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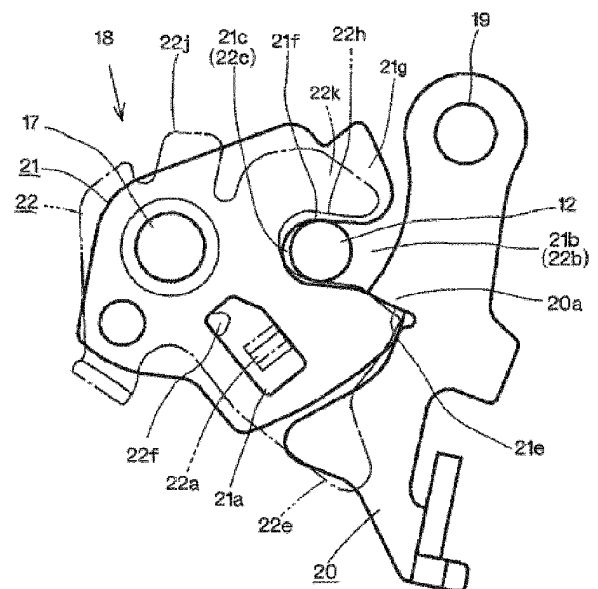
(54) **BONNET LATCH DEVICE**

(57) [The Technical Field]

The present invention relates to a latch device of a bonnet (engine cover), that is, to a bonnet latch device. In particular, the invention relates to a bonnet latch device having improved strength.

[The Summary of the Disclosure]

A bonnet latch device that engages a striker attached to a bonnet and closes the bonnet, the bonnet latch device including: a main latch that is attached to a vehicle body, rotates from an unlatched position to a latched position around a latch shaft, and engages the striker; a ratchet that is axially supported on a ratchet shaft, engages the main latch rotated from the unlatched position to the latched position, and holds the main latch to the latched position; and an antirattle latch that is energized by a spring to push the striker that engages the main latch in an unlatching direction, in which a ratchet retainer that overlaps the ratchet in a direction of a shaft center of the ratchet shaft is provided in the antirattle latch.



**FIG.3**

## Description

### Technical Field

**[0001]** The present invention relates to a latch device of a bonnet (engine cover), that is, to a bonnet latch device. In particular, the invention relates to a bonnet latch device having improved strength.

### Background Art

**[0002]** A conventional bonnet latch device includes a striker attached to a bonnet, and a latch unit attached to a vehicle body and meshing with the striker. The latch unit has: a latch that rotates from an unlatched position to a latched position against the energizing force of a latch spring when the latch contacts and engages the striker; and a ratchet that engages the latch having rotated to the latched position, to thereby hold the latch in the latched position. An engaging groove of the latch that engages the striker is formed slightly wider than the diameter of the striker. The purpose is to ensure that the striker smoothly engages the engaging groove of the latch.

**[0003]** JP Patent publication JP2-232487A discloses a bonnet latch device in which a pressing lever that pushes up a striker that engages a latch in an unlatching direction due to spring energization force and that presses the striker against the latch, is axially supported on the same shaft as the latch. In this configuration, the striker is pressed against the latch to eliminate the gap between the parts and to prevent rattling that occurs between the striker and the latch.

**[0004]** JP Patent publication JP2004-360416A discloses a bonnet latch device in which a latch and a ratchet are placed between a base plate and a cover plate, to prevent the ratchet from shifting in the direction of the shaft center of the ratchet and becoming disengaged from the latch.

**[0005]** JP Patent publication JP63-130881 discloses a bonnet latch device configured such that a part of a base plate is bent to prevent a ratchet from shifting in the direction of the shaft center of the ratchet. In this bonnet latch device, it is difficult to maintain the meshed state between the ratchet and the latch, when the ratchet shifts in the direction of the shaft center of the ratchet.

### Summary of Invention

### Technical Problem

**[0006]** Conventional bonnet latch devices have had many design problems. This is because unique members have been used to prevent rattling or to avoid disengagement of the latch and the ratchet.

