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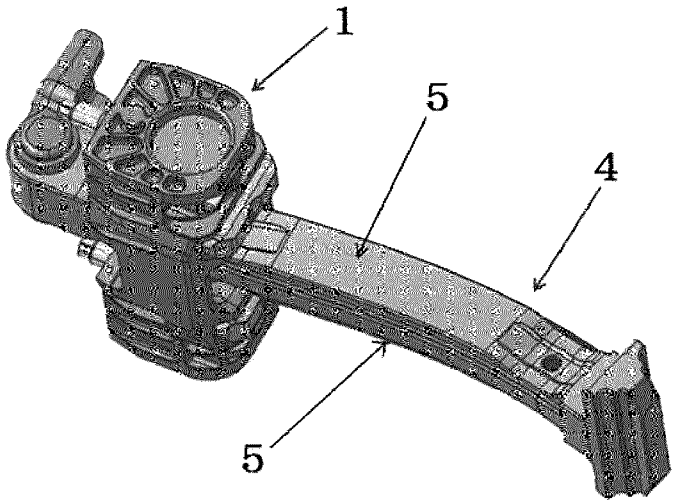
(54) Title: DOOR CHECK LINK DEVICE

[Fig. 1]



(57) Abstract: An object of the present invention is to provide a door check device that can hold a door at any position while having a simple structure that comprises minimum modification from the structure of a conventional door check device of check link arm type. It is also intended that, by changing the profile of the check link arm, desired changes in the opening/closing force during opening/closing the door are provided. The object is achieved by providing a high-friction part and a low-friction part on the slider surface of the check mechanism, and by dividing the surface of the check link arm into a zone where only the low-friction part slides and a zone where the high-friction part slides, it is possible to set a zone wherein the door can be hold at any desired positions. Depending on the profile to be set for the check link arm, it is possible to provide desired changes in the opening/closing force.

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Description

Title of Invention: DOOR CHECK LINK DEVICE

Technical Field

[0001] The present invention relates to a door check link device to define open positions of a door. More specifically, the present invention relates to a door check link device which enables to hold a door at positions of any degree of opening. The door check link device of the present invention is suitable for use in automobiles in particular, but can be used in any field as long as there is a door, such as vehicles, buildings, furniture, or home electric appliances.

Background Art

[0002] As a door check link device to define open positions of a door, there are such devices as those wherein opening/closing operation of the door is regulated at the door-hinge position, and those wherein checking operation is performed at a position close to the hinge by interaction between a link (check link arm) that is subjected to relative movement with the door in accordance with door's movement and a locking device (check mechanism) that has a pressing member to press the link.

Regarding automobile doors, a door is held at intermediate holding positions and fully-opened holding position by a check link device in order to prevent the door from being closed due to externally applied load such as wind, etc. In addition, during parking on a sloping road or on a curbstone, a door is opened and should be held in this intermediate open position, and therefore the following device has been known: the door can be held in an intermediate open position in addition to the fully-opened angle position, and the door can be moved from such holding positions upon application of a certain level or more of opening/closing force.

Citation List

Patent Literature

[0003] [Patent Literature 1] JP A No. 2010-156159

[Patent Literature 2] JP A No. 2009-508023

[Patent Literature 3] JP A No. 2010-95855

[Patent Literature 4] JP A No. 2011-117165

[Patent Literature 5] JP A No. 2006-291559

Summary of Invention

Technical Problem

[0004] However, with respect to conventional door check link devices, in addition to those disclosed in Patent Literatures 1 and 2, i.e., those wherein a door can be held at several predetermined intermediate positions, there are devices wherein a door can be held at

arbitrary positions, and the door can be moved from said arbitrary holding position upon application of more than a certain level of opening/closing force; and such devices include those disclosed in Patent Literatures 3 and 4 wherein a door can be held and opened at arbitrary positions by means of an operating lever, and those disclosed in Patent Literature 5 wherein a door can be held at arbitrary positions without any special operation, by continuously applying a pressing force to generate the holding force at any position, so that a large opening/closing force is required at entire range of opening/closing operation. However, there has been no device having a structure almost as simple as in usual check link devices, whereas an opened state of the door can be maintained at arbitrary positions without special operation, and more stable and ensured holding can be achieved at several predetermined intermediate positions and fully-closed position by generating a holding force and a pulling force, and wherein desired changes in the magnitude of opening/closing force sensed by a hand can be provided.

Therefore, a problem to be solved by the present invention is to provide a door check link device that has a simple structure almost similar to those disclosed in Patent Literature 1 or 2, wherein the door can be stably and firmly held at several intermediate positions, and also the door can be held at arbitrary positions within a certain open-position range, and changes in the magnitude of opening/closing force sensed by a hand can be realized.

Solution to the Problem

[0005] During the investigation to solve the above problem, the present inventors have focused attention on the fact that, by selecting a structure and material of a link arm and a slider that slides on the surface of the link arm in a door check link device, an ideal profile of opening/closing force in opening/closing a door can be arbitrarily set, and after further research, the inventors have accomplished the present invention.

Namely, the present invention relates to the following door check link device.

[0006] [1] A door check link device comprising a check link arm and a check mechanism, characterized in that the check mechanism comprises a slider that slides on the surface of the check link arm while pressing the surface, the sliding surface of the slider comprises a high-friction part with high frictional force and a low-friction part with low frictional force,

the sliding surface of the check link arm has a zone where the high-friction part slides, and a zone where the high-friction part does not slide but only the low-friction part slides.

[2] The device according to [1], wherein the zone of the check link arm where only the low-friction part slides is provided with an avoidance part along the longitudinal direction of the check link arm in order to avoid contact with the high-friction part.

[3] The device according to [1] or [2], wherein the zone where only the low-friction part slides has an inclined part where the thickness of the check link arm changes along the longitudinal direction of the arm, a flat part, or the both parts.

[4] The device according to any one of [1] to [3], wherein the inclined part has a concave profile having a bottom part to hold a door that has been pulled in.

[5] The device according to any one of [1] to [4], wherein the check mechanism has the same structure at both sides of the check link arm, and the check link arm is plane-symmetrical with respect to shape and structure of its sliding surface.

[6] The device according to any one of [1] to [4], wherein the check link arm is not plane-symmetrical, and the zone where only the low-friction part slides is provided at only one side of the check link arm.

[7] The device according to any one of [1] to [6], having an elastic body as a means for generating pressing force to press the surface of the check link arm.

[8] The device according to any one of [1] to [7], wherein the door is for vehicles including automobiles, boats and ships and airplanes, buildings, furniture, or home electric appliances.

[9] The device according to any one of [1] to [8], wherein the check link arm is provided with a discharge hole.

