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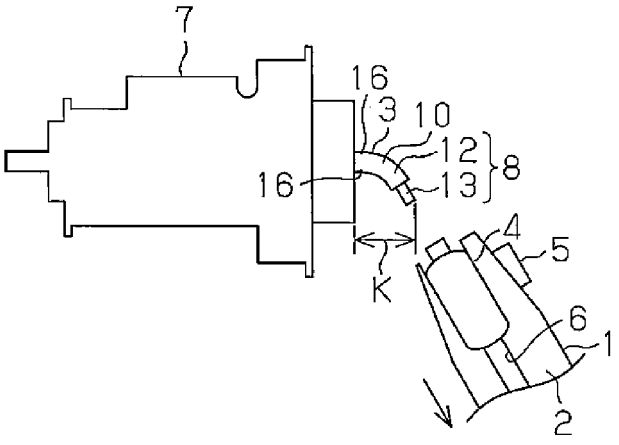
## (54) Mechanism for protecting vehicle occupant from key

(57) A mechanism that protects a vehicle occupant from a key when excessive load is applied to the key while obtaining sufficient strength for a key plate during normal usage. A support 4 pivotally couples a key plate 3 to a key case 2. The key plate 3 includes a basal end 8 fitted into and fixed to a key plate socket 9 in the support 4. The basal end 8 includes a thin portion 13 that is thinner than the key plate body 10 to facilitate separation of the key plate 3 from the support 4. The key plate body 10 includes two grooves 16 located proximal to the basal end to aid bending of the key plate 3. When a jackknife key is inserted into a key cylinder and a vehicle occupant hits and applies excessive load to the jackknife key, the key plate 3 first bends along the grooves 16 and the thin portion 13 then deforms 13 thereby separating the key plate 3 from the key case 2.

Fig.5(c)

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## Description

**[0001]** The present invention relates to a mechanism for protecting a vehicle occupant from a key that is inserted into a key cylinder when, for example, a collision occurs.

**[0002]** Japanese Laid-Open Utility Model Publication No. 61-80971 describes a jackknife type vehicle key including a key case and a key plate that may be folded into the key case. Since the jack knife key is formed to accommodate the key plate in the key case, the key case is enlarged, that is, the size of the jack knife key is increased. Thus, when the driver is driving a vehicle under a situation in which the jackknife key is inserted into the key cylinder that is located near the driver seat, precautions should be taken so that the jackknife key does not produce a strong impact when the driver's knee or the like hits the jackknife key. For example, a known structure includes grooves formed in opposite surfaces of the key plate. In this structure, the key plate breaks at the grooves to absorb the load applied to the key.

**[0003]** When forming grooves in the key plate as described above, the grooves serve to aid breakage of the key plate. However, the grooves also lower the strength of the key plate. Thus, there is a demand for a key that absorbs the load applied to the key when a vehicle occupant hits the key that is inserted in the key cylinder, while also obtaining sufficient strength for the key plate. Such a demand is not limited to jackknife keys and also applies to other types of keys.

**[0004]** It is an object of the present invention to provide a mechanism that protects a vehicle occupant from the key when excessive load is applied to the key, while ensuring sufficient strength for the key plate during normal usage.

**[0005]** One aspect of the present invention is a mechanism for protecting a vehicle occupant from a key when the key is inserted into a key cylinder of a vehicle. The key includes a key body and a key plate, and the key plate includes a key plate body and a basal end fixed to the key body. A separation mechanism is arranged in at least a portion of the basal end of the key plate. The separation mechanism is thinner than the key plate body.

**[0006]** In this structure, when the key is inserted into the key cylinder, for example, if a vehicle occupant hits the key and applies excessive load to the key, the separation mechanism separates the key plate from the key body so that only the key plate remains in the key cylinder. This reduces the impact produced when the vehicle occupant hits the key body and protects the vehicle occupant from the key body. Further, the key plate and the key body may be separated without forming grooves in the key plate. This obtains sufficient strength for the key plate during normal usage. In this manner, the mechanism protects a vehicle occupant from the key when the vehicle occupant hits the key, while ensuring sufficient strength for the key plate during normal usage.