### Solution to Problem

**[0007]** A bonnet latch device 10 of a first aspect of the present invention is bonnet latch device 10 that engages striker 12 attached to a bonnet and closes the bonnet, bonnet latch device 10 including: main latch 21 that is attached to a vehicle body, rotates from an unlatched position to a latched position around latch shaft 17, and engages striker 12; ratchet 20 that is axially supported on ratchet shaft 19, engages main latch 21 rotated from the unlatched position to the latched position, and holds the main latch to the latched position; and antirattle latch 22 that is energized by spring 23, 24 to push striker 12 engaged main latch 21 in an unlatching direction, in which ratchet retainer 22e that overlaps ratchet 20 in a direction of a shaft center of ratchet shaft 19 is provided in antirattle latch 22.

**[0008]** According to bonnet latch device 10 of a second aspect of the present invention, in bonnet latch device 10 of the first aspect, main latch-striker holder 21c that is wider than the diameter of striker 12 and that engages striker 12 is provided in main latch 21.

**[0009]** According to bonnet latch device 10 of a third aspect of the present invention, in bonnet latch device 10 of the first or second aspect, antirattle latch-holder 22c that is a groove surrounded by an U-shaped wall having a first wall and a second wall that are opposite to and face each other, and configured to engage striker 12 to hold striker 12 is provided in antirattle latch 22, and the first wall is pushing wall 22g that abuts on the striker 12 and pushes striker 12 in the unlatching direction, while the second wall is restriction wall 22h that restricts movement of striker 12 in the unlatching direction.

**[0010]** bonnet latch device 10 of a fourth aspect of the present invention is bonnet latch device 10 that engages striker 12 attached to a bonnet and closes the bonnet, bonnet latch device 10 including: main latch 21 that is attached to a vehicle body, rotates from an unlatched position to a latched position around latch shaft 17, and engages striker 12; ratchet 20 that is axially supported on ratchet shaft 19, engages main latch 21 rotated from the unlatched position to the latched position, and holds main latch 21 to the latched position; and antirattle latch 22 that is energized by spring 23, 24 to push striker 12 engaged main latch 21 in an unlatching direction, in which: antirattle latch-holder 22c that is a groove surrounded by an U-shaped wall having a first wall and a second wall that are opposite to and face each other, and configured to engage striker 12 to hold striker 12 is provided in antirattle latch 22; and the first wall is pushing wall 22g that abuts on striker 12 and pushes striker 12 in the unlatching direction, while the second wall is reinforcement wall 22h that restricts movement of striker 12 in the unlatching direction.

**[0011]** According to bonnet latch device 10 of a fifth aspect of the present invention, in bonnet latch device 10 of the fourth aspect, ratchet retainer 22e that overlaps ratchet 20 in a direction of a shaft center of ratchet shaft

19 is provided in antirattle latch 22.

**[0012]** According to bonnet latch device 10 of a sixth aspect of the present invention, in bonnet latch device 10 of any one of the first to fifth aspects, antirattle latch 22 is axially supported on latch shaft 17.

**[0013]** According to bonnet latch device 10 of a seventh aspect of the present invention, in bonnet latch device 10 of the sixth aspect, main latch 21 and antirattle latch 22 are connected so as to rotate in an interlocked manner with predetermined play 27 in between.

**[0014]** According to bonnet latch device 10 of an eighth aspect of the present invention, in bonnet latch device 10 of any one of the third to sixth aspects, antirattle latch 22 is axially supported on latch shaft 17, an upper structure 21g is provided in main latch 21, engaging wall 21f of main latch-striker holder 21c is formed in a side wall of upper structure 21g, upper structure 22k is provided in antirattle latch 22, reinforcement wall 22h is provided in a side wall of upper structure 22k, and upper structure 21g and upper structure 22k overlap one another in the direction of the shaft center of latch shaft 17.