[0007] The door check link device of the present invention comprises a check link arm, and a check mechanism with a built-in slider that presses the check link arm, wherein the check link arm is attached to either a door or a main body (such as a vehicle body) to which the door is attached via a hinge, in a rotatable manner around the rotational axis that is approximately parallel to the rotational axis of the hinge, and a housing of the check mechanism is fixed to the other part.

On the pressing surface of the pressing slider that is contained or assembled in the housing and that presses the surface of the check link arm, a part with high coefficient of friction (COF) and a part with low-COF are provided. On the surface of the check link arm, two zones are provided: a zone where the part with high-COF can slide, and a zone where only the part with low-COF of the slider can slide by being provided with a concave part (avoidance part) to avoid the high-COF part; here, this concave part (such as a groove) is made in a direction parallel to the relative movement of the check link arm and the pressing slider, thereby avoiding contact with the part with high-COF; namely, this latter zone has an avoidance part.

[0008] In the profile of the arm viewed from a direction perpendicular to the longitudinal direction of the check link arm, two zones are provided: a flat zone where the part with high-COF of the pressing slider can slide, and a concave zone having a valley-like concave shape, the bottom of which serves as a predetermined holding position, and also having an inclined surface where only the part with low-COF can slide, i.e., a

profile-concave zone, wherein the slider can slide on this inclined surface while only its low-COF part is in contact with the surface.

When the slider slides on the inclined surface, due to its low-COF and the action between a pressing force of the pressing slider and an inclination of the inclined surface, the pulling force continue to generate until the slider reaches the valley bottom of the concave zone.

[0009] There may be another type of check link arm wherein the part where only the low-COF part of the pressing slider slides is not inclined, so that the entire check link arm has a flat shape. In this case, in order for the low-COF part alone to slide, a zone with a groove as an avoidance part is provided on the sliding surface of the flat check link arm. Since the sliding resistance of the slider differs largely between the zone where the low-COF part slides and the zone where the high-COF part slides due to a large difference in the frictional force, it is possible to make a door operator to feel that, when the slider reaches the zone with the avoidance part from the zone where the high-COF part slides, the resistance force suddenly disappears and the door is pulled in.

However, in this case, because the force to hold the door is hardly acting at the zone where only the low-COF part slides, this zone may be used for a state wherein the door is fully closed and kept in closed position by a door latch, or alternately, a profile-concave part may be further provided at the end of the flat part in order to hold the door.

[0010] By adopting the check link arm structure wherein combination of high-COF part and low-COF part and combination of inclined part and flat part are appropriately selected, it is possible to set desired door-holding positions, and to realize desired changes in the magnitude of opening/closing force sensed by a hand. For example, when the inclination is made steeper, then the pulling force can be strengthened.

[0011] Furthermore, it is also possible to make only one side of the arm to be a surface with the check link arm profile and make the other side to be flat, and to make the COF of the pressing slider that slides on the flat surface low. In this case, changes in the magnitude of opening/closing force sensed by a hand are produced by the pressing slider of one side.

[0012] Moreover, when the profile of one side of the check link arm is made to be flat, it is also possible to omit the pressing slider on this flat side, and to use this flat side only for guiding the check link arm, with the housing of the check mechanism, or a slider or roller which is separated from the check mechanism.

[0013] Moreover, the check link arm may be provided with one or more discharge holes for water or liquid discharge in order to facilitate discharge or drainage of liquid such as rainwater, leaked water, and leaked oil. When the holes are provided at the bottom of the avoidance part, discharge effect is strengthened.

Advantageous Effects of Invention

[0014] While the present invention has such a simple structure as comprising a check link arm and a check mechanism with a built-in pressing slider, the invention has the following effects: owning to the surface shape of the check link arm and structural characteristic of the pressing surface of the pressing slider, a pulling force toward a holding position or an arbitrary position is generated at intermediate positions of pre-determined degrees of door opening, fully-opened holding position, and near fully-closed positions are realized; and it is also possible to hold the door in an open state at arbitrary positions within a predetermined range (namely, holding in a non-step manner).

In this structure, as for the check link arm mounting and housing of the checking mechanism, those of conventional check link devices which do not have a function to hold a door at arbitrary positions (namely, a non-step-manner holding function) can be used, and therefore, improvement of the function of already-equipped check link devices is possible. In addition, because there is almost no difference in the shape, it is also possible to replace already-equipped check link devices.

[0015] In addition, since a concave part is provided for predetermined holding positions, even after the part with high-COF abrades away and the holding function at arbitrary positions deteriorates, the function as a usual check link device can be maintained.

Furthermore, by selecting an allocation of concave parts on the check link arm surface and inclination of the inclined surface, and by selecting a position of the flat part that is a door-holding part at arbitrary positions and thickness of the arm at the flat part, it is possible to produce desired distribution of pressing force of the pressing slider.

[0016] Furthermore, even with the same check mechanism, different pulling forces and holding forces can be obtained by combined use of a check link arm having a different profile; therefore, for example, for heavier doors, a check link arm having a profile with higher height may be used; thus, rationalization of production can be achieved.

[0017] By providing a discharge hole in a check link arm, retention of excessive liquid such as rainwater, leaked water, leaked oil and attached oil can be avoided, and moreover, rapid discharge of washing liquid during car wash and oil wash, etc. can be achieved. Accordingly, it is appropriate to provide a discharge hole at the bottom of a flat part and avoidance part.

Brief Description of Drawings

[0018] [Fig. 1] Figure 1 is an overall sketch drawing of one example of the check link device of the present invention.

[Fig. 2] Figure 2 is a partially cutaway view of a locking device of one example of

the check link device of the present invention (only the link arm is a conventional one).

[Fig. 3] Figure 3 is a drawing of one example of a slider pressing surface of the check link device of the present invention.

[Fig. 4] Figure 4 is a drawing of one example of the check link arm of the present invention.

[Fig. 5] Figure 5 is an explanatory drawing of a part where the slider slides on the check link arm surface of the present invention.

[Fig. 6] Figure 6 is a drawing showing a sliding-surface profile of other example (not up-down symmetrical) of the check link arm of the present invention; Fig. 6-1 shows the upper surface, and Fig. 6-2 shows the lower surface.

[Fig. 7] Figure 7 shows a check link device of conventional technology, wherein it has one check position between fully-opened and fully-closed positions.

[Fig. 8] Figure 8 is a graph showing opening/closing force of a door of the device of conventional technology shown in Fig. 7; the vertical axis represents opening/closing force, and the horizontal axis represents opening angle.

[Fig. 9] Figure 9 is a graph showing opening/closing force of a door in the check link device of the present invention having 2 check positions of fully-opened and fully-closed states; the vertical axis represents opening/closing force, and the horizontal axis represents opening angle.

[Fig. 10] Figure 10 shows one example of a check link arm that does not have an inclined surface.

