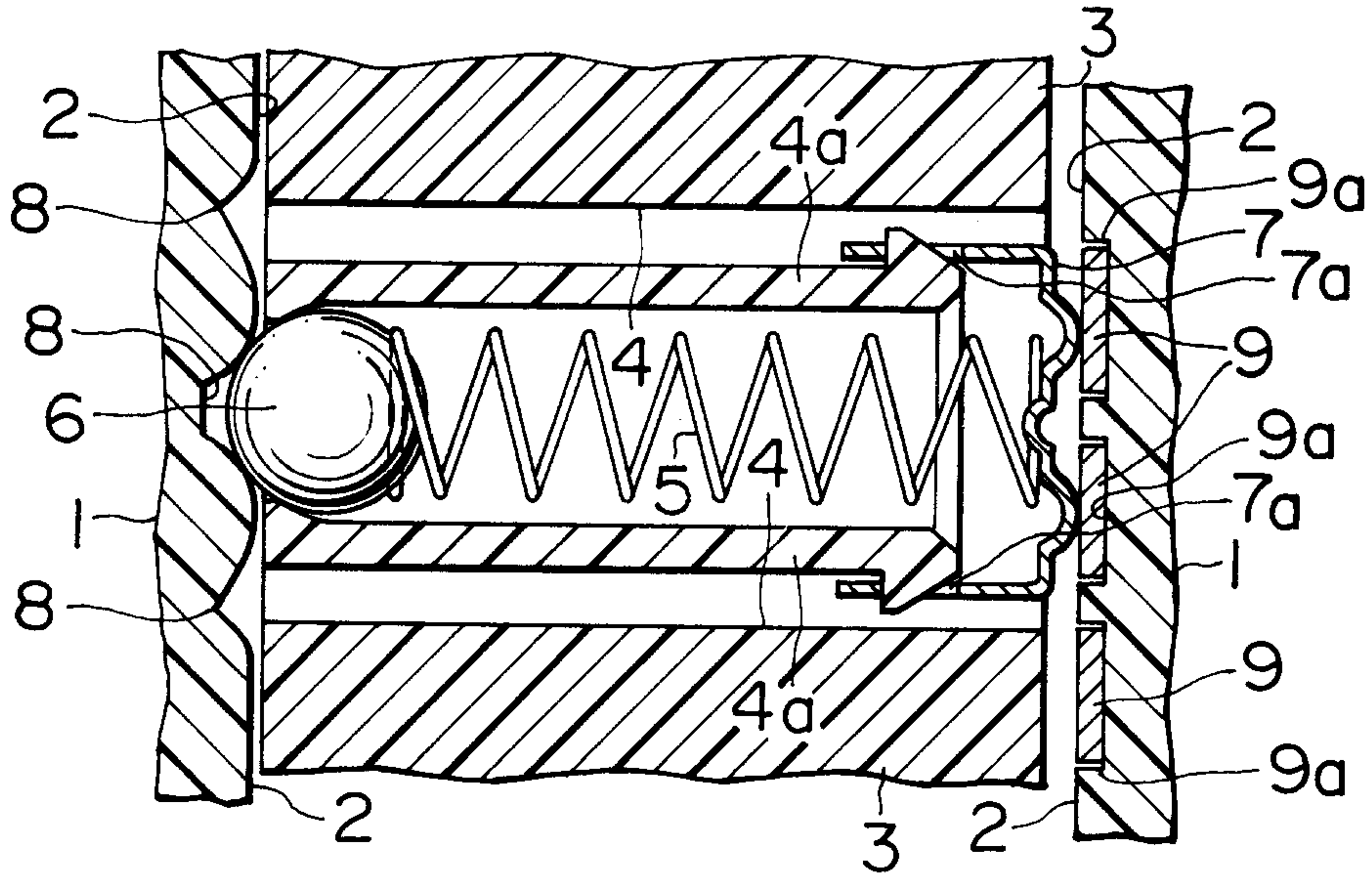
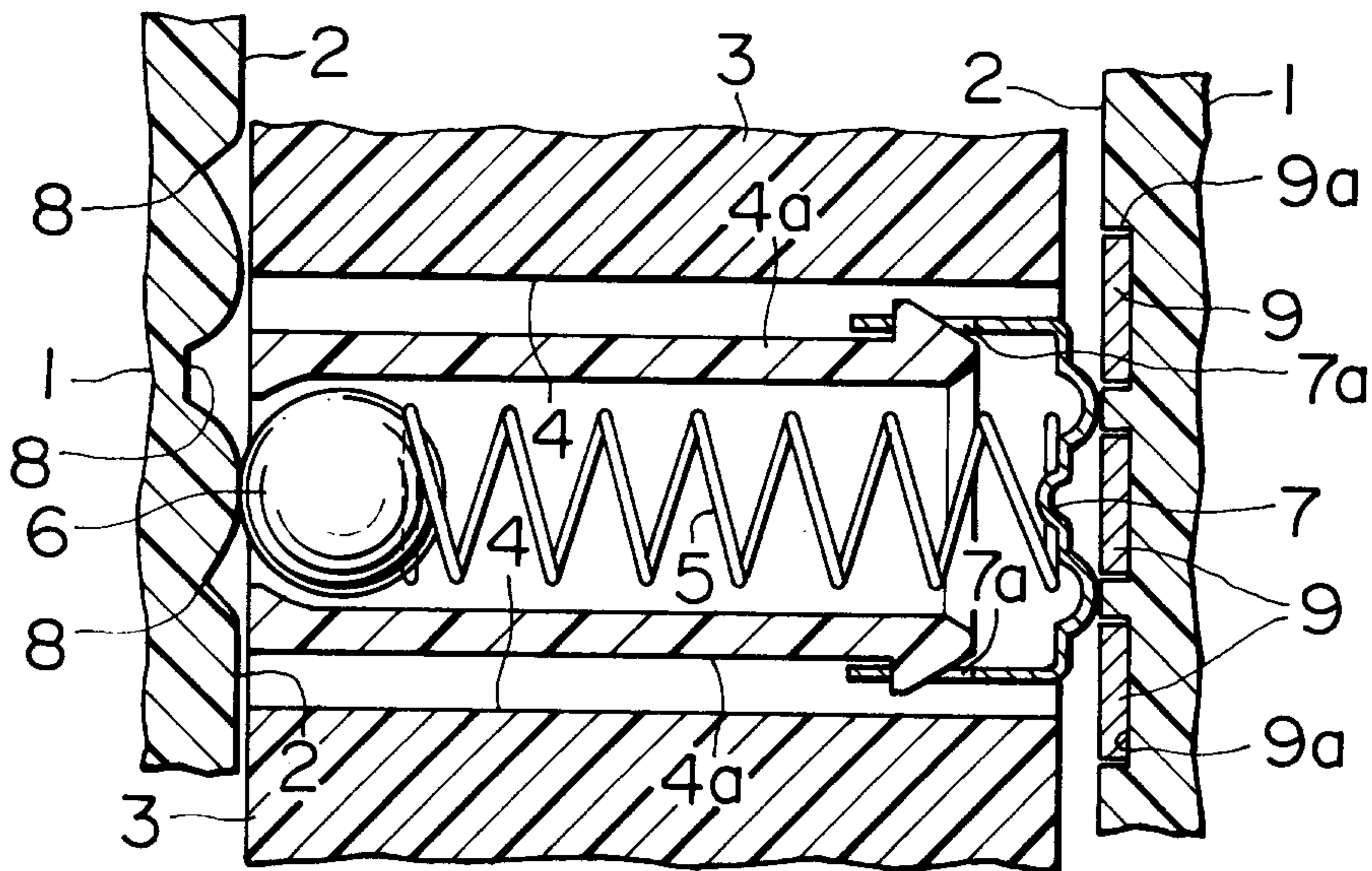