**[0007]** Preferably, the separation mechanism includes a thin portion that is thinner than the key plate body and located at the basal end of the key plate. Vehicle occupant protection and sufficient key plate strength are both obtained with the simple structure of the thin portion.

**[0008]** Preferably, the key plate body includes a groove that aids bending of the key plate and is located proximal to the basal end of the key plate. In this structure, if an excessive load is applied to the key when, for example, a vehicle occupant hits the key that is inserted into the key cylinder, the key plate is first bent at where the groove is formed. After the key plate is bent, the key plate is separated from the key body. Thus, the key plate remaining in the key cylinder bends at the portion of the grooves. This reduces the projection amount from the key cylinder. Thus, subsequent to the separation of the key body, the key plate remaining in the key cylinder is not an obstacle.

**[0009]** Preferably, the thin portion includes a protrusion engaged with an engaged portion of the key body. In this structure, the protrusion is engaged with the engaged portion, which is located in the key body. This obtains sufficient coupling strength for the key plate.

**[0010]** Preferably, the protrusion is formed to deform and disengage from the engaged portion when load is applied to the key. In this structure, the application of excessive load to the key deforms only the key plate. This allows for smooth separation of the key plate from the key body.

**[0011]** Preferably, the mechanism is applied to a jackknife type key in which the key plate is pivotal about a pivot axis of the key body between a retracted position where the key plate is accommodated in the key body and a projected position where the key plate is projected from the key body. The jackknife key accommodates the key plate in the key body and thus has a relatively large size. Thus, when the vehicle is being driven, the knee of the like of a vehicle occupant (driver) may hit the jackknife key. The application of this mechanism to the jackknife key increases the effect for protecting the vehicle occupant when driving the vehicle even if a part of the vehicle occupant's body hits the jackknife key.

**[0012]** When the key is inserted into the key cylinder that is located near the driver seat of a vehicle, the present invention protects the vehicle occupant when excessive load is applied to the key, while obtaining sufficient strength for the key plate strength during normal usage.

**[0013]** Other aspects and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

**[0014]** The invention and referenced objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1A is a plan view showing a jackknife key when a key plate is located at a retracted position;

Fig. 1B is a plan view showing the jackknife key when the key plate is located at a projected position;
Fig. 2 is a side view of the jackknife key;
Fig. 3 is a cross-sectional view showing a basal end of a key plate;
Fig. 4 is a cross-sectional view taken along line II-II in Fig. 3;
Figs. 5A to 5C are diagrams showing how the key plate is separated from a key case when load is applied to the jackknife key that is inserted into a key cylinder; and
Fig. 6 is a partially enlarged view showing deformation at the basal end of the key plate that has been separated from the key case.

**[0015]** One embodiment of a mechanism for protecting a vehicle occupant from a key will now be described with reference to Figs. 1 to 6.

**[0016]** As shown in Figs. 1A and 1B, a jackknife key 1 (folding key) includes a key case 2, a key plate 3, and a support 4. The key case 2 serves as a handle of the jackknife key 1. The key plate 3 is flat and provided with grooves. The support 4, which is a generally U-shaped coupling, pivotally couples the key plate 3 to the key case 2. The key plate 3 is pivotal about an axis of the support 4 in the directions of arrows A shown in Fig. 1A. More specifically, the key plate 3 is pivotal by approximately 180 degrees in the clockwise direction from the position shown in Fig. 1A. The jackknife key 1 includes an operation button 5 arranged on the key case 2 and operated by the driver to pivot and project the key plate 3 out of the key case 2. The jackknife key 1 is one example of a key. The key case 2 and the support 4 form one example of a key body that is an element of the key.

**[0017]** As shown in Fig. 2, the key case 2 includes a key plate retainer 6, which is located in one side of the key case 2. The key plate retainer 6 is slit-shaped and accommodates the key plate 3. When the key plate 3 is accommodated in the key plate retainer 6, operation of the operation button 5 causes the urging force of an urging mechanism such as a spring in the key case 2 to pivot the key plate 3 and the support 4 by approximately 180 degrees about the axis of the support 4. This projects the key plate 3 out of the key case 2. When the key plate 3 is projected, the key plate 3 may be manually pivoted and folded in the opposite direction to return the key plate 3 to its original retraction position.