[Fig. 11] Figure 11 is a graph showing opening/closing force of a door in the device shown in Fig. 10; the vertical axis represents opening/closing force, and the horizontal axis represents opening angle.

Description of Embodiments

[0019] Figures 1 to 4 show one embodiment of the present invention. In these figures, a check mechanism (1) has a built-in pressing slider (2), and the pressing slider is pressed against the sliding surface (5) of a check link arm (4) by means of a biasing means (3) of a reaction force member such as spring, etc.

A locking device is fixed to a door (not shown), and the check link arm (4) is supported in a rotatable manner by a rotational axis (6) of the check link arm that is parallel to the axis of a door hinge, and the check link arm (4) also passes completely through the check mechanism (1). At the penetration part of the check mechanism (1), the check link arm (4) is pressed by the pressing slider (2) at its upper and lower sliding surfaces (5). When the door is subjected to opening/closing operation, the check link arm (4) undergoes relative movement with the check mechanism (1) while the surface of the upper and lower pressing sliders (2) slide on the arm's upper/lower

sliding surfaces (5).

[0020] As shown in Fig. 2, two pressing sliders (2) are provided to press the check link arm equally from the upper and lower directions by applying pressing force by the biasing means (3).

As shown in Fig. 3, on the pressing surface of the pressing slider (2), a high-friction part with high-COF (7) and a low-friction part with low-COF (8) are provided; as shown in Fig. 4, the sliding surface (5) of the check link arm (4) consists of, in its longitudinal-directional profile, a flat part (9) where the high-friction part (7) slides, and a profile-concave part (11) that has a groove (10) to avoid contacting the high-friction part (7) and that has a concave shape in the profile.

[0021] At one end of the check link arm (4), a hole (12) for the rotation-supporting axis is provided, and at the other end a stopper (13) to stop the door in the fully-opened state is provided; at the side closer to the rotation-supporting hole (12), there is provided a profile-concave part (11a) for checking the closed position at which pulling force is exerted when the door is in the fully closed position, and at the side closer to stopper, there is provided a profile-concave part (11b) for checking the door at opened positions. When a holding position is to be set at an intermediate position, it can be set by providing a profile-concave part, which has an inclined surface with a groove to avoid contacting the high-friction part, at any desired positions.

[0022] Referring to Fig. 5, the check mechanism (1) is fixed to the door (not shown) by a stud (14), and the rotational axis (6) of the check link arm is fixed to the body (not shown) via a bracket (15). It is preferable that the check link arm has up-down symmetrical sliding surfaces (5) and the locking device is up-down symmetrical, and that the upper and lower surfaces are pressed by the upper and lower pressing sliders (2). Reasons for this preference are as follows: since equal pressing forces generate against each other, no deviated stress is applied to the locking device or the door, and the check link arm is also pressed equally from both sides, so that unnecessary stress is not applied to the rotational axis (6) of the check link arm.

[0023] When this structure is adopted, the same components can be used for the pressing means of the slider (2) and check mechanism, which is preferred in terms of production efficiency and maintenance.

However, in the present invention, it is not essential that the check link arm is up-down symmetrical, and the invention may include the following examples: as shown in Figs. 6-1 and 6-2, a profile-concave part or a flat part in the profile is provided on both sides, but no avoidance part is provided on the other sliding surface, or although not shown in the figures, the entire profile of the surface without an avoidance part may be made to be flat.

[0024] Figure 7 is a drawing showing a door check device of conventional technology. No

avoidance part is provided in the check link arm and no high-friction part is provided in the slider. Figure 8 is a graph showing the relationship between the door opening angle and the door operating force in the conventional door check device shown in Fig. 7; the door operating forces C and D at a position different from the check positions are insufficiently small to hold the door.

In contrast to the above, Fig. 9 shows the relationship between the door opening angle and the door operating force in the door check device of the present invention (different from that in Fig. 7, this device does not have intermediate check positions), demonstrating that the door operating forces A and B are large enough to hold the door.

[0025] Figure 10 shows an example of a check link arm without an inclined surface. In this example, no pulling force is generated as shown in the graph of door opening/closing force of Fig. 11. However, due to the large changes in the opening/closing force, an operator would feel that the door is being pulled. There is almost no holding force at the flat part where only the low-friction part slides; however, since the door is held by a door latch when it is in the fully closed state, the rotational-axis side of the check link arm may be made as a flat part so that the door is held at arbitrary positions only, or alternately, multiple positions at which pulling force is felt may be provided. It is also possible to provide an inclined surface only at positions where holding force is expected.

[0026] In the case of automobiles, an appropriate value of operating forces at the high-friction part, i.e., A and B in Fig. 8, is approximately between 10 N (newton) and 25 N (newton) as an opening/closing operating load at a door grip knob (an operating part), which is a value that enables holding of the door with an appropriate force of not-too-light and not-too-heavy, even on a sloping road or under the influence of strong wind, etc. Compared to this value, the door operating forces at a position other than check positions in the conventional door check device, i.e., C and D, are smaller than A and B, indicating weaker effect of holding a door.

[0027] In Figs. 7 and 8, there are regions at which the door operating force reaches the opposite side of the horizontal axis, and these regions show that a pulling force is generated. These graphs show that even in the conventional technology, a pulling force is exerted; however, at positions other than these, sufficient holding force cannot be exerted, and therefore the ability to hold the door at arbitrary positions is absent.

[0028] The material of the sliding surface of the check link arm is preferably a nylon or the like material with good anti-friction characteristic and sliding characteristic, and the material of the sliding surface of the slider is, preferably, as the low-friction material, an engineering plastic material with good sliding characteristic such as polyacetal; and as the high-friction material, a material having high-COF and anti-attrition charac-

teristic, such as elastomeric or rubber series or sintered materials.

[0029] In addition, for the high-friction material part, when the design of a conventional slider is changed such that only the center part is made of a different material, then the same housing of the check mechanism as in the conventional slider can be used.

By replacing only the check link arm and slider, it can be used at locations of conventional check link devices; therefore, new designing is not required and functional improvement can be achieved by a simple process.

[0030] Here, as a means for fixing the bracket and the housing of the check mechanism at mounting positions, use of a stud is shown in the above examples; however, needless to say, any fixing means may be used such as welding, gluing, bolt/nut, rivet, etc. as long as it is a fixing means to exert necessary strength.

[0031] The door check link of the present invention can be used for a door of vehicles including automobiles, rail vehicles, boats and ships and airplanes, buildings, furniture, or home electric appliances or any other applications as far as there is a door.