FIG. 4



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FIG. 5

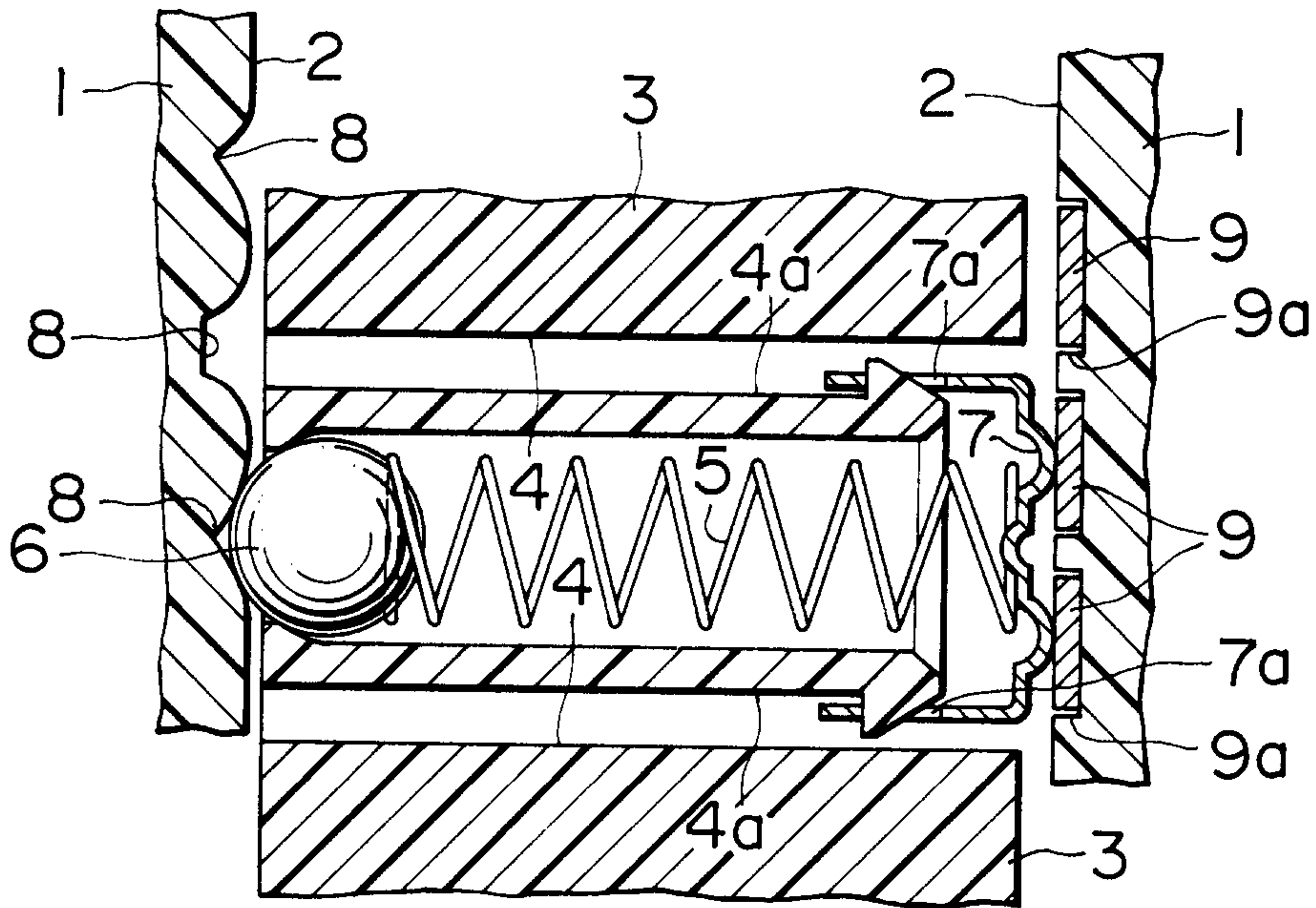
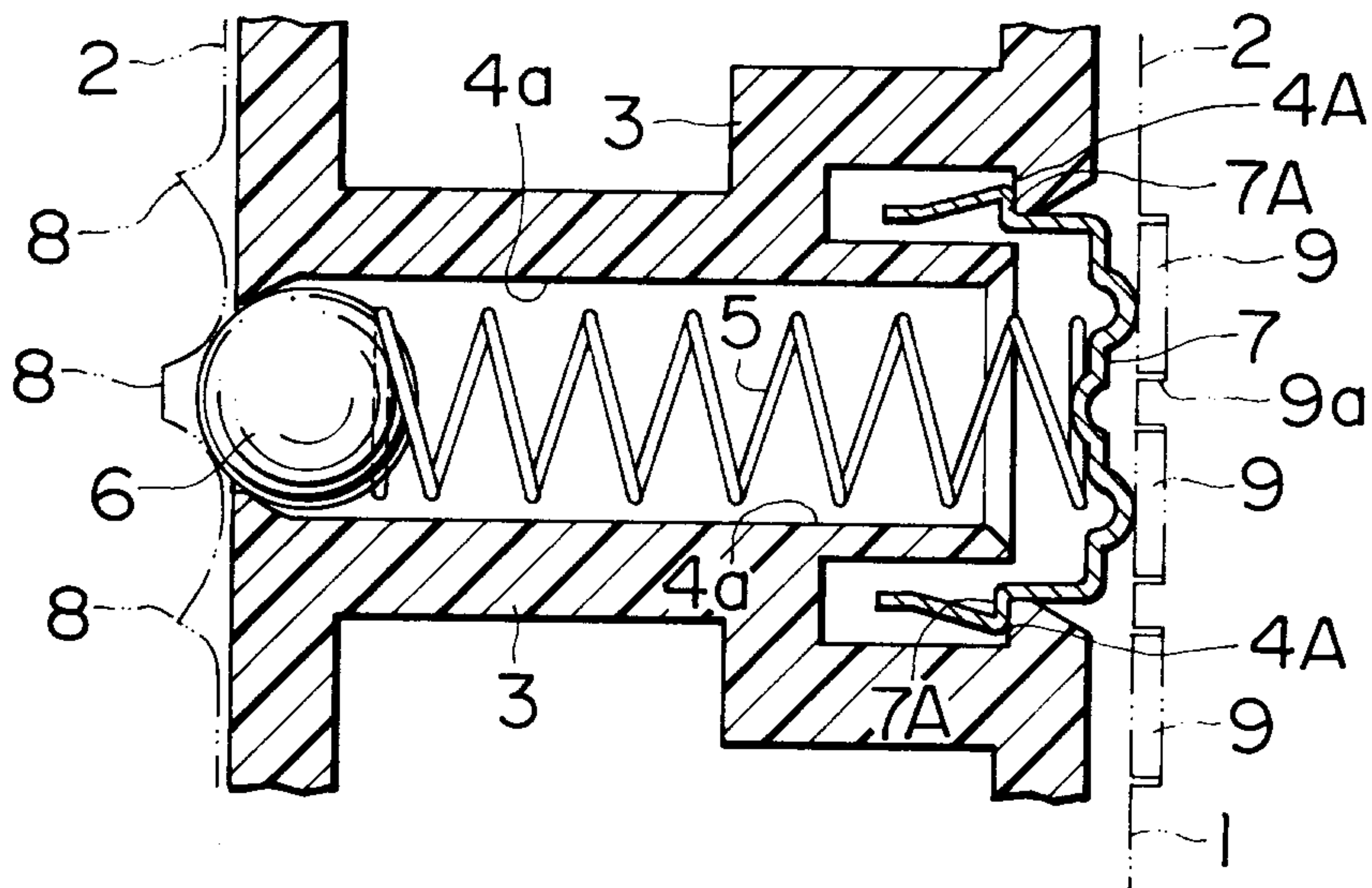
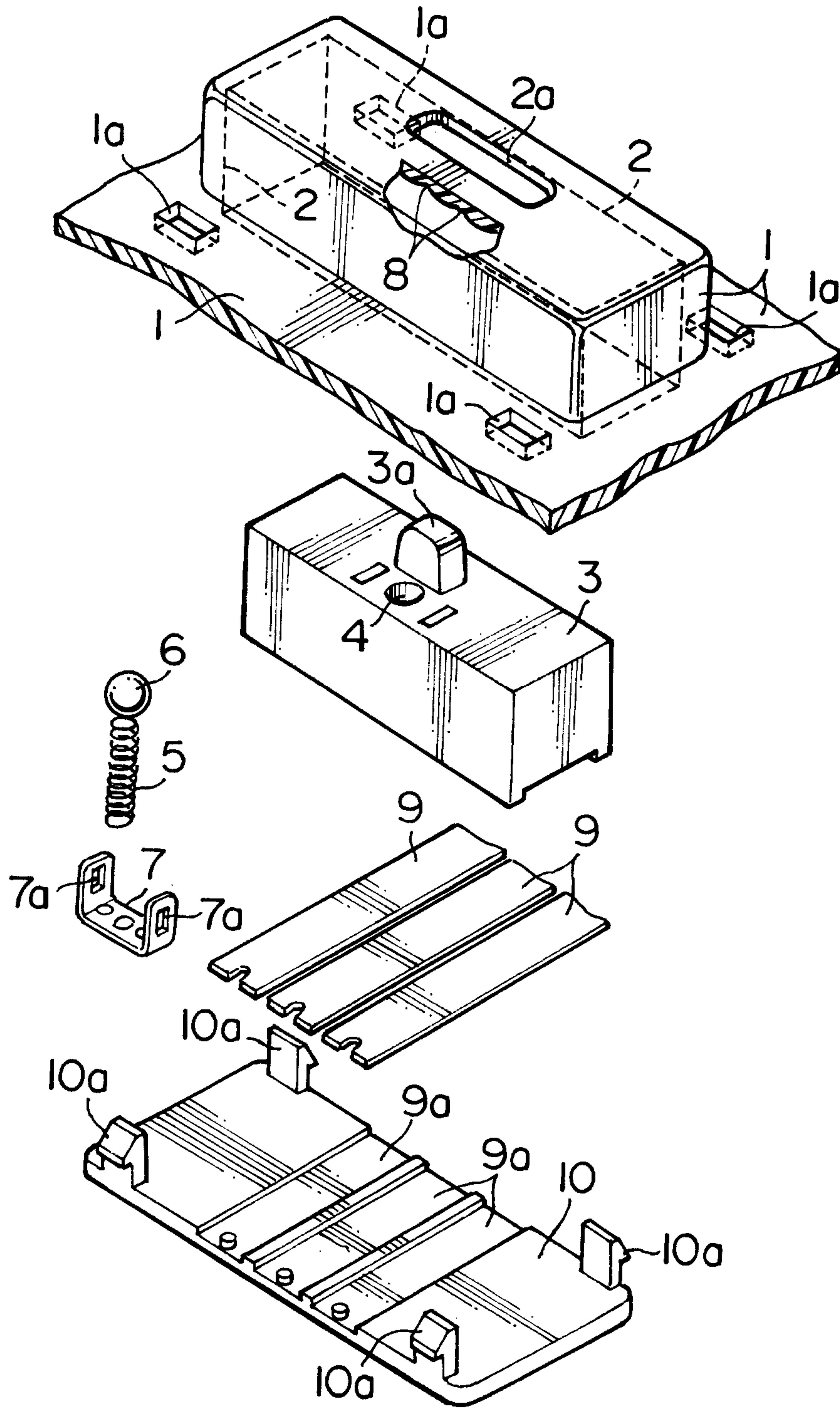


FIG. 6



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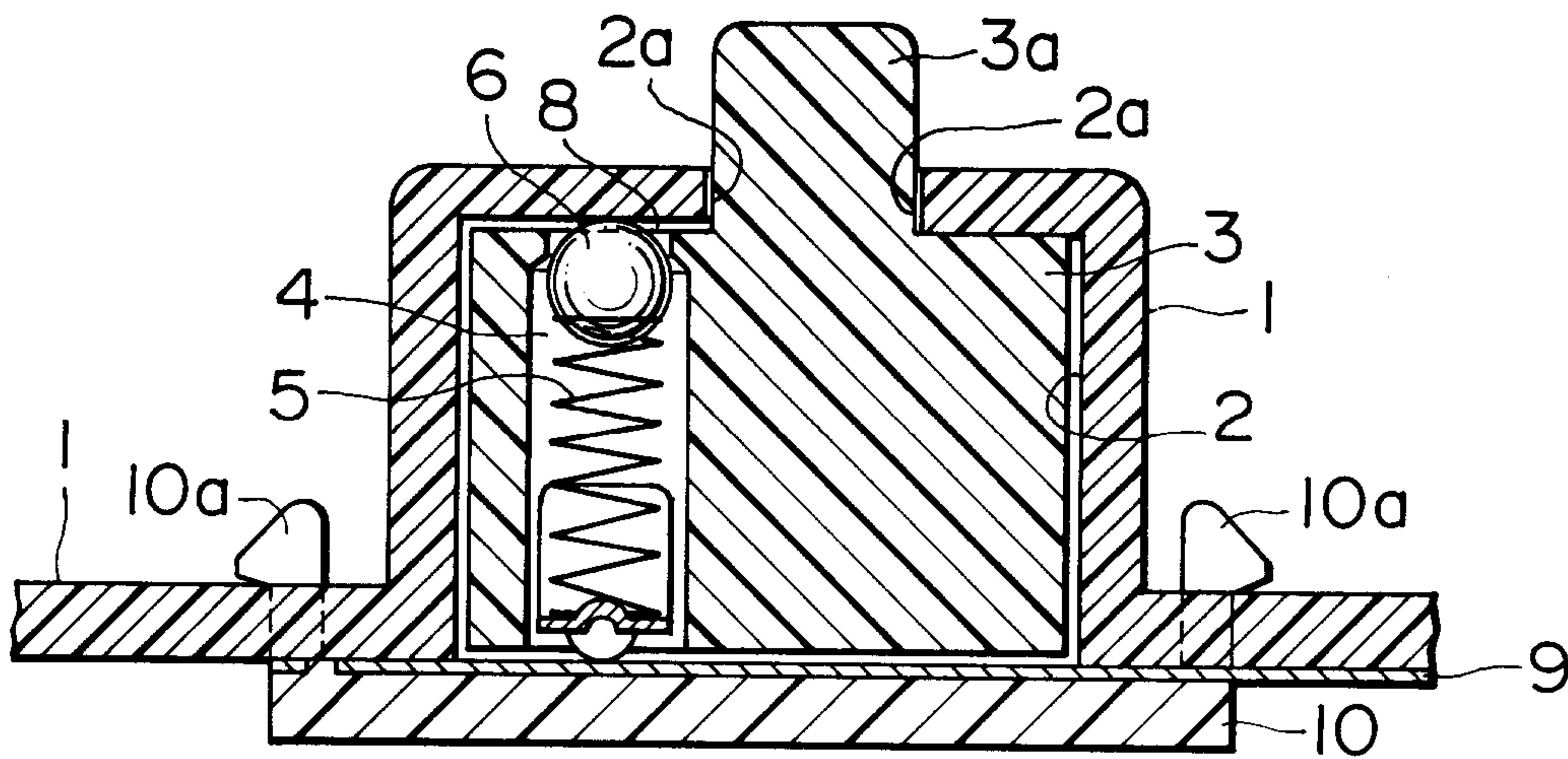
FIG. 7