**[0018]** Referring to Figs. 3 and 4, the jackknife key 1 includes a vehicle occupant protection structure that protects a vehicle occupant from the jackknife key 1, for example, when the vehicle occupant strongly hits the jackknife key 1 that is inserted into a key cylinder 7 (refer to Fig. 1B), which is located near the driver seat. The vehicle occupant protection structure of the present example is formed so that the key plate 3 is separated from the key case 2 when the vehicle occupant strongly hits the jackknife 1. Further, the vehicle occupant protection structure is formed so that the projection amount K (refer to Fig. 5C) of the key plate 3 remaining in the key cylinder 7 after separation of the key case 2 is less than or equal to a specified amount. The key cylinder 7 is an ignition cylinder arranged near the driver seat in the passenger compartment.

**[0019]** Referring to Fig. 3, the support 4 includes a key plate socket 9. The key plate 3 includes a basal end 8, which is fitted into and fixed to the key plate socket 9, and a key plate body 10, which includes the grooves. The basal end 8 has a smaller width in the Y axis direction shown in Fig. 3 than the key plate body 10. A fastening pin 11 fixes the key plate 3, which is fitted into the key plate socket 9, to the support 4. The fastening pin 11 extends through the support 4 in the thicknesswise direction of the support 4 (Z axis direction in Fig. 3). The fastening pin 11 is one example of an engaged portion.

**[0020]** Referring to Fig. 4, the basal end 8 of the key plate 3 includes a seat 12 and a thin portion 13. The seat 12 is accommodated in the key plate socket 9 without forming any gaps with the key plate socket 9. The thin portion 13 is formed integrally with the seat 12 but has a thickness Wb that is less than that of the seat 12 (key plate body 10). The seat 12 is accommodated in the key plate socket 9 in close contact with the walls of the key plate socket 9, and the seat 12 has a thickness Wa that is equal to that of the key plate body 10. The thin portion 13 is located at the basal end of the key plate 3 to facilitate removal of the key plate 3 from the support 4. The axis of the thin portion 13 is aligned with the axis of the key plate body 10 (seat 12). The thin portion 13 is one example of a separation mechanism.

**[0021]** As shown in Figs. 3 and 4, the thin portion 13 includes a generally arcuate protrusion 14, which is engaged with the fastening pin 11. The protrusion 14 includes a generally circular recess 15, which is proximal to the seat 12. The seat 12 of the basal end 8 is fitted into the key plate socket 9 and the protrusion 14 is engaged with the fastening pin 11 to fix the key plate 3 to the support 4.

**[0022]** As shown in Fig. 4, the key plate 3 includes two grooves 16 formed in opposite surfaces of the key plate body 10 proximal the basal end 8 of the key plate body 10. The two grooves 16 aid the bending of the key plate 3. The grooves 16 each have a depth Wc that allows the key plate 3 to be bent but resists breakage of the key plate 3.

**[0023]** The operation of the vehicle occupant protection structure will now be described with reference to Figs. 5 and 6.

**[0024]** Referring to Fig. 5A, when the jackknife key 1 is inserted into the key cylinder 7, a predetermined load may be applied to the key case 2 from above. Referring to Fig. 5B, the load bends the key plate body 10 at the portion where the two grooves 16 are formed. Then, referring to Fig. 5C, the bending of the key plate body 10 deforms the thin portion 13 (protrusion 14). When the protrusion 14 is disengaged from the fastening pin 11, the key case 2 is separated from the key plate 3.

**[0025]** The Economic Commission for Europe (ECE) includes an internal protrusion restriction requirement to protect the driver. For example, when the jackknife key 1 is fitted into the key cylinder 7 located near the driver seat and a predetermined load is applied to the jackknife key 1, the ECE requires that the projection amount K of the key plate 3 remaining in the key cylinder 7 decrease to the specified value or less when the key plate 3 is broken. In the present example, when excessive load is applied to the key case 2, the key plate 3 is bent at where the grooves 16 are located. Thus, after the key case 2 is separated, the projection amount K of the key plate 3 remaining in the key cylinder 7 is decreased to less than or equal to the specified amount.