Reference Signs List

[0032] 1: Check mechanism
2: Slider
3: Elastic device (spring, rubber, etc.)
4: Check link arm
5: Sliding surface
6: Check link arm rotational axis
7: High-friction part
8: Low-friction part
9: Flat part
10: Groove
11: Profile valley part
12: Axis hole
13: Stopper
14: Stud
15: Bracket
16: Discharge hole

Claims

[Claim 1] A door check device comprising a check link arm and a check mechanism, characterized in that the check mechanism comprises a slider that slides on the surface of the check link arm while pressing the surface, and the sliding surface of the slider comprises a high-friction part with high frictional force and a low-friction part with low frictional force, and the sliding surface of the check link arm has a zone where the high-friction part slides, and a zone where the high-friction part does not slide but only the low-friction part slides.

[Claim 2] The device according to Claim 1, wherein the zone of the check link arm where only the low-friction part slides is provided with an avoidance part along the longitudinal direction of the check link arm in order to avoid contact with the high-friction part.

[Claim 3] The device according to Claim 1 or 2, wherein the zone where only the low-friction part slides has an inclined part where the thickness of the check link arm changes along the longitudinal direction of the arm, a flat part, or the both parts.

[Claim 4] The device according to Claim 3, wherein the inclined part has a concave profile having a bottom part to hold the door that has been pulled in.

[Claim 5] The device according to any one of Claims 1 to 4, wherein the check mechanism has the same structure at both sides of the check link arm, and the check link arm is plane-symmetrical with respect to shape and structure of its sliding surface.

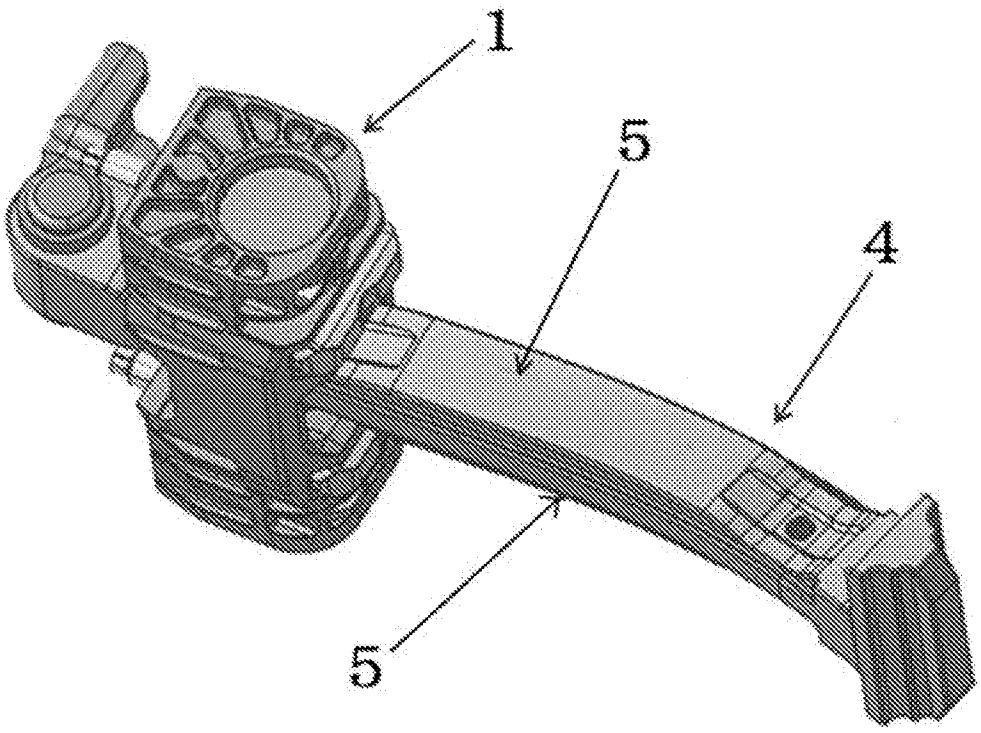
[Claim 6] The device according to any one of Claims 1 to 4, wherein the check link arm is not plane-symmetrical, and the zone where only the low-friction part slides is provided at only one side of the check link arm.

[Claim 7] The device according to any one of Claims 1 to 6, having an elastic body as a means for generating pressing force to press the surface of the check link arm.

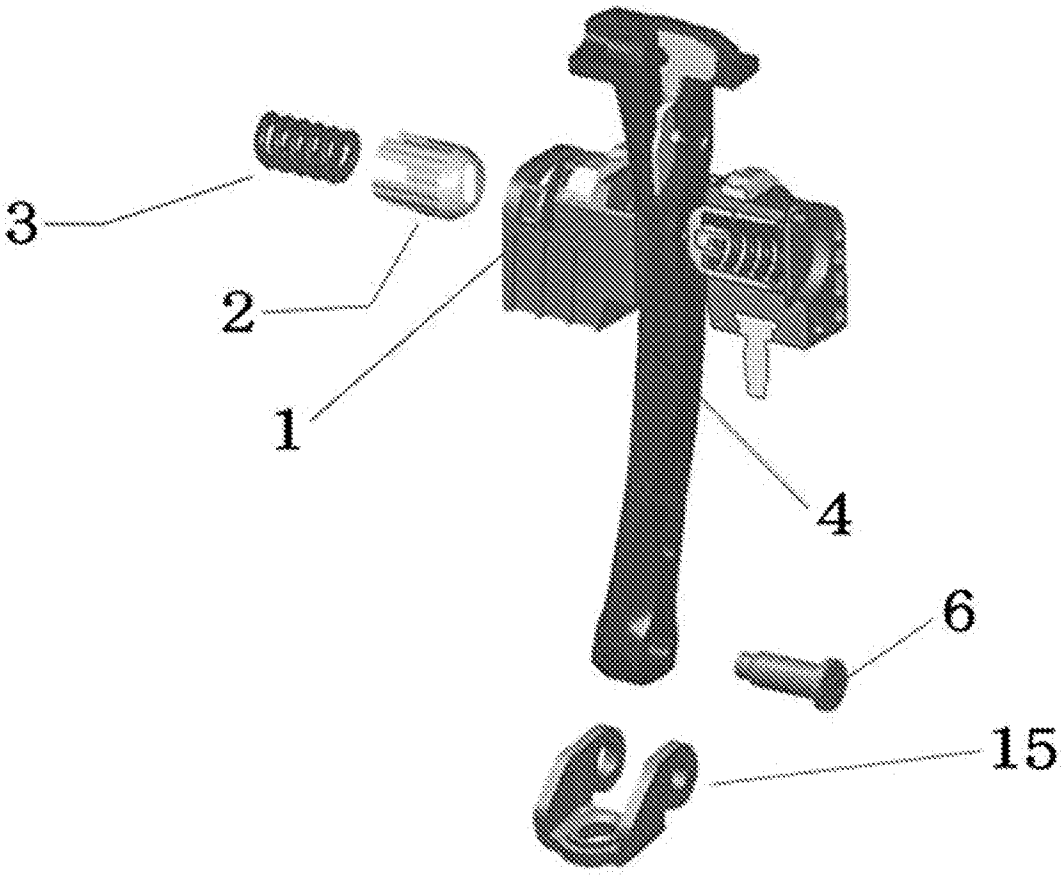
[Claim 8] The device according to any one of Claims 1 to 7, wherein the door is for vehicles including automobiles, boats and ships and airplanes, for buildings, for furniture, or for home electric appliances.