#### Advantageous Effects of Invention

**[0015]** In the bonnet latch devices of the first and second aspects of the present invention, antirattle latch 22 that prevents rattling between main latch 21 and striker 12 can suppress displacement and deformation of ratchet 20 in the direction of the shaft center of ratchet shaft 19. Hence, a rational bonnet latch device can be achieved.

**[0016]** In the bonnet latch device of the third aspect of the present invention, antirattle latch 22 can reinforce and support engaging between main latch 21 and striker 12. Hence, a more balanced bonnet latch device can be achieved.

**[0017]** In the bonnet latch device of the fourth aspect of the present invention, antirattle latch 22 can reinforce and support main latch 21 that engages striker 12. Hence, a balanced bonnet latch device can be achieved.

**[0018]** In the bonnet latch device of the fifth aspect of the present invention, antirattle latch 22 can prevent displacement and deformation of ratchet 20 in the direction of the shaft center of ratchet shaft 19. Hence, a more balanced bonnet latch device can be achieved.

**[0019]** In the bonnet latch device of the sixth aspect of the present invention, main latch 21 and antirattle latch 22 are axially supported by the same shaft. Hence, antirattle latch 22 can reinforce the entire front side of main latch 21.

**[0020]** In the bonnet latch device of the seventh aspect of the present invention, main latch 21 and antirattle latch 22 are connected so as to rotate in an interlocked manner with predetermined play 27 in between. Hence, a strong effect can be assured.

**[0021]** In the bonnet latch device of the eighth aspect of the present invention, upper structure 21g and upper structure 22k overlap one another in the direction of the

shaft center of latch shaft 17. Hence, antirattle latch 22 can prevent displacement and deformation of main latch 21 in the direction of the shaft center of latch shaft 17.

**[0022]** The above and other objectives, characteristics, and advantages of this application will be made clear in the following detailed description by referring to the accompanying drawings that exemplify the application.

#### Brief Description of Drawings

##### **[0023]**

FIG. 1 is a front view of a bonnet latch device in an open state.

FIG. 2 is a rear view of the bonnet latch device from which front members are omitted.

FIG. 3 is a front view of a latch body and a ratchet in a closed state.

FIG. 4 is a front view of a main latch of the bonnet latch device.

FIG. 5 is a front view of an antirattle latch of the bonnet latch device.

FIG. 6 is a front view of the ratchet and an operation lever of the bonnet latch device.

FIG. 7 is a schematic view illustrating play between the main latch and the antirattle latch.

FIG. 8 is a schematic view illustrating a gap between a striker holder and a striker, in the main latch and the antirattle latch.

FIG. 9 is a schematic view illustrating movement of a torsion coil spring in a closed state.

FIG. 10 is a schematic view illustrating movement of the torsion coil spring in an open state (lift-up state).

FIG. 11 is a perspective view of an inclined plane of a base plate.

#### Description of Embodiments

**[0024]** An embodiment of the present invention will be described with reference to the drawings. FIG. 1 illustrates the front of bonnet latch device 10 of the embodiment. In many vehicles, an engine room is arranged in front of a vehicle compartment, and a typical bonnet (not shown) that covers the engine room has a rear end part (base end part) axially supported on the vehicle body by a hinge or the like. Bonnet latch device 10 includes latch unit 11 fixed to the front end of the vehicle body, and striker 12 fixed to a front end part (rotating end part) of the bonnet.

**[0025]** As illustrated in FIGs. 1 and 2, latch unit 11 includes metal base plate 13. Rectangular attachment holes 14 are formed on both right and left sides of base plate 13. Attachment holes 14 are formed sufficiently larger than shaft diameters of bolts 15 inserted thereto, and the attachment position of latch unit 11 is finely adjusted by utilizing play between holes 14 and bolts 15.

**[0026]** Vertical striker groove 16 having an open upper end is formed in the center of an upper part of base plate

13. As illustrated in FIG. 1, on both sides of striker groove 16, latch body 18 is axially supported by latch shaft 17 in a left part of base plate 13, and ratchet 20 is axially supported by ratchet shaft 19 in a right part of base plate 13. The shaft center of latch shaft 17 and the shaft center of ratchet shaft 19 are set parallel to each other.