**[0026]** Fig. 6 shows the deformed shape of the thin portion 13 (protrusion 14) of the key plate after separation of the support 4. The load deforms the protrusion 14 at the tip of the thin portion 13 and disengages the protrusion 14 from the fastening pin 11. This separates the key case 2 that includes the support 4 from the key plate 3 and reduces the impact when the vehicle occupant hits the jackknife key 1.

**[0027]** The mechanism for protecting a vehicle occupant from a key in the present embodiment has the advantages described below.

(1) The basal end 8 of the key plate 3 fixed to the key plate socket 9 of the support 4 includes the thin portion 13 that is thinner than the key plate body 10. This facilitates separation of the key case 2, which includes the support 4, from the key plate 3. Thus, for example, if a vehicle occupant hits the jackknife key 1 when the jackknife key 1 is inserted into the key cylinder 7 and applies excessive load to the jackknife key 1, the thin portion 13 (protrusion 14) is deformed and disengaged from the fastening pin 11. The key case 2 is separated from the key plate 3 so that only the key plate 3 remains in the key cylinder 7. This reduces the impact produced when the vehicle occupant hits the jackknife key 1 and protects the vehicle occupant from the jackknife key 1. Further, deep grooves are not used to break the key plate 3 and separate the key case 2 from the key plate 3. This obtains sufficient strength for the key plate 3 during normal usage. In this manner, the mechanism for protecting a vehicle occupant from a key in the present embodiment protects a vehicle occupant while ensuring sufficient strength for the key plate 3.

(2) The basal end 8 of the key plate 3 includes the seat 12 and the thin portion 13, which is thinner than the seat 12. This facilitates the separation of the key case 2 from the key plate 3. Thus, vehicle occupant protection and sufficient strength of the key plate 3 are both obtained through the simple structure that decreases the thickness at a portion of the basal end 8 of the key plate 3.

(3) If an excessive load is applied to the jackknife key 1 when a vehicle occupant hits the jackknife key 1 that is inserted into the key cylinder 7, the key plate 3 is first bent at where the grooves 16 are formed. After the key plate 3 is bent, the thin portion 13 is deformed. This separates the key case 2 from the key plate 3. In this manner, the key plate 3 remaining in the key cylinder 7 is separated at the portion of the thin portion 13. This reduces the projection amount K from the key cylinder 7. Thus, subsequent to the separation of the key case 2, the key plate 3 remaining in the key cylinder 7 is not an obstacle. This also keeps the projection amount K of the key plate 3 remaining in the key cylinder 7 to less than or equal to the specified value and thereby satisfies the ECE requirement.

(4) The arcuate protrusion 14 at the basal end (thin portion 13) of the key plate 3 is engaged with the fastening pin 11 of the support 4. This keeps the key plate 3 engaged with the support 4 and obtains sufficient coupling strength for the key plate 3 and the support 4.

(5) When excessive load is applied to the jackknife key 1 that is inserted into the key cylinder 7, the shape of the fastening pin 11 remains the same. Only the thin portion 13 (protrusion 14) of the key plate 3 is deformed when the key plate 3 is separated from the support 4. This smoothly separates the key plate 3 and the support 4.

(6) The jackknife key 1 accommodates the key plate 3 in the key case 2 and thus has a relatively large size. Thus, when the vehicle is being driven, the knee of the like of a vehicle occupant (driver) may hit the jackknife key 1. By using the vehicle occupant protection structure of the present example for the jackknife key 1, the vehicle occupant may be protected from the relatively large jackknife key 1 when driving the vehicle even if a part of the vehicle occupant's body hits the jackknife key 1.

**[0028]** It should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit or scope of the invention. Particularly, it should be understood that the present invention may be embodied in the following forms.

**[0029]** In the above embodiment, voids are formed between the thin portion 13 and the walls of the key plate socket 9. Instead, the support 4 may include a thick portion that fills such voids.