[Claim 9] The device according to any one of Claims 1 to 8, wherein the check link arm is provided with a discharge hole.

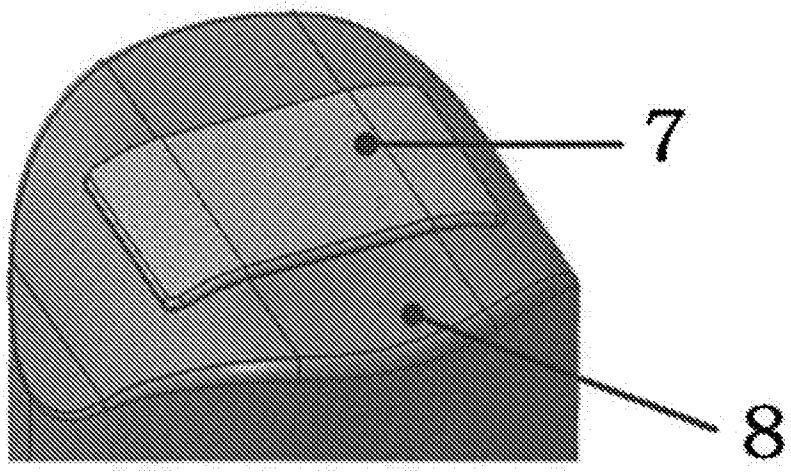
[Fig. 1]



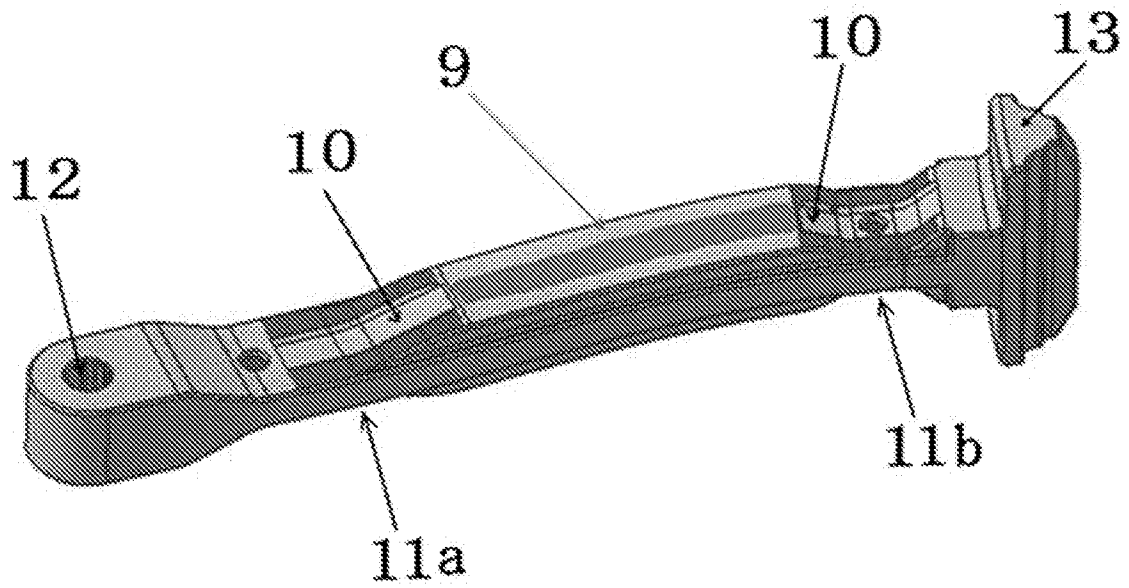
[Fig. 2]



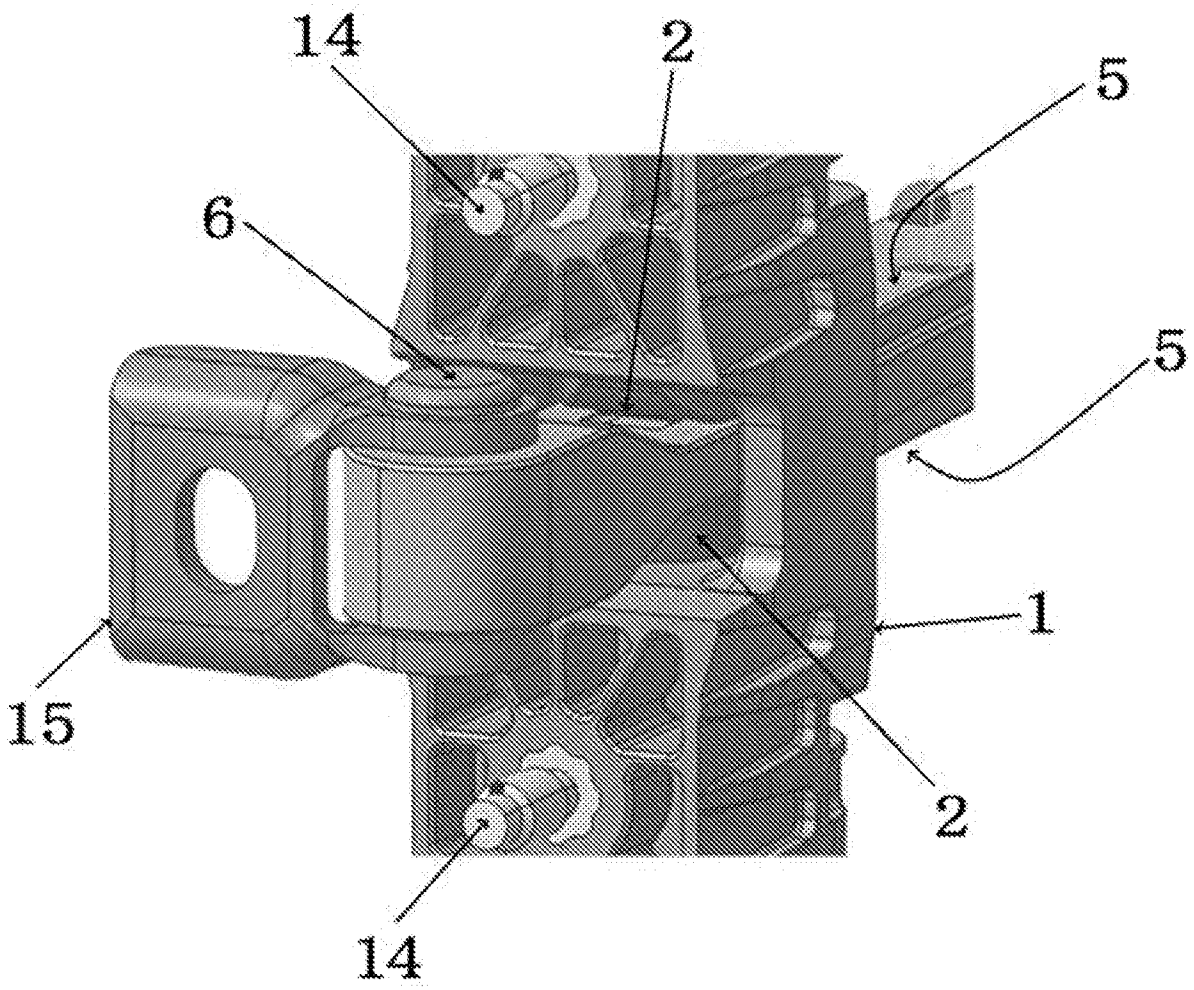
[Fig. 3]