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0 2 1 9 8 9 7 0

FIG. 8



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FIG. 9

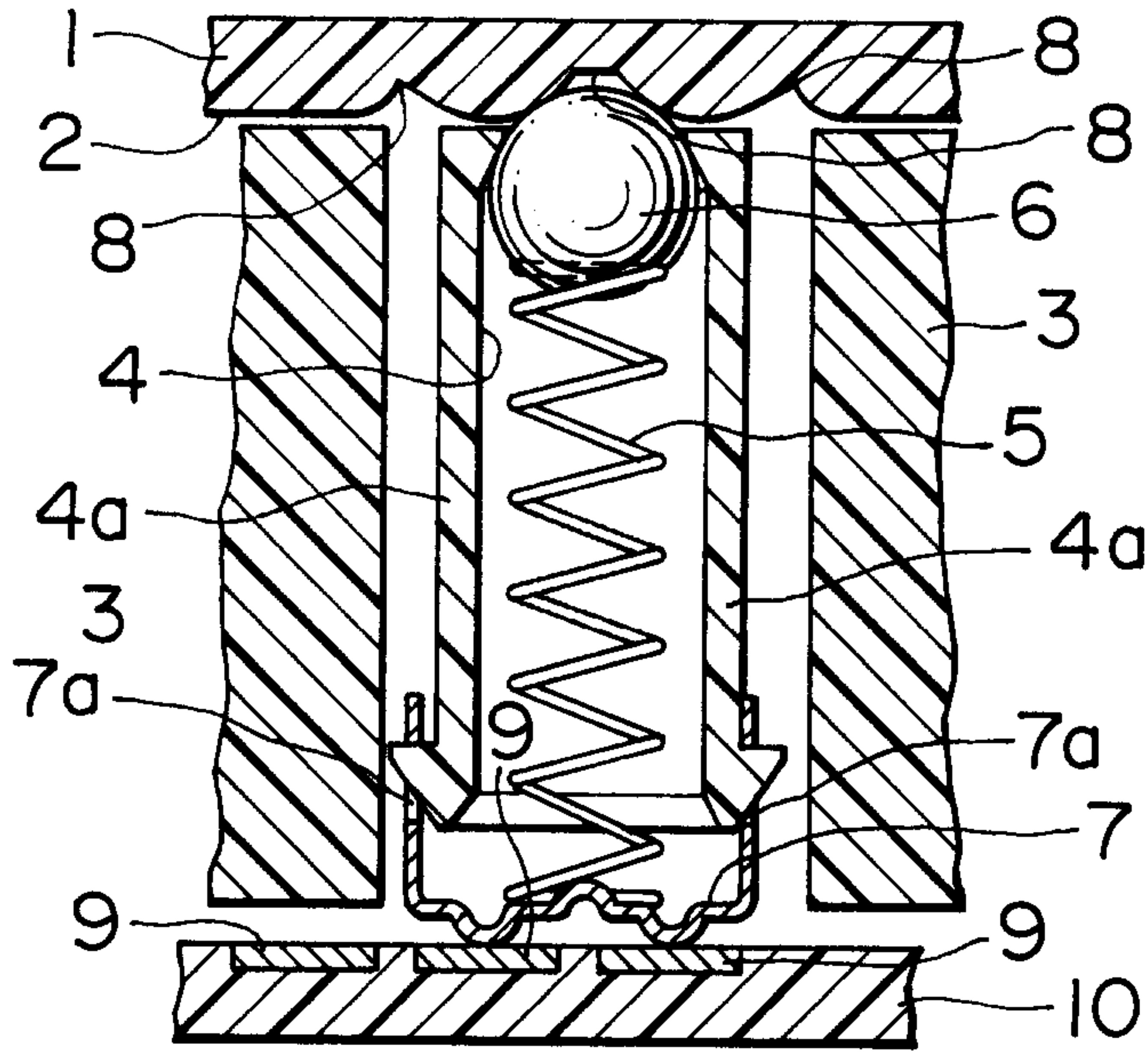
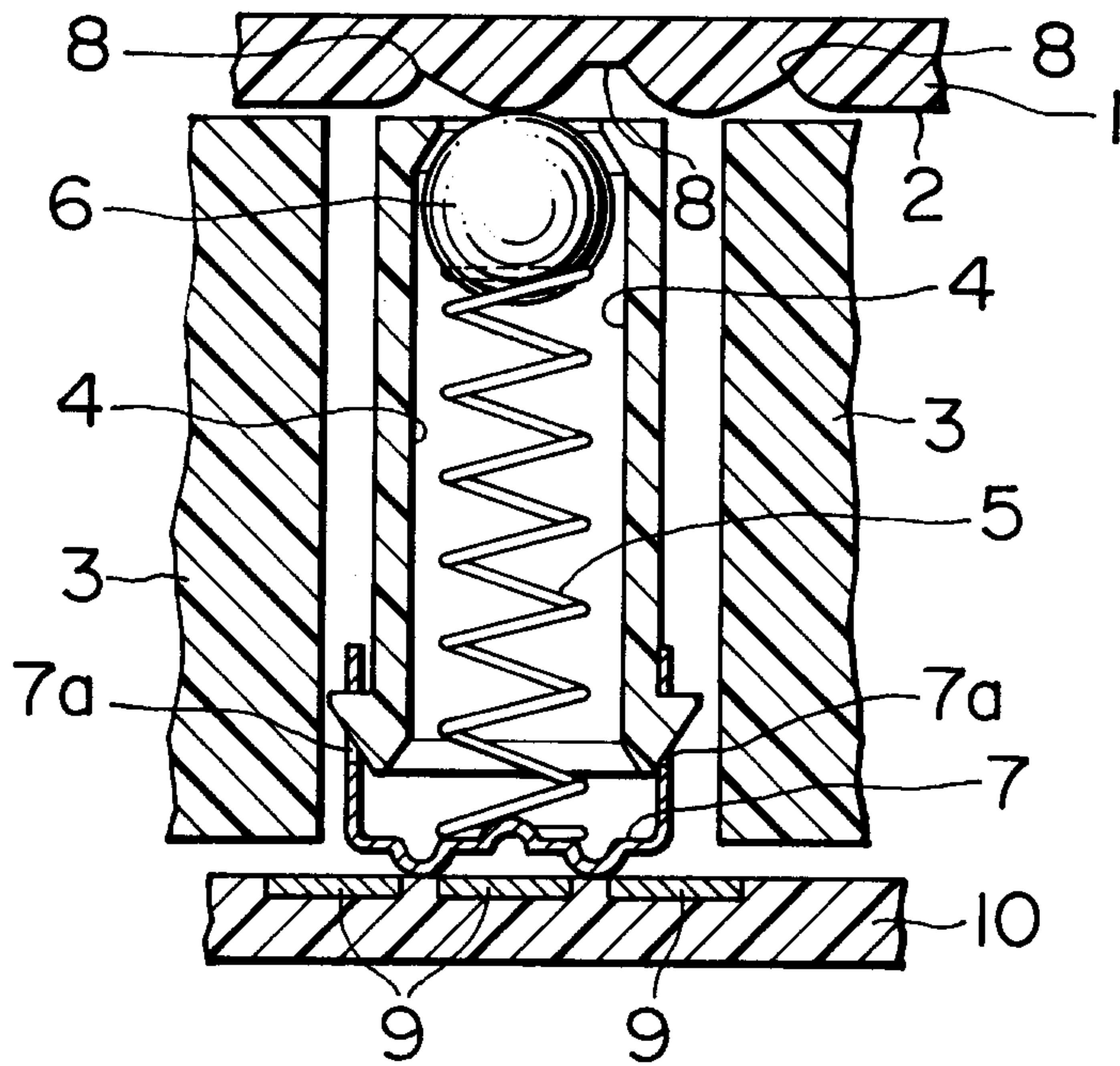
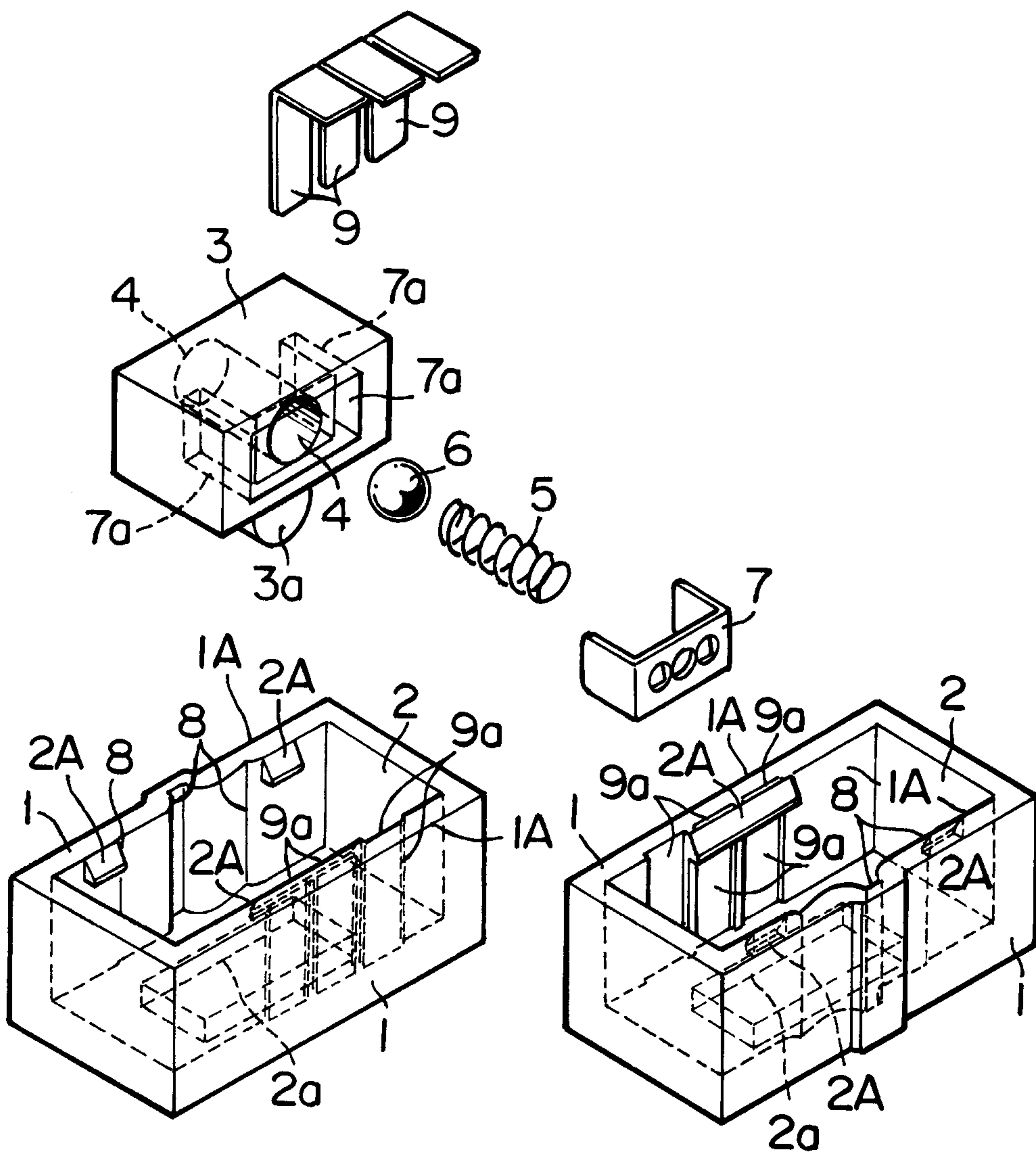


FIG. 10



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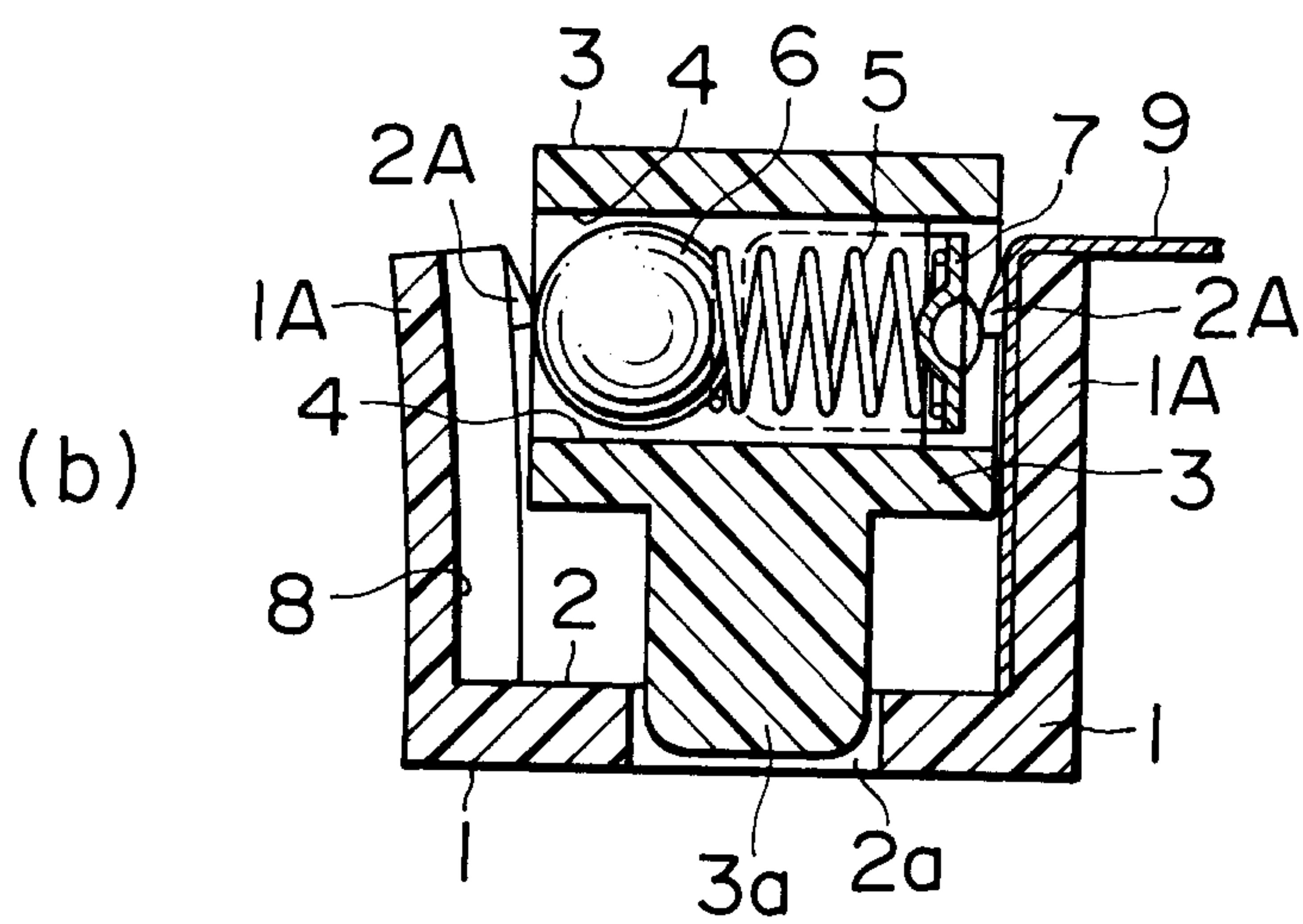
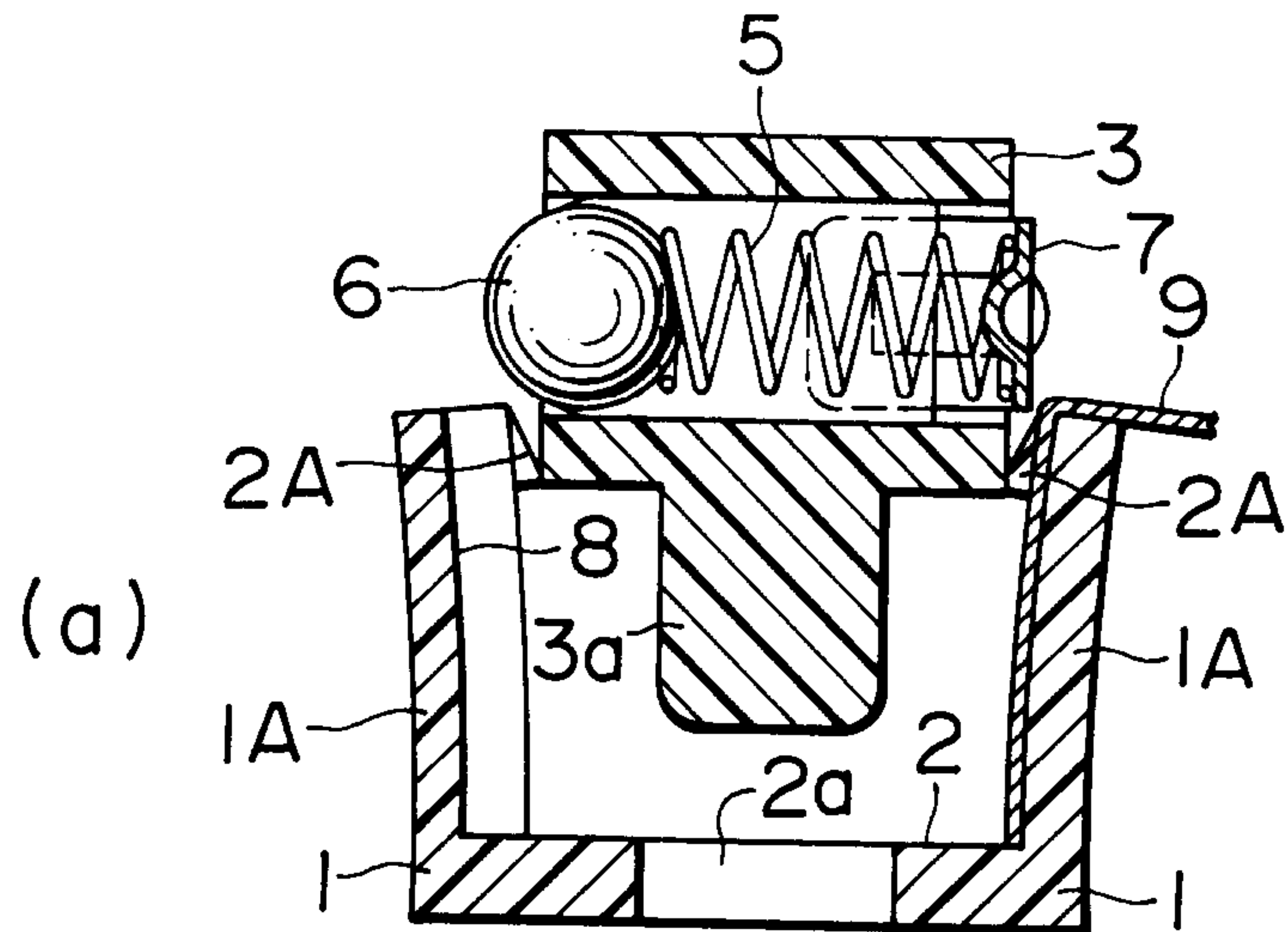
FIG. 11