**[0030]** The groove 16 may be formed in only one surface of the key plate 3. The grooves 16 may also be omitted.

**[0031]** The protrusion 14 does not have to be shaped as shown in the illustrated embodiment. The protrusion 14 may have any of a variety of shapes as long as the fastening pin 11 may be engaged.

**[0032]** The engaged portion is not limited to the fastening pin 11 and may be any member shaped to allow

for engagement with the protrusion 14.

**[0033]** The thin portion 13, for example, may occupy the entire basal end 8.

**[0034]** The fastening structure that engages the protrusion 14 of the key plate 3 with the fastening pin 11 of the support 4 may be omitted.

**[0035]** The separation mechanism may be located in the basal end 8 of the key plate 3 where the width is less than that of the key plate body 10.

**[0036]** A pivotal portion may be replaced by any of a variety of couplings other than the support 4.

**[0037]** The jackknife key 1 may be formed so that the operation for projecting the key plate 3 and the operation for retracting the key plate 3 are both performed manually.

**[0038]** The key does not have to be of a type (jackknife key 1) that pivots the key plate 3 when projecting and retracting the key plate 3 out of and into the key case 2. For example, the key may be of a type that linearly moves the key plate 3 back and forth when projecting and retracting the key plate 3 out of and into the key case 2.

**[0039]** The key does not have to be of a type that projects and retracts the key plate 3 out of and into the key case 2. For example, the key may be of a type in which the key plate 3 is accommodated beforehand in the key case 2 like a wireless key.

**[0040]** The present examples and embodiments are to be considered as illustrative and not restrictive.

**[0041]** A mechanism that protects a vehicle occupant from a key when excessive load is applied to the key while obtaining sufficient strength for a key plate during normal usage. A support 4 pivotally couples a key plate 3 to a key case 2. The key plate 3 includes a basal end 8 fitted into and fixed to a key plate socket 9 in the support 4. The basal end 8 includes a thin portion 13 that is thinner than the key plate body 10 to facilitate separation of the key plate 3 from the support 4. The key plate body 10 includes two grooves 16 located proximal to the basal end to aid bending of the key plate 3. When a jackknife key is inserted into a key cylinder and a vehicle occupant hits and applies excessive load to the jackknife key, the key plate 3 first bends along the grooves 16 and the thin portion 13 then deforms 13 thereby separating the key plate 3 from the key case 2.

## Claims

1. A mechanism for protecting a vehicle occupant from a key when the key is inserted into a key cylinder of a vehicle, wherein the key includes a key body (2, 4) and a key plate (3), and the key plate (3) includes a key plate body (10) and a basal end (8) fixed to the key body (2, 4), the mechanism being **characterized by:**

   a separation mechanism (13) arranged in at least a portion of the basal end (8) of the key plate, wherein the separation mechanism is thinner than the key plate body.

2. The mechanism according to claim 1, further being **characterized in that** the separation mechanism includes a thin portion (13) that is thinner than the key plate body and located at the basal end of the key plate.

3. The mechanism according to claim 1 or 2, **characterized in that** the key plate body includes a groove that aids bending of the key plate, wherein the groove is located proximal to the basal end of the key plate.

4. The mechanism according to claim 3, **characterized in that** the thin portion includes a protrusion (14) engaged with an engaged portion (11) of the key body (2, 4).

5. The mechanism according to claim 4, **characterized in that** the protrusion is formed to deform and disengage from the engaged portion when load is applied to the key.

6. The mechanism according to any one of claims 1 to 5, **characterized in that** the mechanism is applied to a jackknife type key in which the key plate is pivotal about a pivot axis of the key body between a retracted position where the key plate is accommodated in the key body and a projected position where the key plate is projected from the key body.