[Fig. 4]



[Fig. 5]



[Fig. 6]

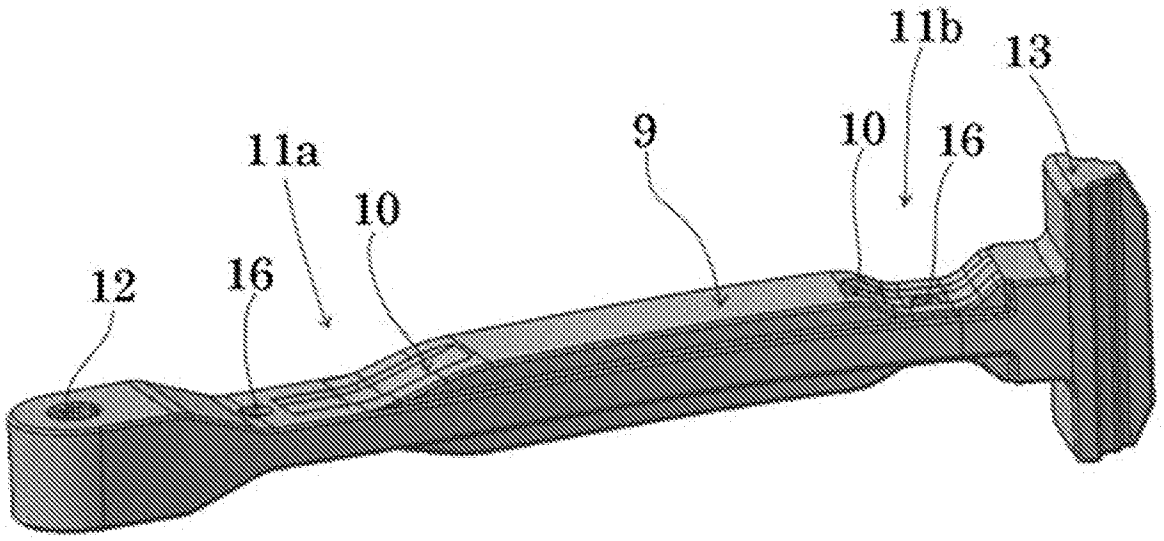


Fig. 6-1

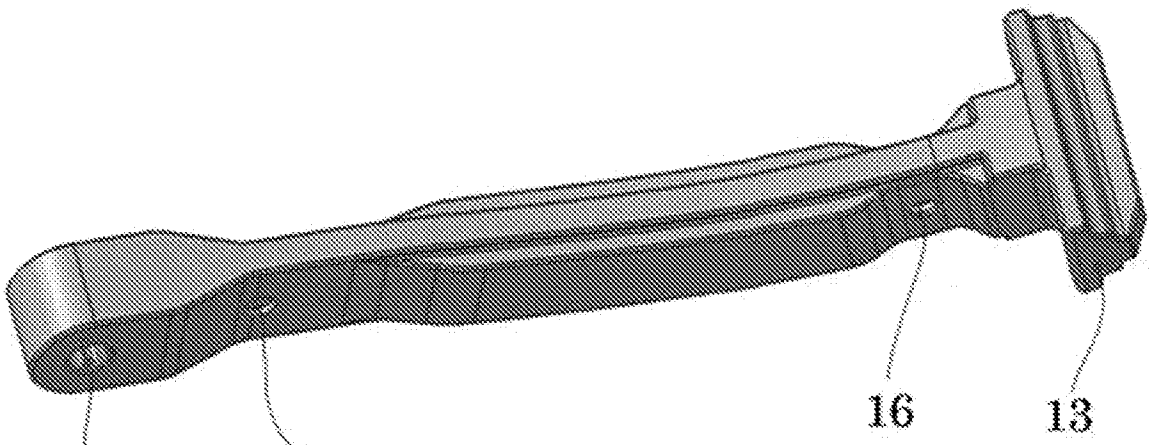