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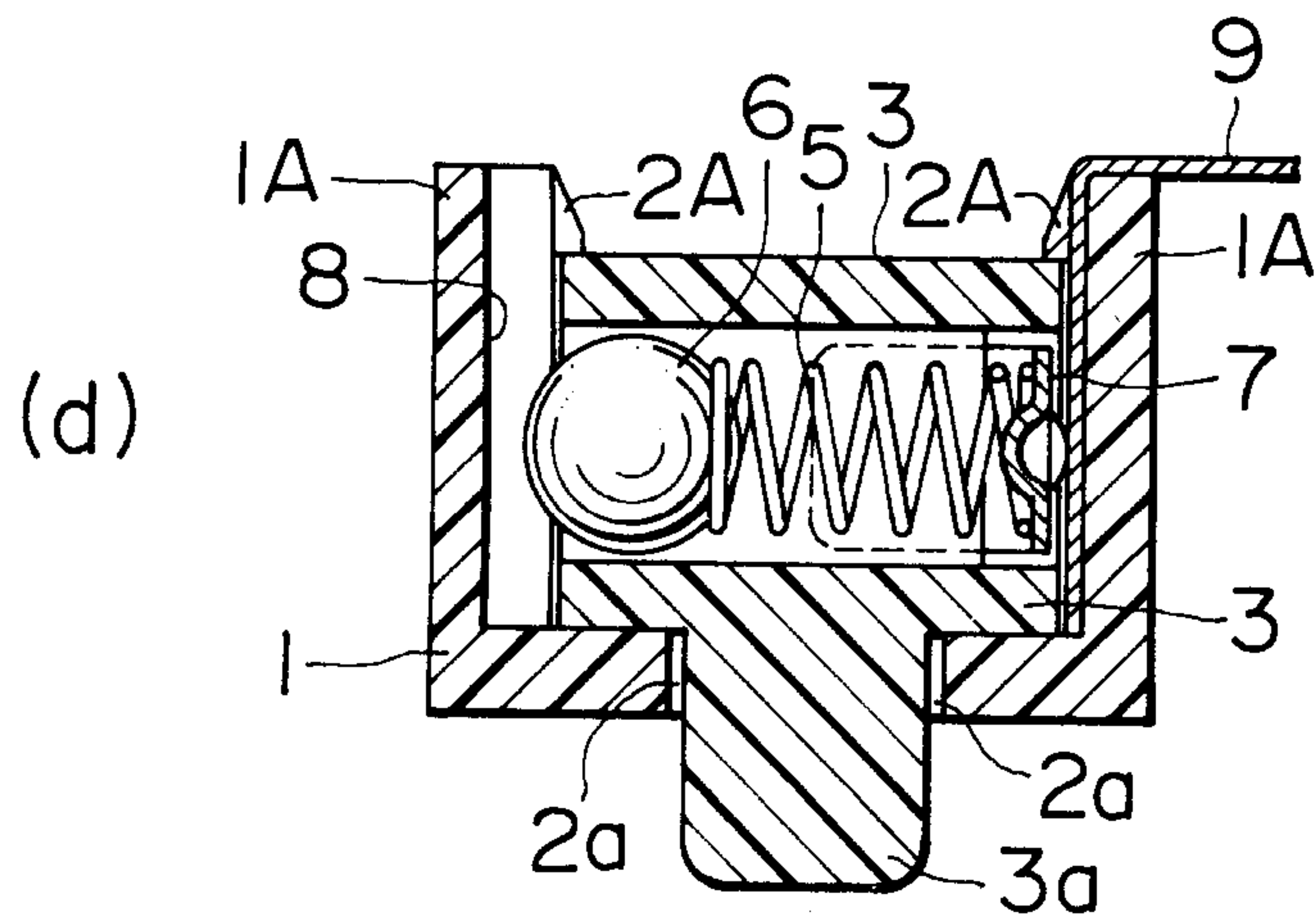
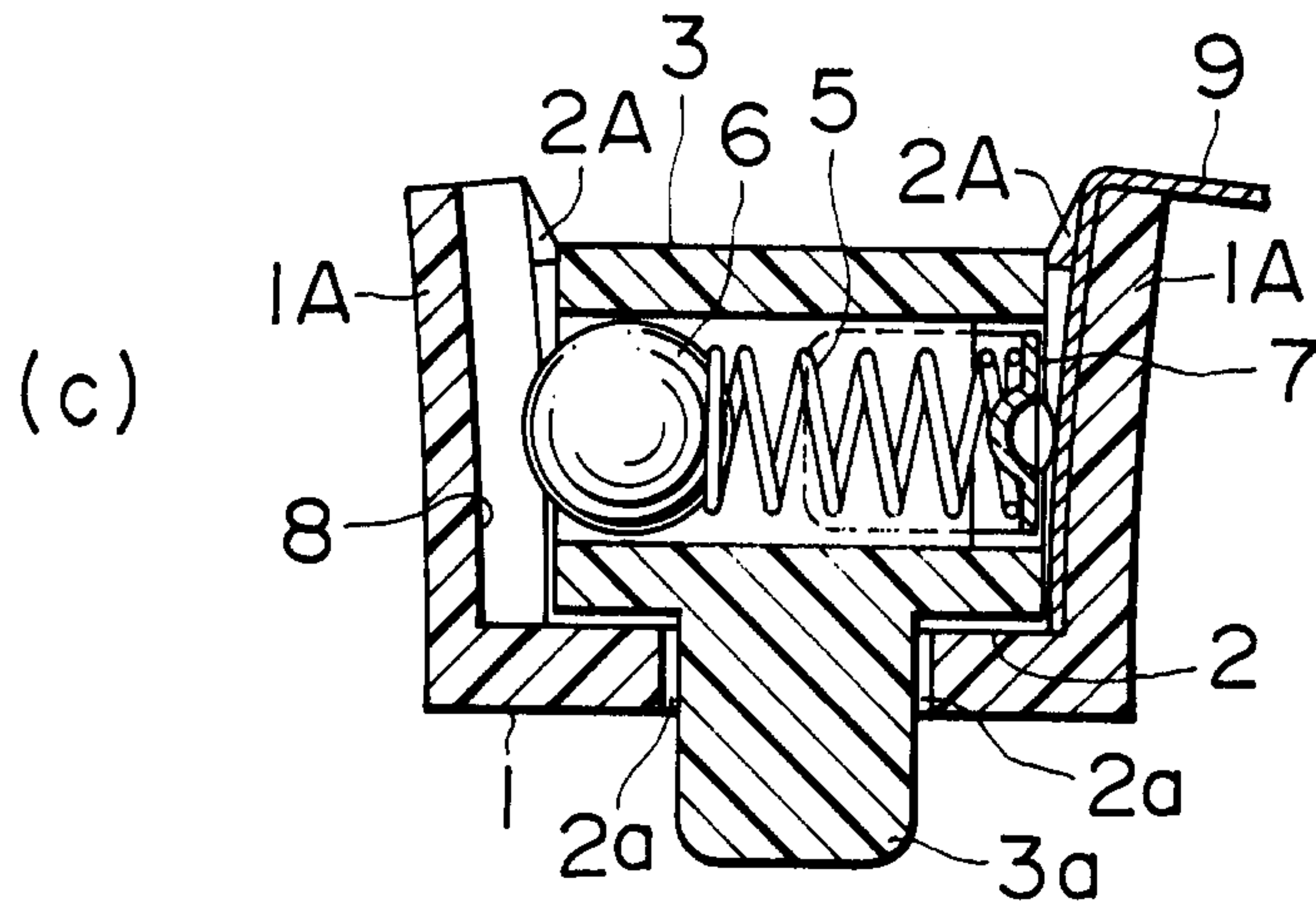
FIG. 12