**[0027]** Latch body 18 includes main latch 21 (refer to FIG. 4) and antirattle latch 22 (refer to FIG. 5). Main latch 21 and antirattle latch 22 are arranged in such a manner as to overlap one another in the direction of the shaft center of latch shaft 17. Main latch 21 and antirattle latch 22 rotate in a substantially interlocked manner, and are energized in the anticlockwise direction (unlatching direction) due to the energizing forces of first latch spring 23 (one example of a spring) and second latch spring 24 (one example of a spring). Ratchet 20 is energized in a latch-engaging direction (clockwise direction) by the energizing force of ratchet spring 25.

**[0028]** FIG. 1 illustrates an open state (unlatched state) of bonnet latch device 10. When the bonnet is closed, striker 12 moves downward, enters striker groove 16, and comes into contact with and engages latch body 18. With these series of operations, latch body 18 rotates in a latching direction (clockwise direction) against the energizing forces of first latch spring 23 and second latch spring 24.

**[0029]** Then, when latch body 18 reaches a latched position, ratchet 20 engages latch body 18 by the energizing force of ratchet spring 25, and maintains the closed state of the bonnet (striker 12). Note that sub latch 26 in FIG. 1 is illustrated on a traveling path of striker 12, and as will be mentioned later, comes into contact with striker 12 and is thereby pushed out to the side by striker 12. For this reason, sub latch 26 does not inhibit downward movement of striker 12.

**[0030]** Both of main latch 21 and antirattle latch 22 are axially supported on latch shaft 17. In the embodiment, main latch 21 is arranged between base plate 13 and antirattle latch 22.

**[0031]** A recess or opening 21a is formed in main latch 21, and protrusion 22a that protrudes into opening 21a is formed in antirattle latch 22 (refer to FIG. 7, for example). Opening 21a opens larger than protrusion 22a, in a rotating direction (circumferential direction) around latch shaft 17. Circumferential play 27 is set between opening 21a and protrusion 22a. With this setting, main latch 21 and antirattle latch 22 are connected so as to rotate in an interlocked manner with circumferential play 27 in between. Play 27 is used to prevent rattling that occurs between main latch 21 and striker 12. Prevention of rattling will be described later.

**[0032]** As illustrated in FIGs. 1, 3, 8, and other drawings, engaging groove 21b that engages striker 12 is formed in main latch 21, while engaging groove 22b that also engages striker 12 is formed in antirattle latch 22. Engaging groove 21b and engaging groove 22b are formed into similar shapes, and extend in radial directions of latch shaft 17. Striker holders 21c, 22c where both

walls (opposite walls) are substantially parallel to each other and formed into a U shape, are formed in parts that are on the deep end side of engaging groove 21b and engaging groove 22b and are close to latch shaft 17. In a closed state, striker 12 engages striker holders 21c, 22c on the deep end side. Striker holder 21c is one example of a main latch-holder, and striker holder 22c is one example of an antirattle latch-holder.

**[0033]** In bonnet latch device 10, the widths of striker holders 21c, 22c are formed about 0.5 mm to 1 mm wider than the diameter of striker 12, and gap 28 is formed between striker holders 21c, 22c and striker 12. Gap 28 is necessary for smoothly inserting striker 12 into and engaging striker holders 21c, 22c of metal main latch 21 and antirattle latch 22.

**[0034]** Flared clearances 21d, 22d are formed in parts of engaging groove 21b and engaging groove 22b that are separated from latch shaft 17.

**[0035]** Main latch 21 is arranged on the same plane as ratchet 20. Contact plane 21e with which claw 20a of ratchet 20 engages is formed in a side wall of clearance 21d of main latch 21. Ratchet retainer 22e that extends sideways from latch shaft 17 is formed in antirattle latch 22. Ratchet retainer 22e extends to a position where it overlaps ratchet 20 in the direction of the shaft center of ratchet shaft 19. Ratchet retainer 22e at least overlaps ratchet 20 in the closed state in FIG. 3, and preferably overlaps ratchet 20 in the open state in FIG. 1 as well.