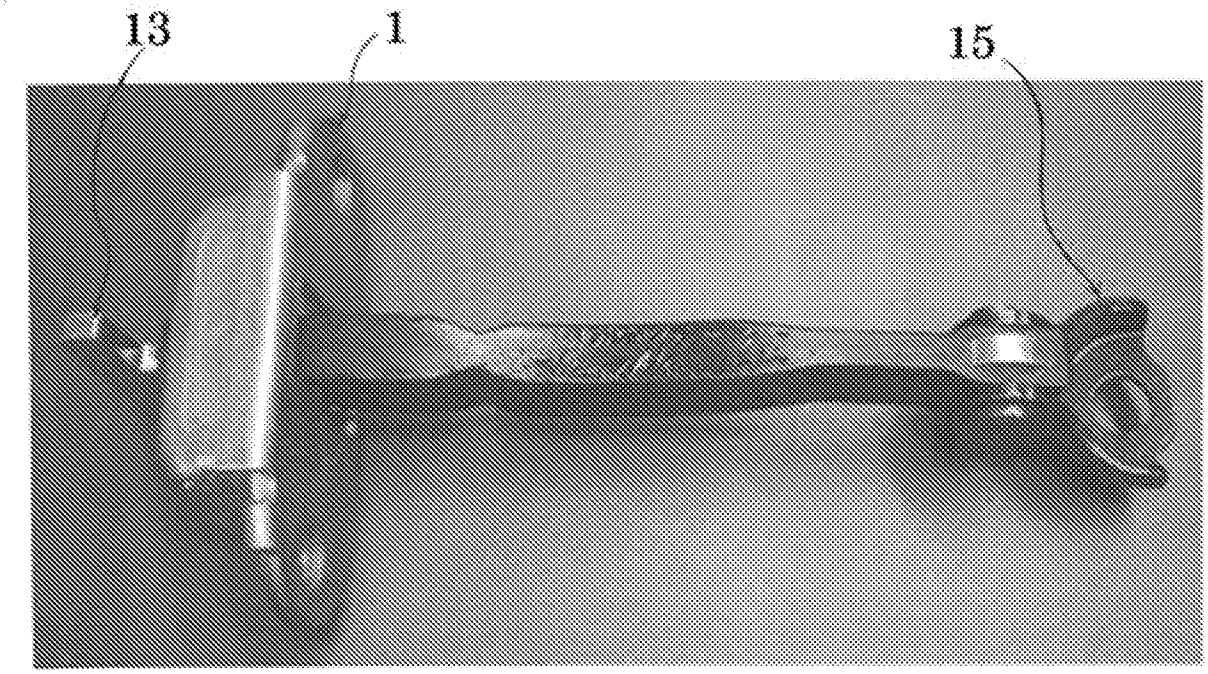
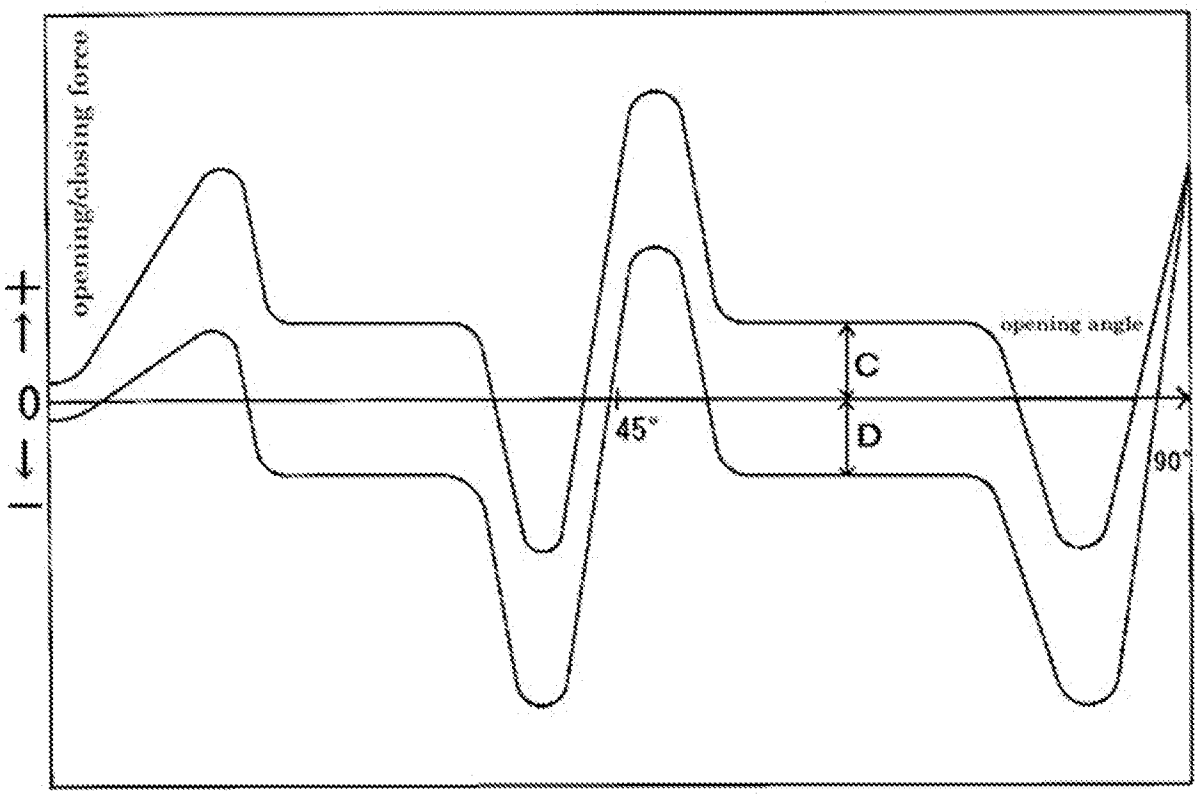


Fig. 6-2

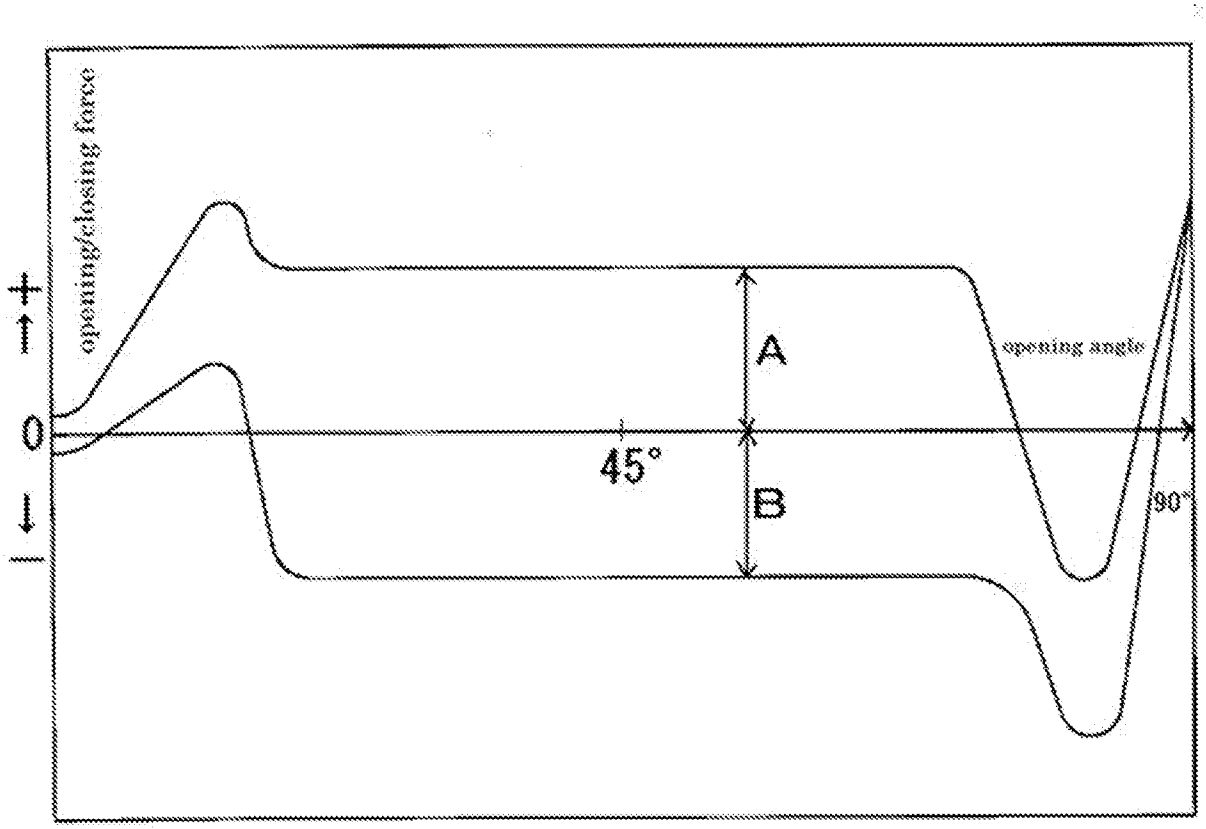
[Fig. 7]