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FIG. 12



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FIG. 13

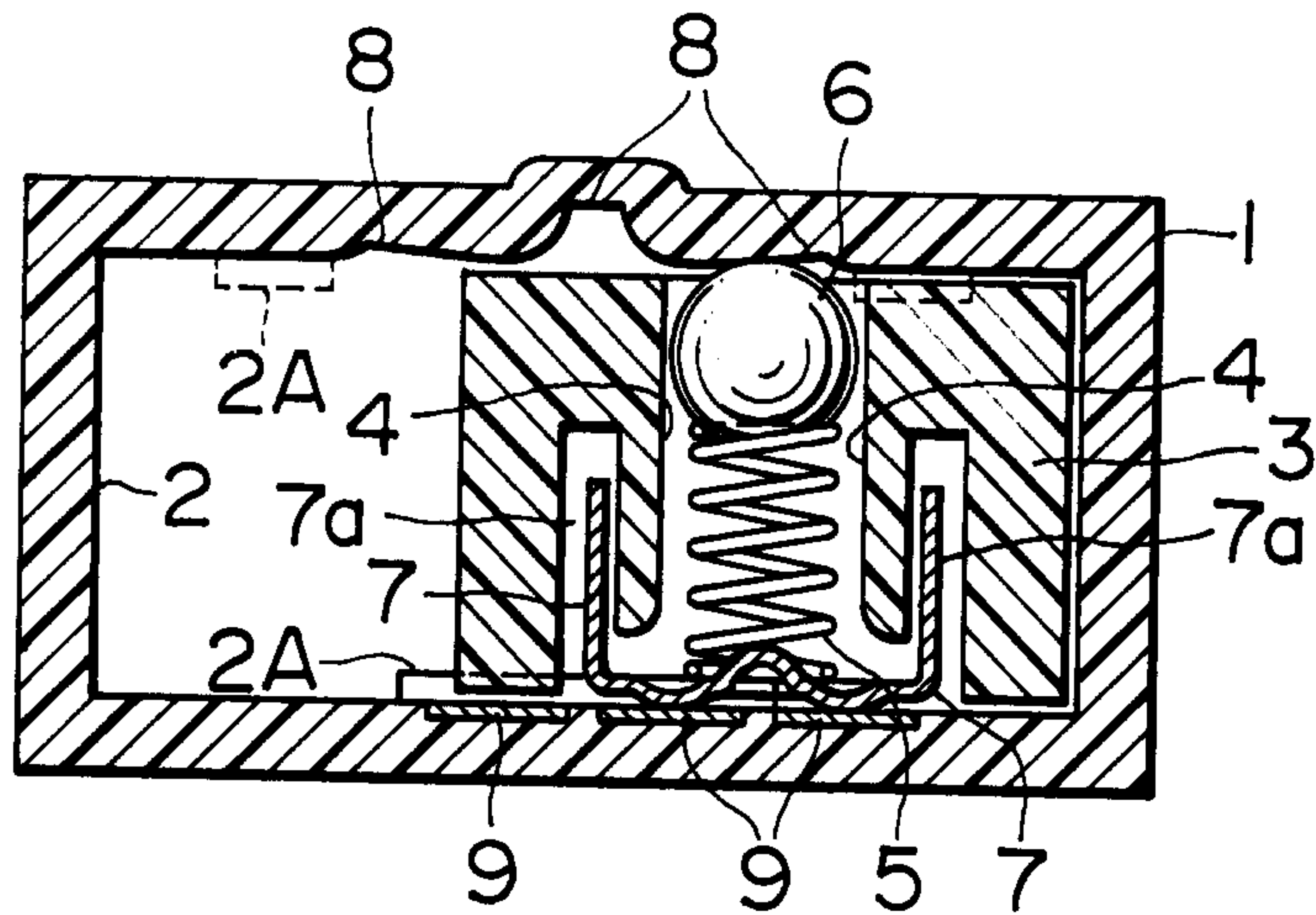
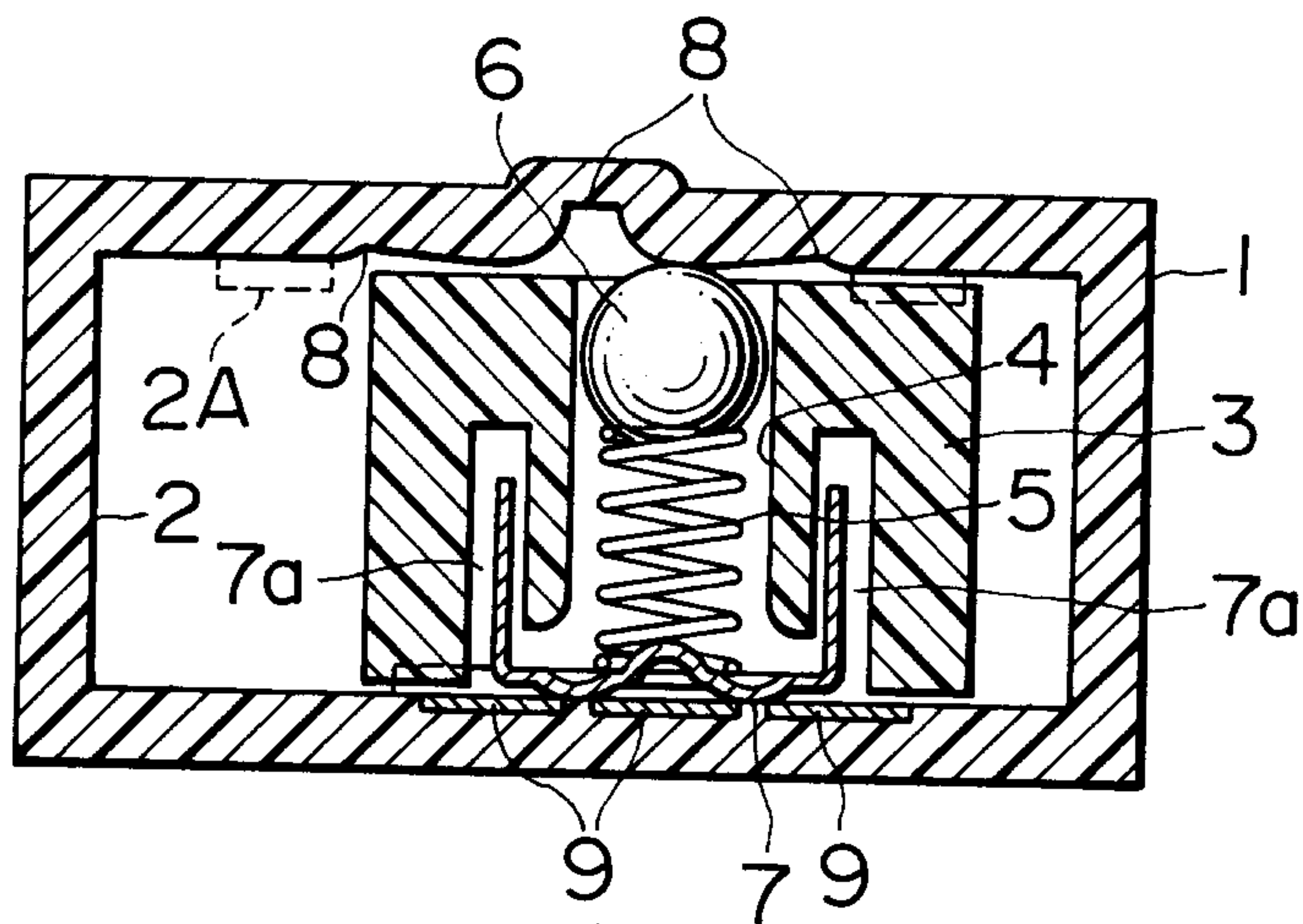


FIG. 14



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FIG. 15

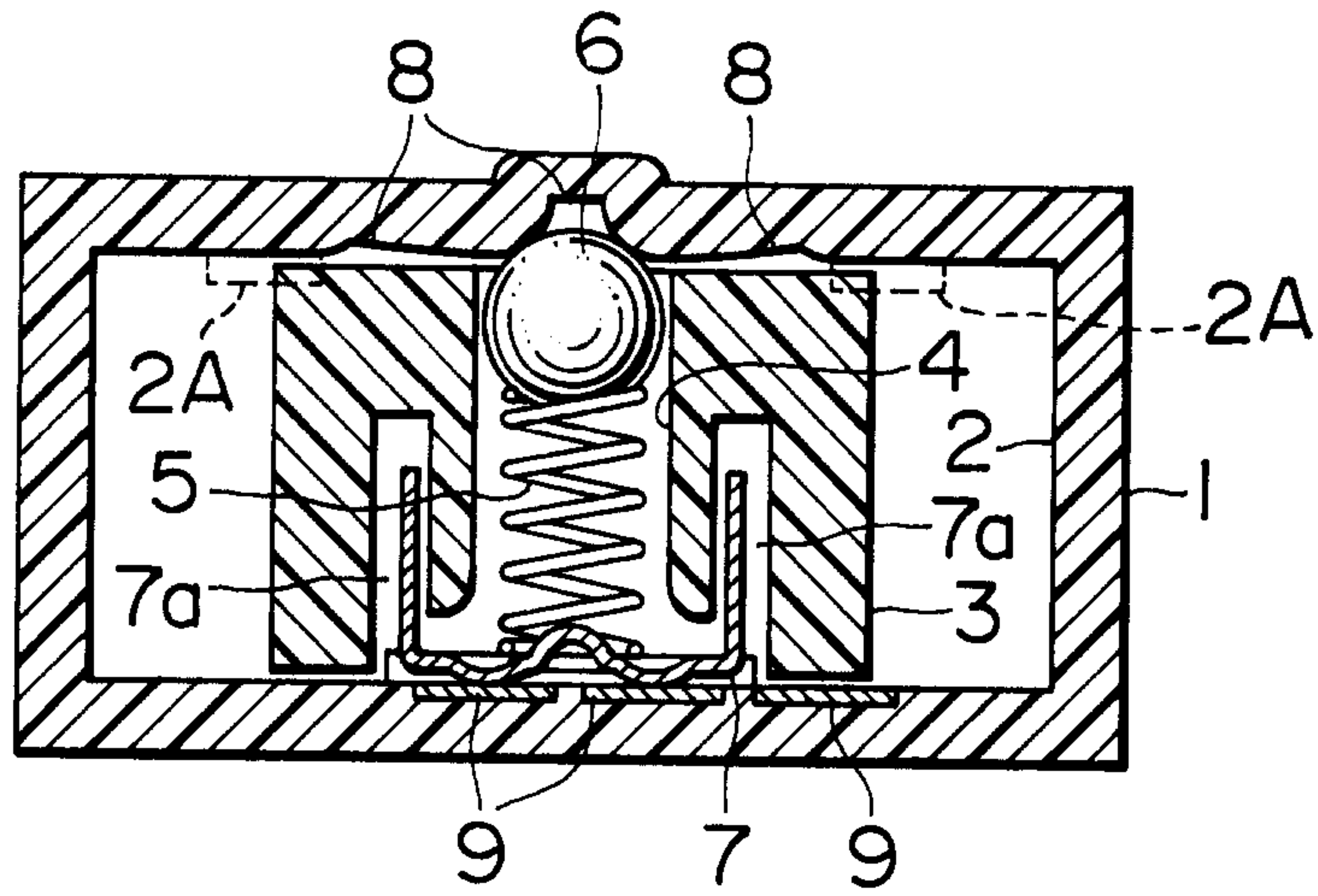
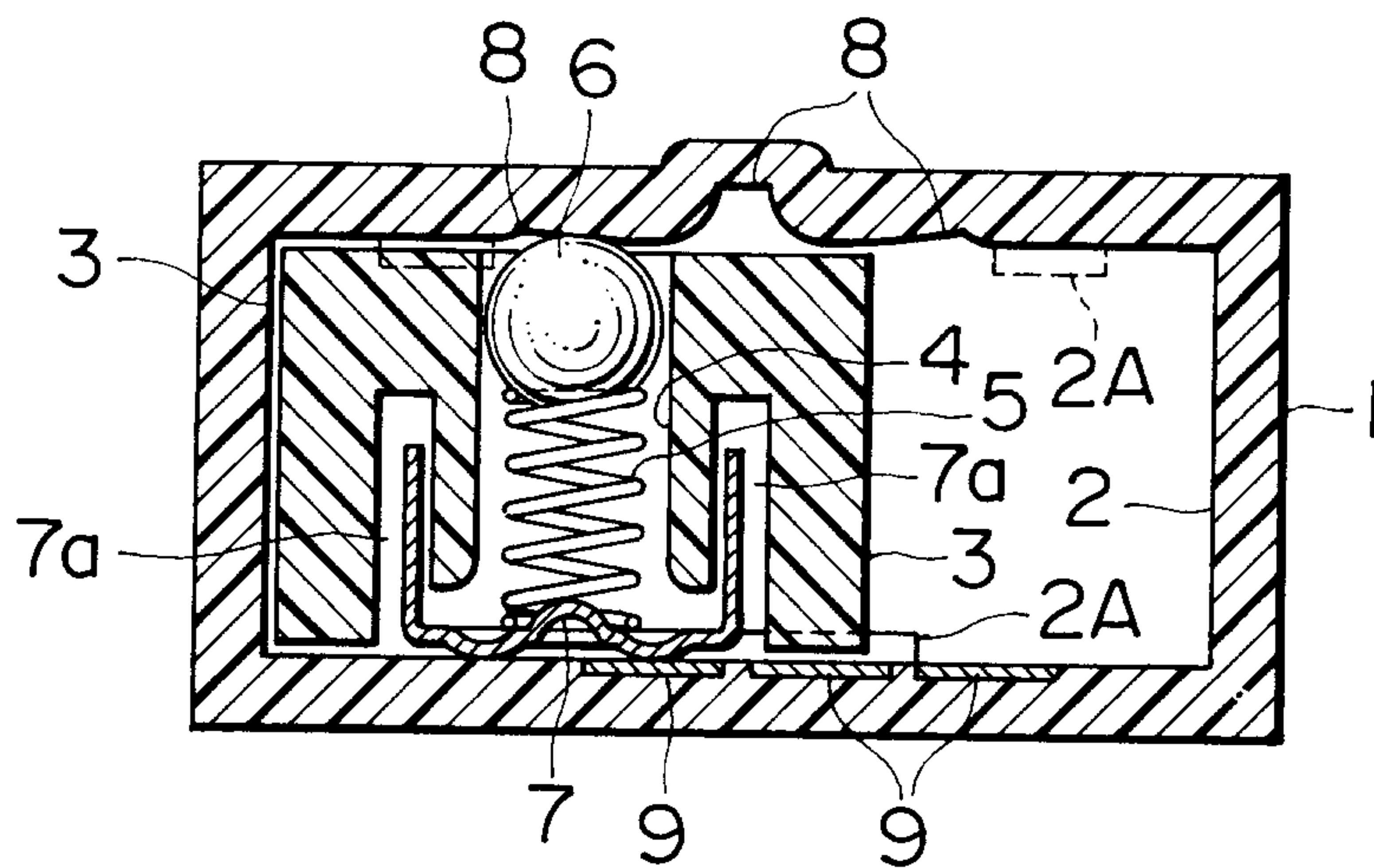
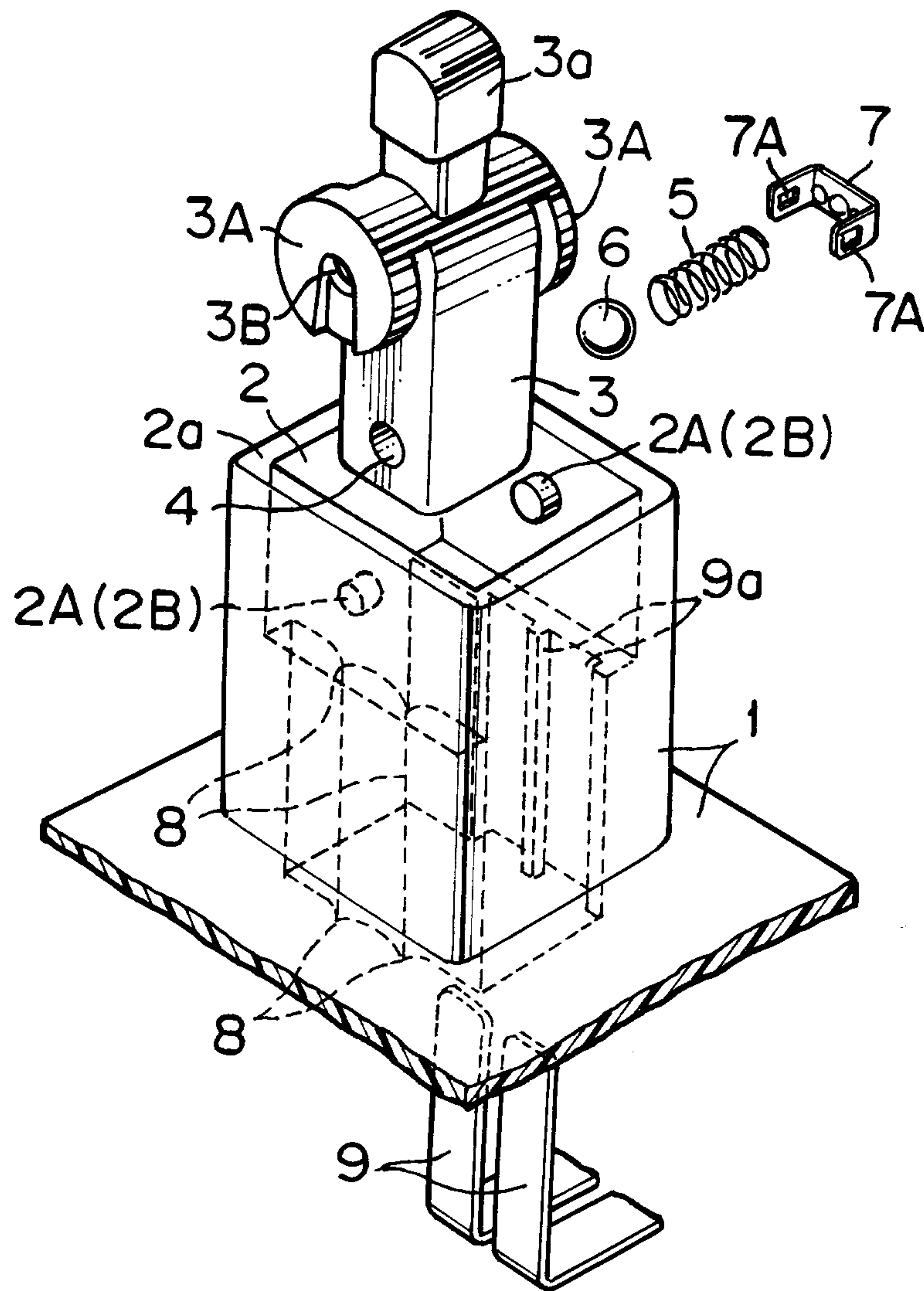