**[0036]** Main latch 21 is arranged on the same plane as ratchet 20. Meanwhile, antirattle latch 22 is on a different rotating plane from ratchet 20, and does not engage ratchet 20.

**[0037]** When the bonnet or base plate 13 is deformed, for example, an external force in the direction of the shaft center of ratchet shaft 19 may be applied to ratchet 20. The external force in this direction acts as an external force that disengages claw 20a of ratchet 20 from contact plane 21e of main latch 21. However, since ratchet retainer 22e of antirattle latch 22 is arranged in an overlapping manner in the direction of the shaft center of ratchet shaft 19 on the front side of ratchet 20, the front side of ratchet 20 is protected and reinforced. Hence, the engagement between claw 20a of ratchet 20 and contact plane 21e of main latch 21 can be firmly maintained. Note that the rear side of ratchet 20 is protected and reinforced by base plate 13.

**[0038]** First latch spring 23 is preferably a cylindrical coil spring locked between antirattle latch 22 of latch body 18 and base plate 13. The energizing force of first latch spring 23 is transmitted to main latch 21 through contact between protrusion 22a and opening 21a.

**[0039]** Second latch spring 24 is preferably a torsion coil spring including a coil part 24a, first leg part 24b, and second leg part 24c. In the embodiment, the tip end side of first leg part 24b is brought into contact with side wall 13a of base plate 13, and the tip end of second leg part 24c is locked onto locking hole 22f of antirattle latch 22. Then, as in the case of first latch spring 23, the energizing

force of second latch spring 24 is transmitted to main latch 21 through the contact between protrusion 22a and opening 21a.

**[0040]** In the closed state illustrated in FIG. 3, claw 20a of ratchet 20 is in contact with contact plane 21e of main latch 21, and holds main latch 21 in the latched position. Ratchet 20 does not engage antirattle latch 22 arranged on a different rotating plane. For this reason, antirattle latch 22 can rotate independently in the unlatching direction (anticlockwise direction) due to the energizing forces of first latch spring 23 and second latch spring 24, by the amount of play 27 set between antirattle latch 22 and main latch 21. Pushing wall 22g (one example of a first wall) on the lower side of striker holder 22c of antirattle latch 22 having rotated independently comes into contact with a lower surface of striker 12, and pushes striker 12 in an opening direction. Striker 12 is pressed against the upper engaging wall 21f on the upper side of the striker holder 21c of main latch 21 by the movement of antirattle latch 22 and then striker 12 is sandwiched between engaging wall 21f and pushing wall 22g by the spring energization force. Accordingly, gap 28 which is about 0.5 mm to 1 mm and which is set between striker holders 21c, 22c and striker 12 is eliminated (or becomes narrow). As a result, rattling caused by gap 28 is effectively reduced.

**[0041]** In the closed state illustrated in FIG. 3, if striker 12 is pulled up in the opening direction with great force, engaging groove 21b (engaging wall 21f) of main latch 21 may deform and break, and may open the bonnet. Hence, in the embodiment, antirattle latch 22 also has a latch reinforcement function, in addition to both the rattling prevention function and the function of preventing the axial shifting of ratchet 20. Specifically, striker holder 22c is formed into a U shape, and its upper wall (one of the opposite walls) serves as reinforcement wall 22h (one example of a second wall) of engaging groove 21b (engaging wall 21f) of main latch 21.

**[0042]** In FIG. 3 illustrates the closed state, reinforcement wall 22h is shifted from engaging wall 21f by the amount of play 27, and is not arranged on the same plane. However, if engaging wall 21f deforms, reinforcement wall 22h immediately comes into contact with striker 12 to maintain the closed state. Thus, the reinforcement effect of reinforcement wall 22h is sufficient.