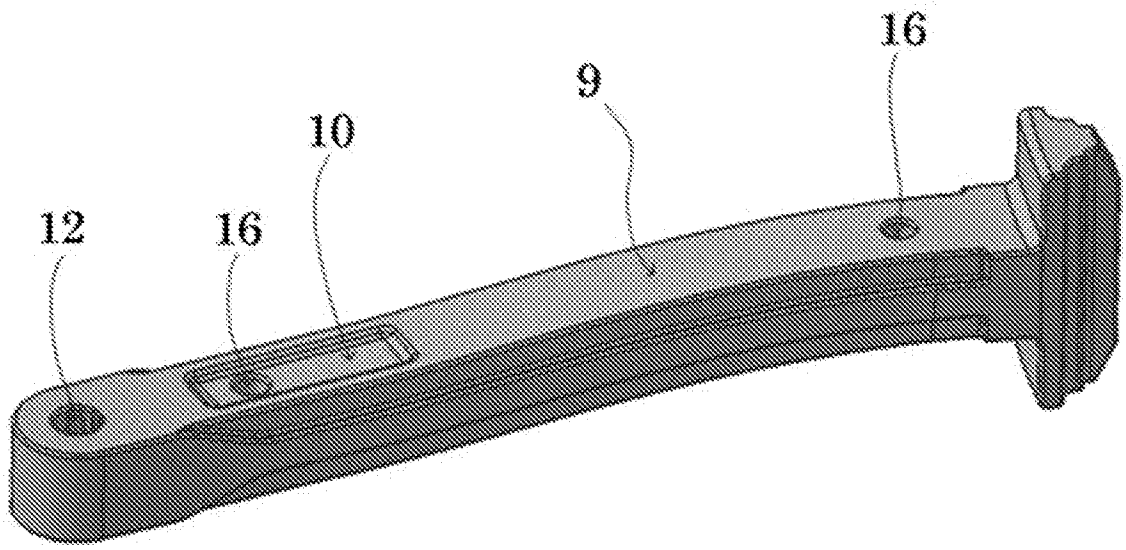
[Fig. 8]



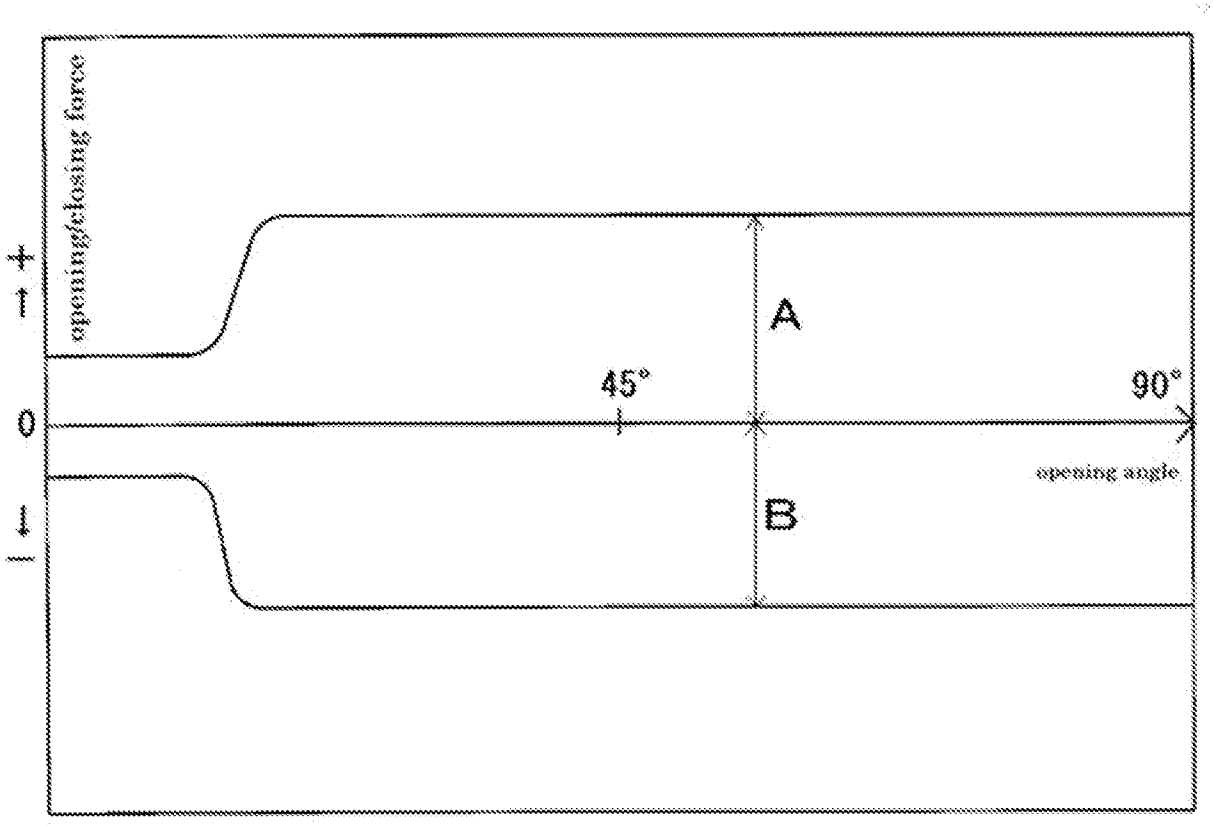
[Fig. 9]



[Fig. 10]



[Fig. 11]



INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2012/006593

A. CLASSIFICATION OF SUBJECT MATTER
INV. E05C17/20
ADD.

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)
E05C

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2004 100279 A (RIKEN KAKI KOGYO KK) 2 April 2004 (2004-04-02) paragraph [0019] - paragraph [0027]; figures 1-9	1,3-9
X	US 2004/251696 A1 (MURAYAMA YUJI [JP] ET AL) 16 December 2004 (2004-12-16) paragraphs [0030], [0034], [0035], [0038]; figures 1-9	1,3-9
A	US 2007/040392 A1 (MATSUKI KATSUHIRO [JP]) 22 February 2007 (2007-02-22) abstract; figures 1,2,3,6	7,9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 January 2013	18/02/2013

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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