FIG. 16



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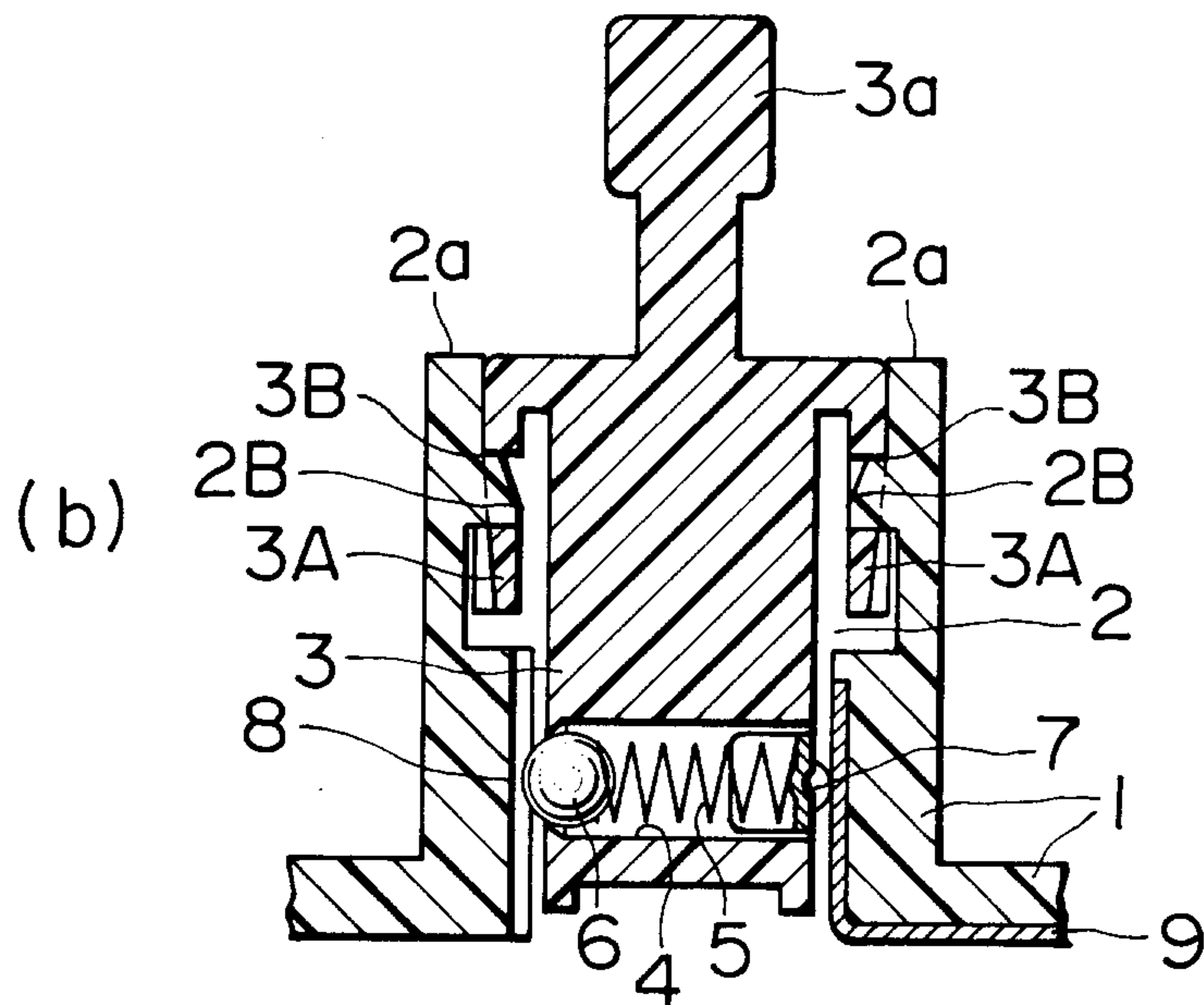
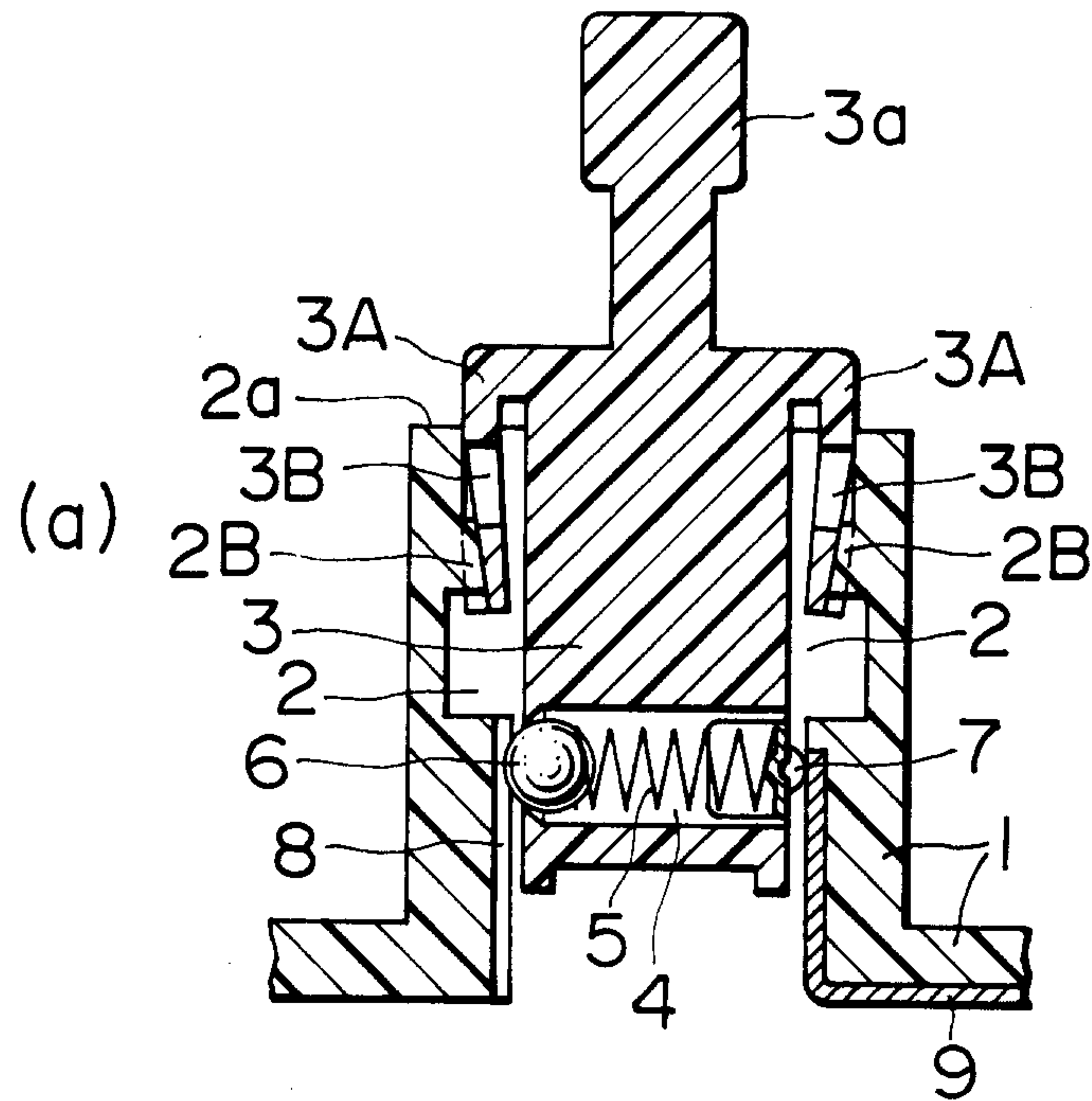
FIG. 17