Fig.1 (a)

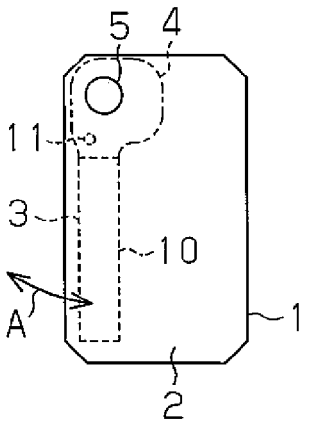



Fig.1 (b)

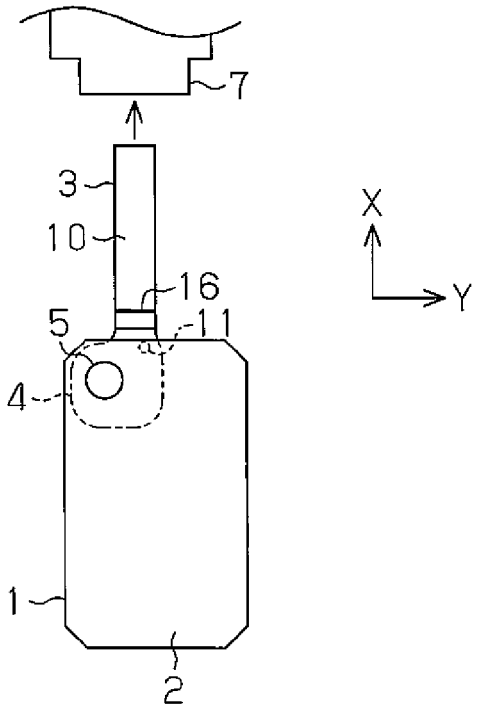
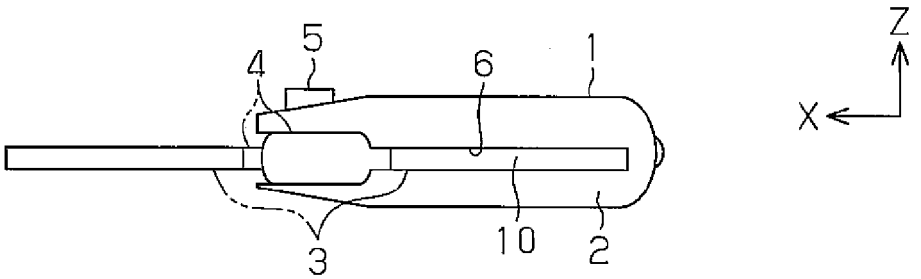
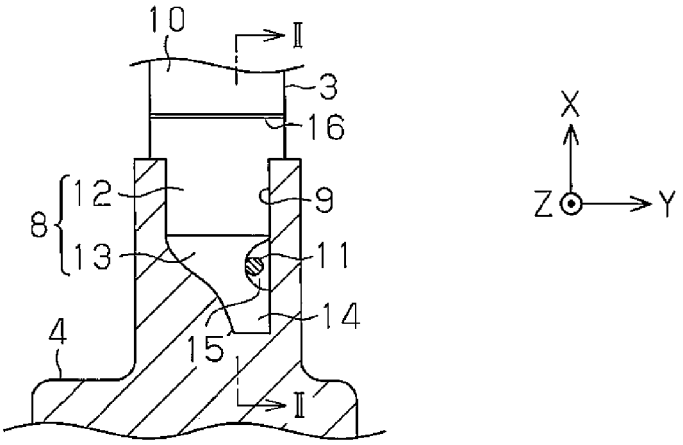



Fig.2



# Fig.3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II
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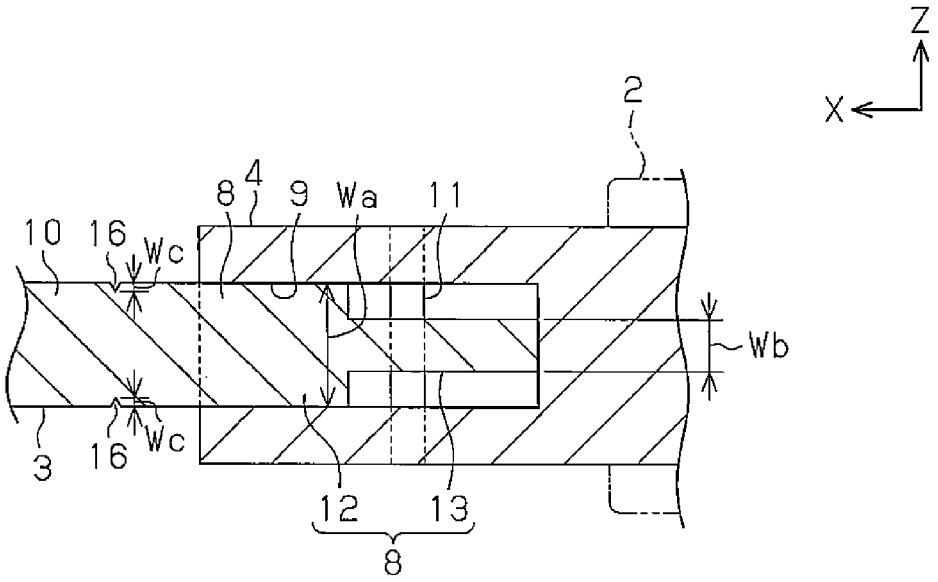
II
X
Z
Y