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FIG. 18



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FIG. 19

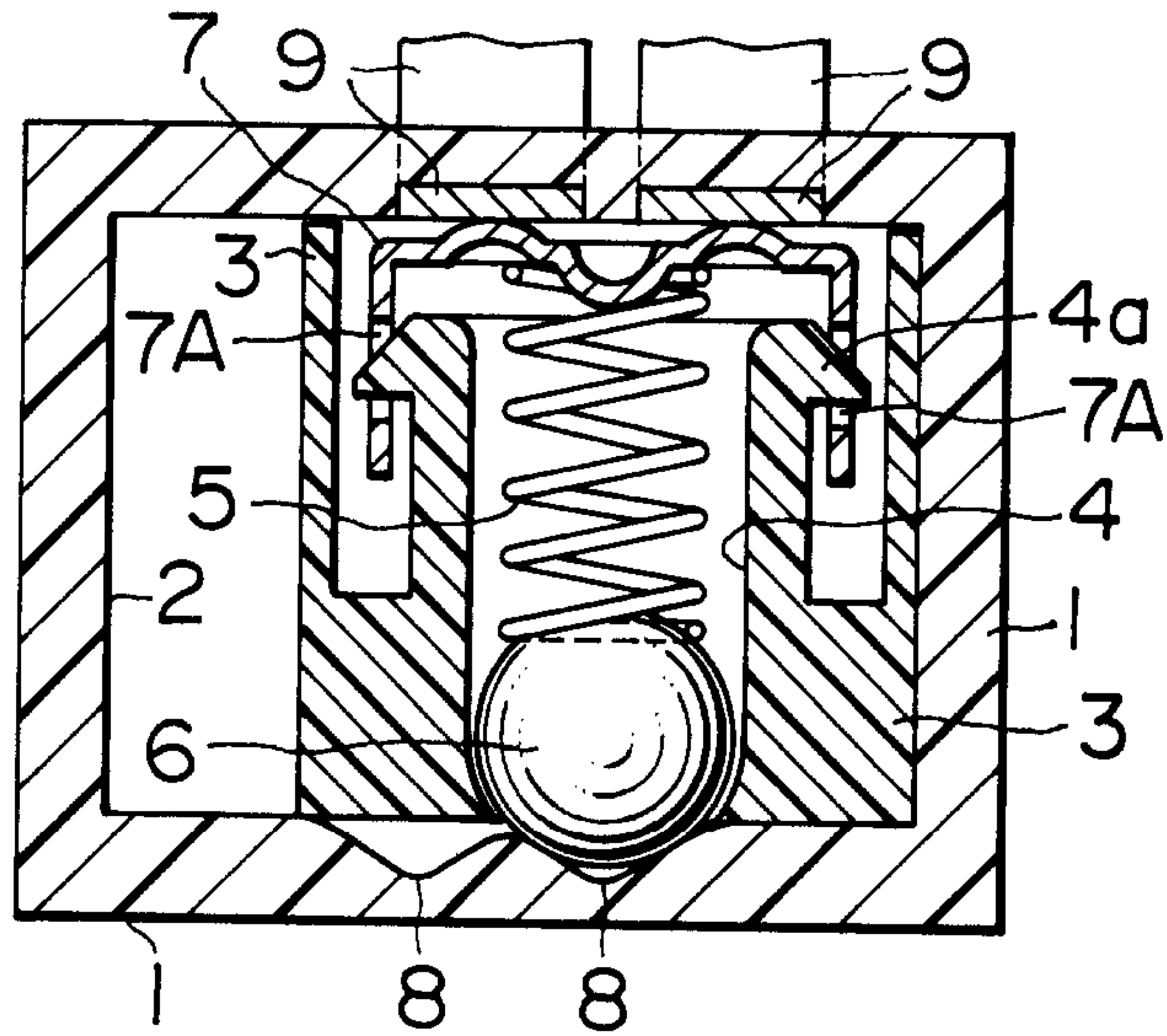


FIG. 20

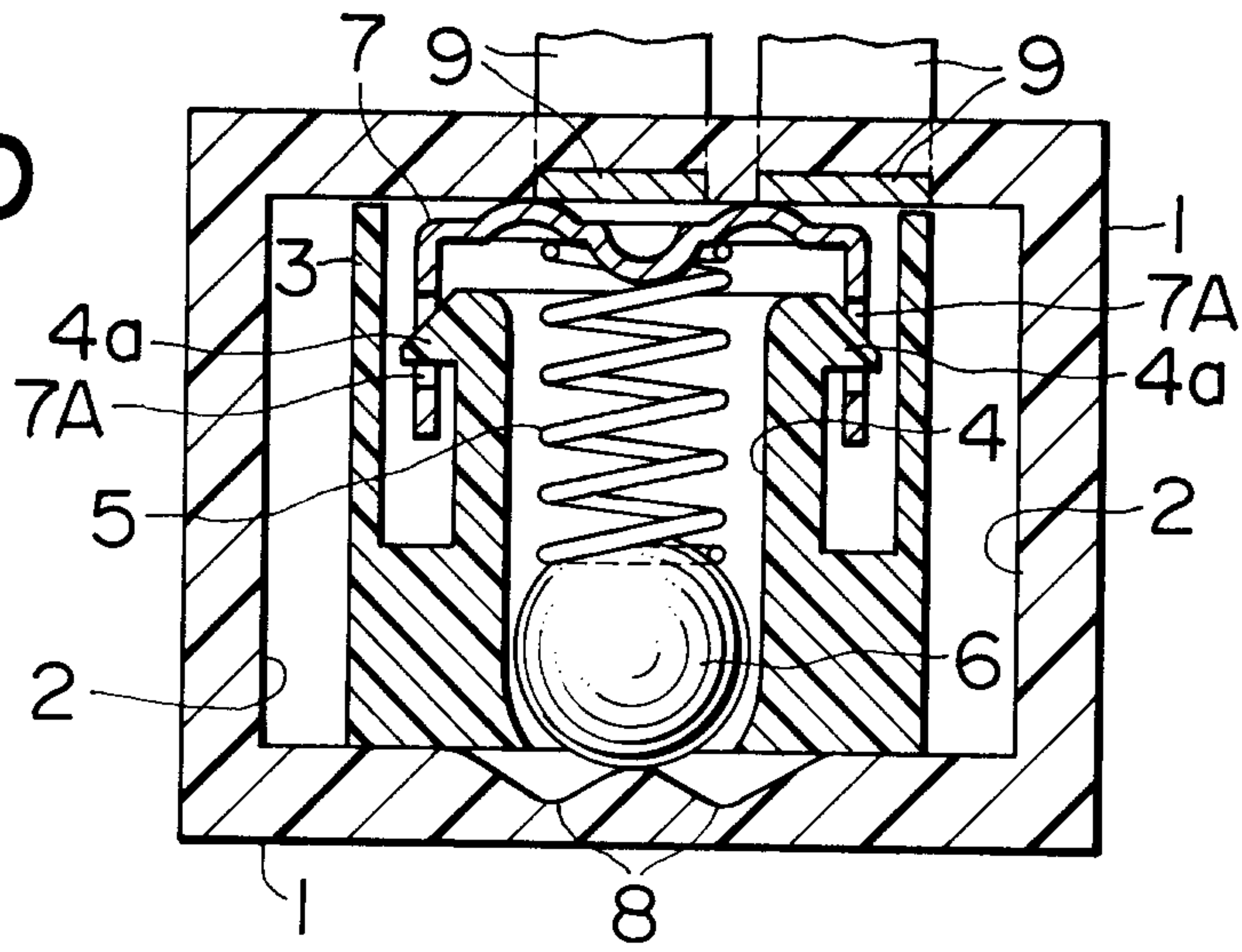
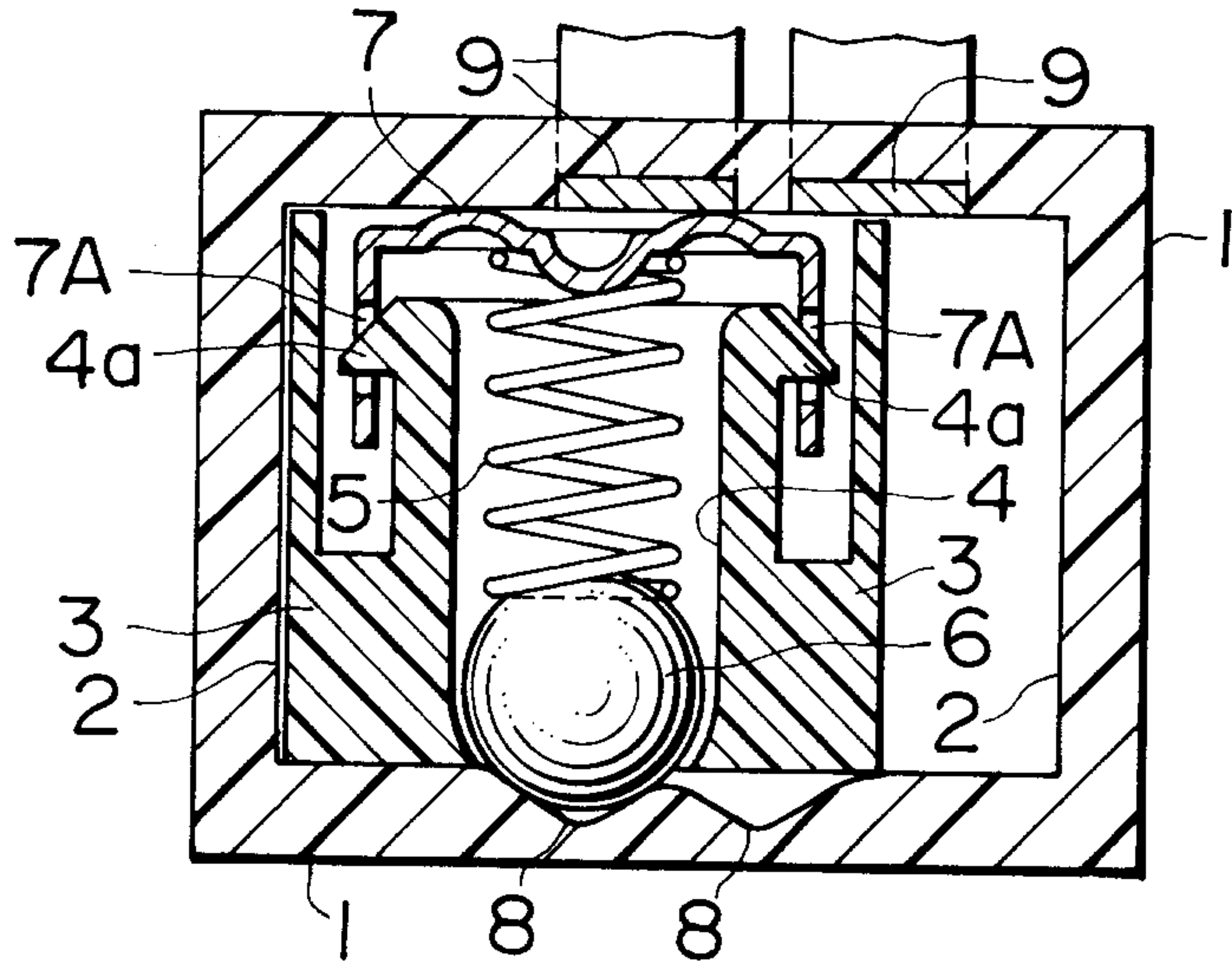


FIG. 21



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FIG. 22

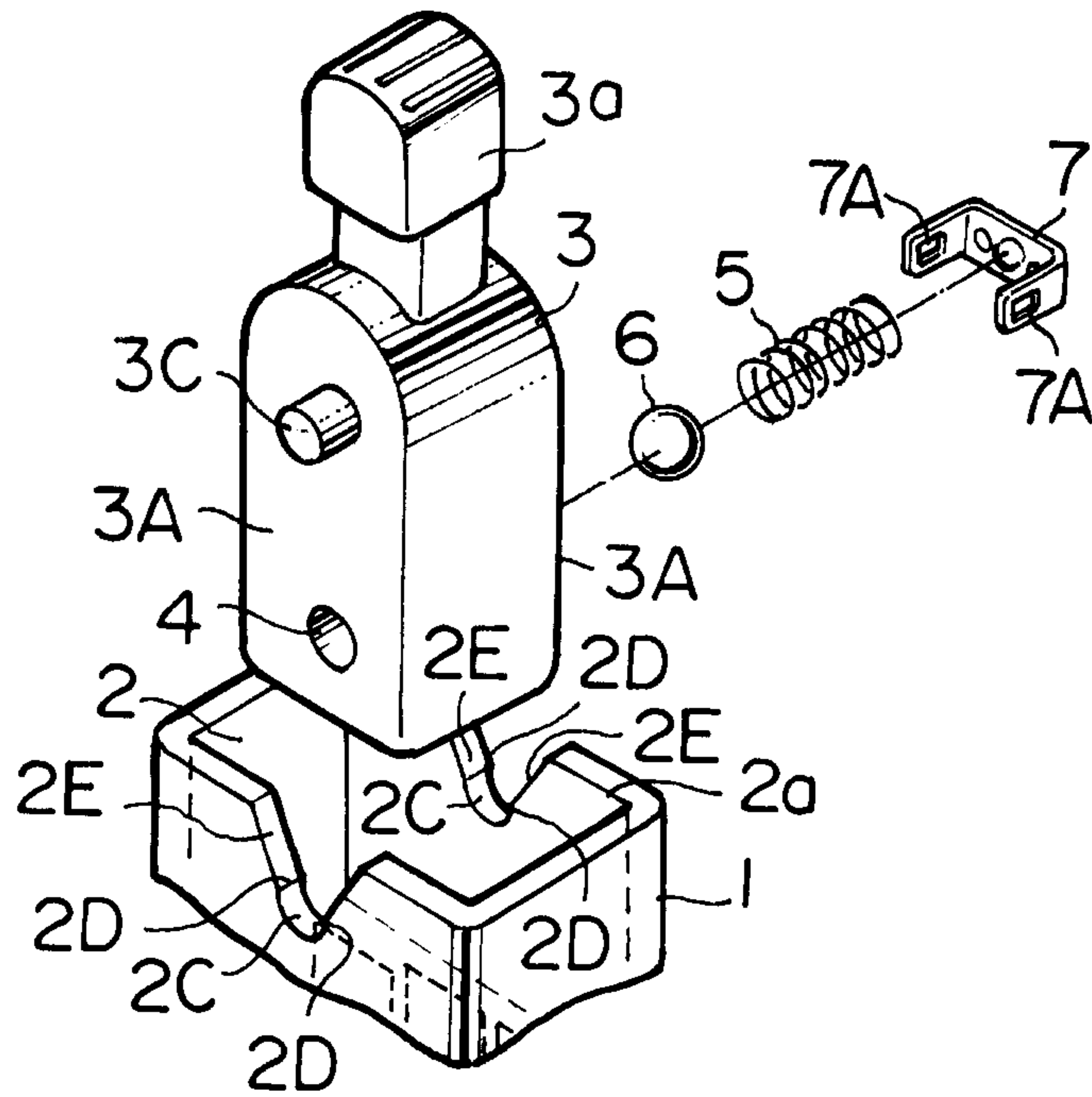
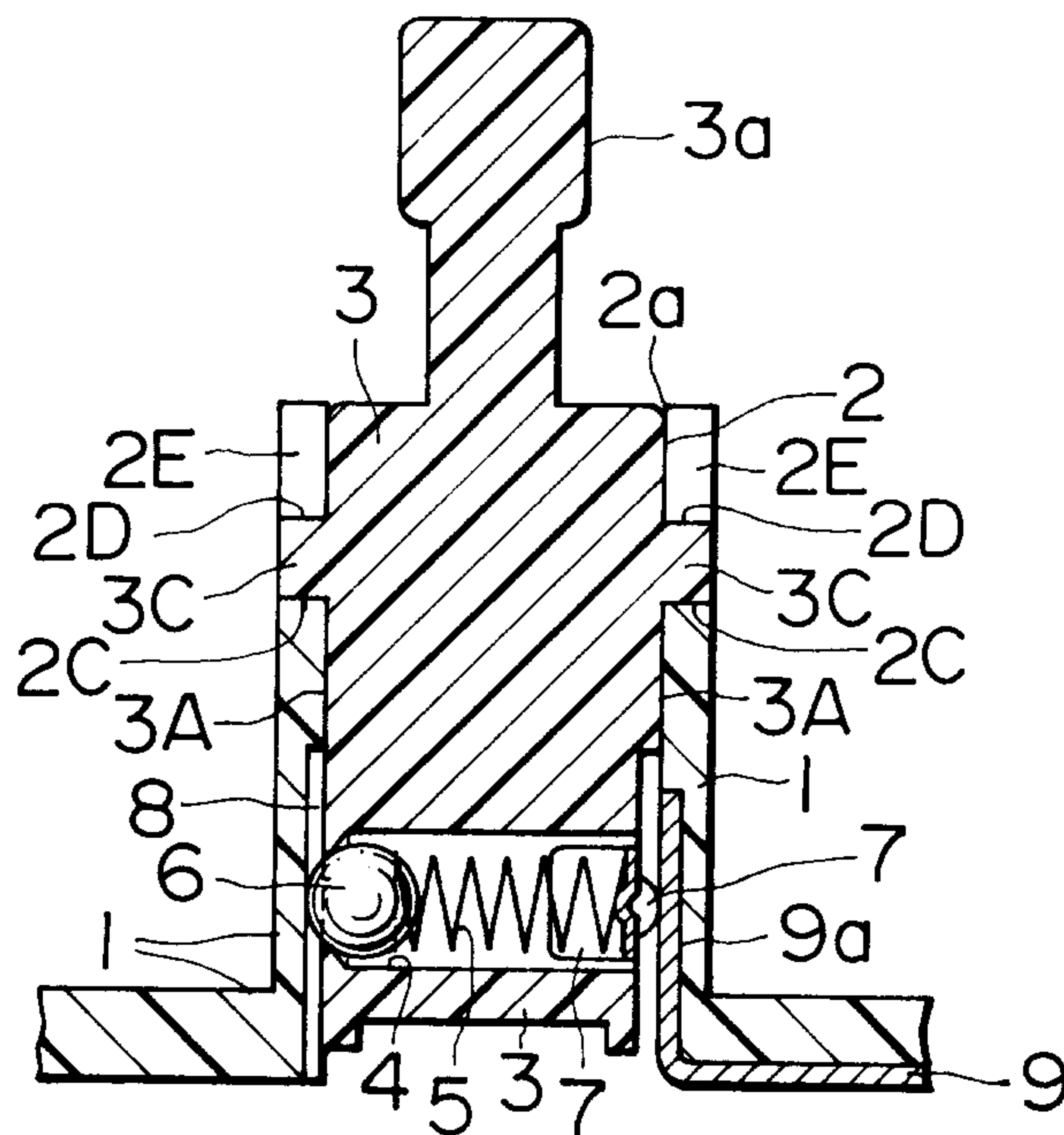


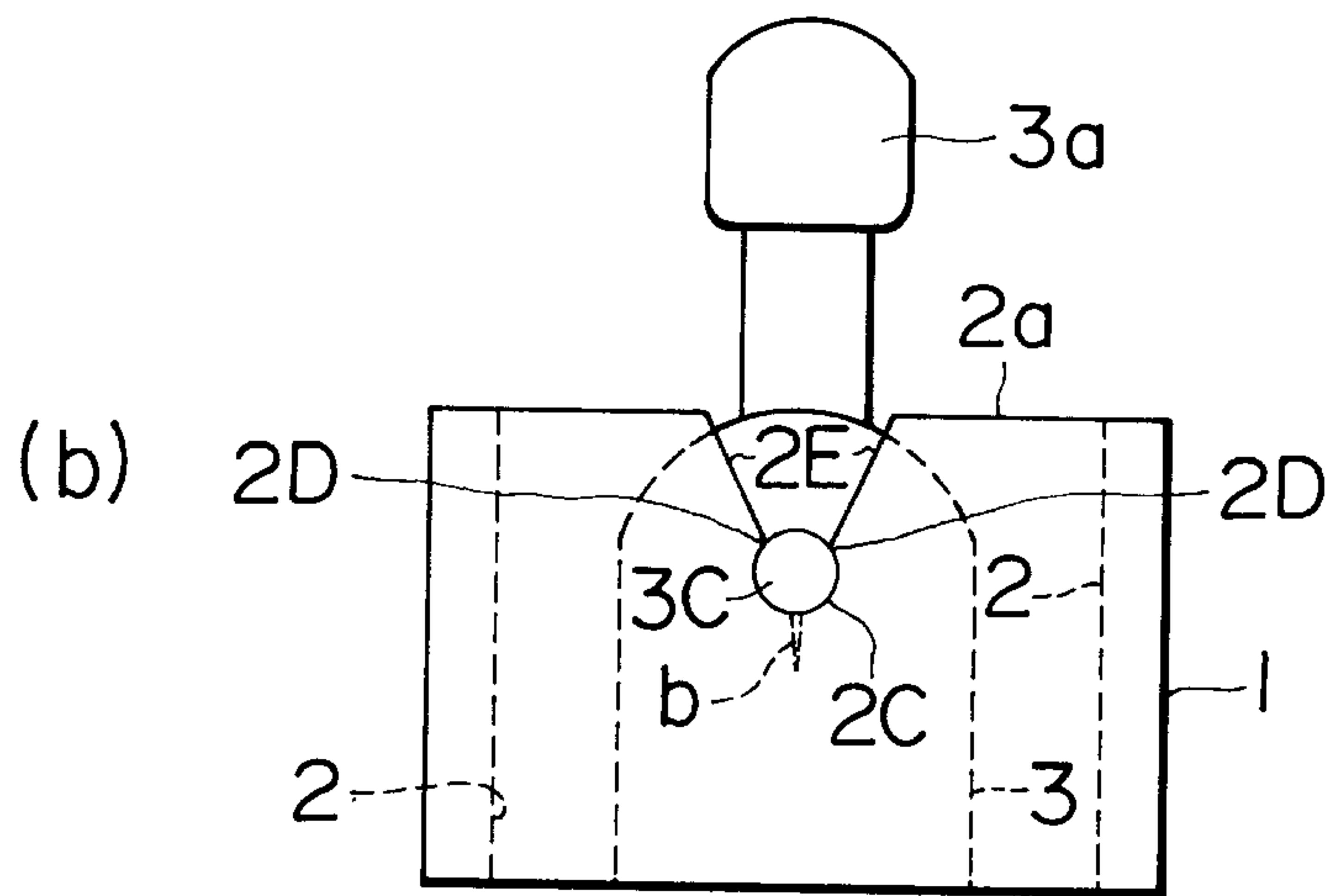
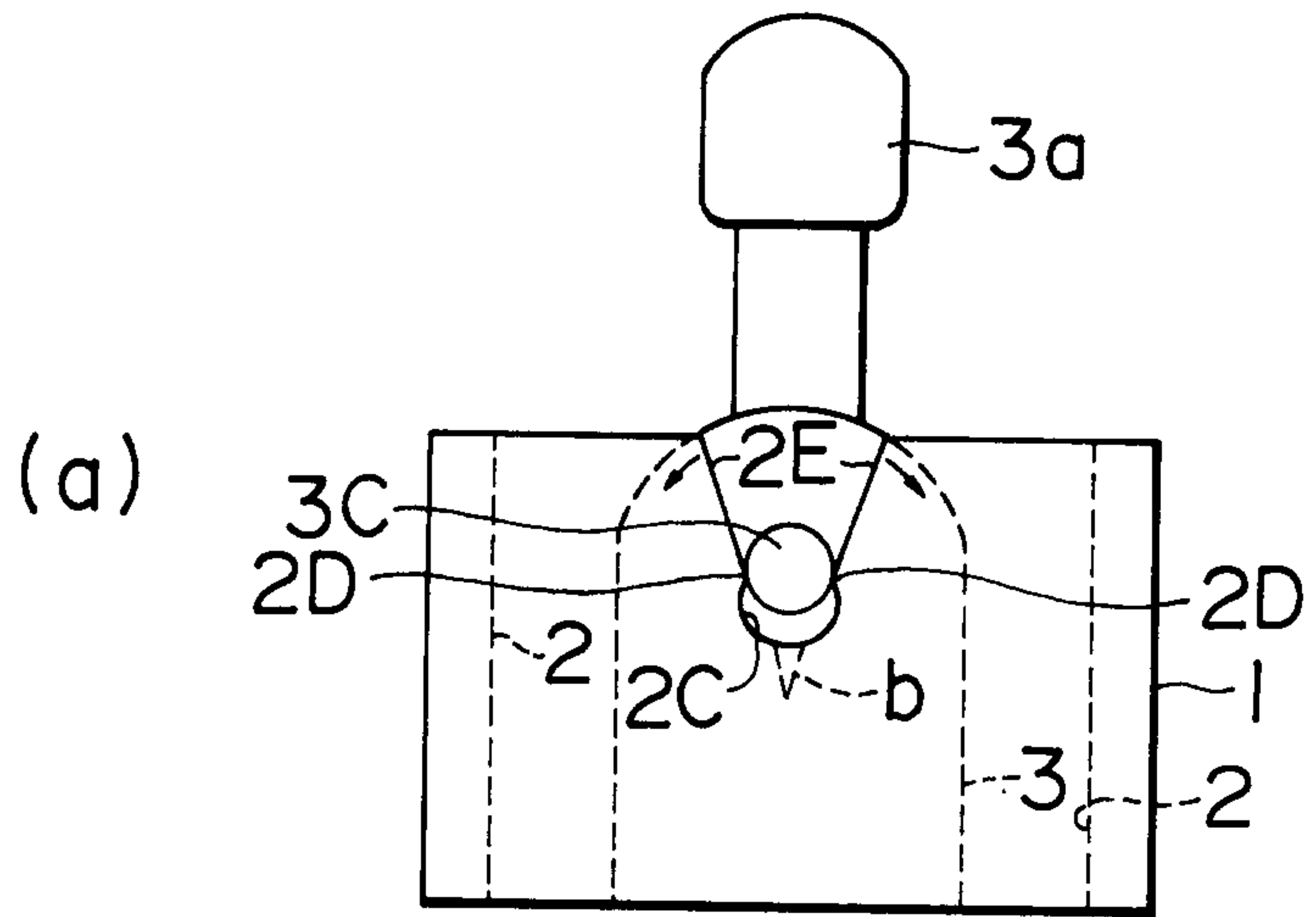
FIG. 24



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FIG. 23



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