# Fig.4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8

Fig.5(a)

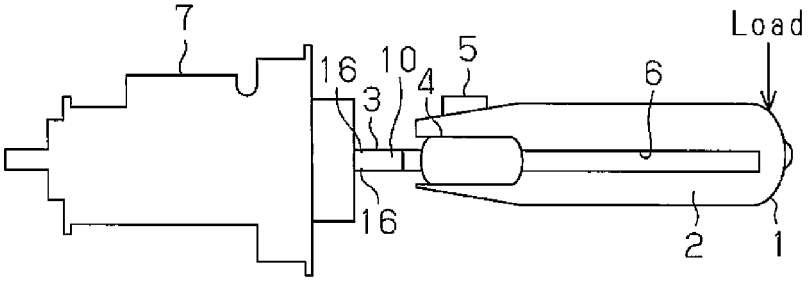



Fig.5(b)

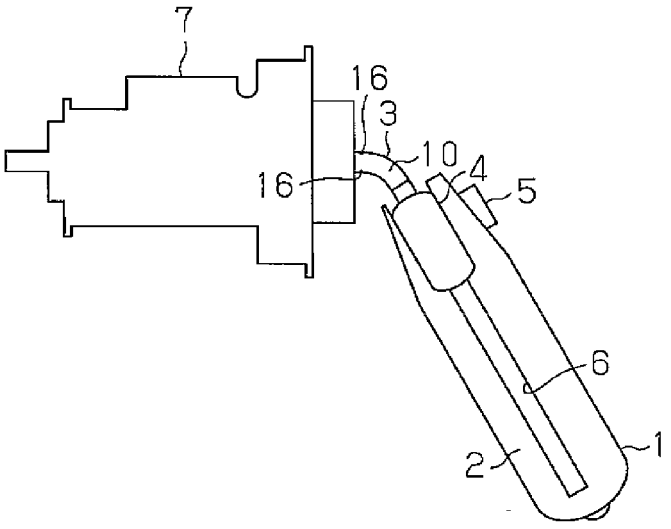



Fig.5(c)

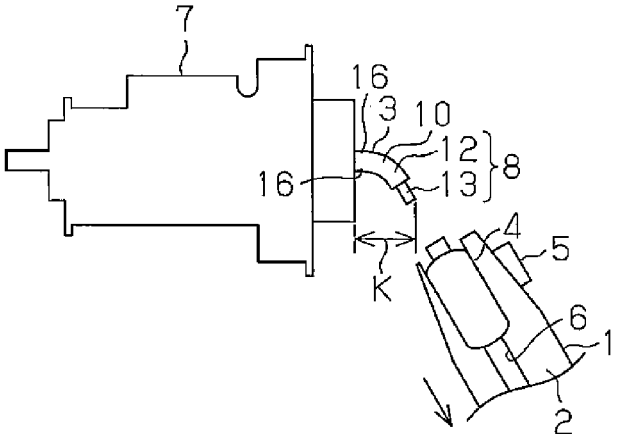
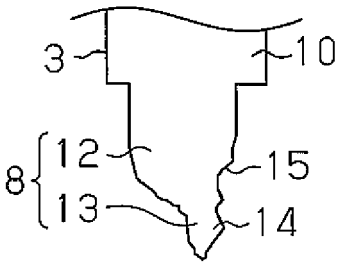


Fig.6



## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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