**[0043]** Antirattle latch 22 is axially supported on same latch shaft 17 as main latch 21, and covers the front side of main latch 21. For this reason, antirattle latch 22 also acts as a reinforcement member for preventing deformation of main latch 21 in the direction of the shaft center of latch shaft 17. In the embodiment, in particular, upper structure 22k that forms reinforcement wall 22h of antirattle latch 22 and lower structure 22m that forms pushing wall 22g of antirattle latch 22 are respectively arranged on the front side of upper structure 21g that forms engaging wall 21f of main latch 21 and lower structure 21h that forms contact plane 21e of main latch 21. Hence, antirattle latch 22 can favorably prevent deformation of

main latch 21 in the direction of the shaft center of latch shaft 17.

**[0044]** Ratchet 20 is preferably connected to operation lever 29 in the vehicle compartment, through connection wire 30 (refer to FIG. 6). When ratchet 20 is rotated anticlockwise by operation lever 29, in FIG. 3, claw 20a is disengaged from contact plane 21e of main latch 21, and latch body 18 rotates in the unlatching direction (anticlockwise direction) due to the energizing forces of first latch spring 23 and second latch spring 24. At this time, the rotary force of latch body 18 in the unlatching direction is basically proportional to the intensity of the energizing forces of first latch spring 23 and second latch spring 24. Hence, the degree of spring elasticity is adjusted according to the weight of the bonnet and other factors.

**[0045]** The minimum energizing force required for first latch spring 23 and second latch spring 24, is an energizing force that can reliably lift up the bonnet to a lift-up position due to an unlatching rotation of latch body 18. The lift-up position is a position where a gap wide enough to allow insertion of the hand of a driver or a maintenance engineer is formed between the bonnet and the vehicle body. Normally, the size of the gap is about 2 cm to 3 cm.

**[0046]** As illustrated in FIG. 2, sub latch 26 is axially supported on the rear side of base plate 13 by shaft 31. In this case, spring 32 energizes sub latch 26 in the clockwise direction in FIG. 2, and in the anticlockwise direction in FIG. 1. Inclined plane 34 that can come into contact with striker 12 moving in the closing direction, is formed on the tip end of arm 33 extending upward from sub latch 26. In FIG. 1, when striker 12 moves downward at the time of closure, striker 12 comes into contact with inclined plane 34, and rotates sub latch 26 clockwise. Hence, the downward movement of striker 12 is not inhibited.

**[0047]** Open lever 35 that can be accessed by a driver or a maintenance engineer when he/she inserts his/her hand between the lifted up bonnet and the vehicle body, is provided in sub latch 26.

**[0048]** When an operation of operation lever 29 disengages claw 20a of ratchet 20 from contact plane 21e of main latch 21, striker 12 (bonnet) is lifted up by latch body 18 rotating in the unlatching direction due to the energizing forces of first latch spring 23 and second latch spring 24, and moves to the lift-up position. In the lift-up state, striker 12 is pushed up to the farthest position by latch body 18, but is lower than hook 36 formed in arm 33 of sub latch 26. Additionally, the movement of sub latch 26 is independent from the movement of ratchet 20. For this reason, even if ratchet 20 comes off latch body 18 in an accident while driving, for example, hook 36 of sub latch 26 can reliably capture striker 12 and prevent opening of the bonnet.

**[0049]** In order to fully open the bonnet in the lift-up position, sub latch 26 may be rotated by open lever 35, to move hook 36 away from the upward locus of striker 12.

**[0050]** As illustrated in FIG. 1, latch switch 37 is arranged in the vicinity of a lower part of latch body 18. Latch switch 37 detects whether the bonnet is in a closed

state or in an open state (lift-up state), according to the rotary position of latch body 18.

**[0051]** As illustrated in FIGs. 9 and 10, coil part 24a of second latch spring 24 made of a torsion coil spring is locked onto spring-locking bent piece 22j of antirattle latch 22. Spring-locking bent piece 22j is separated from latch shaft 17 by a predetermined distance. Center X of coil part 24a locked onto spring-locking bent piece 22j is shifted from the shaft center of latch shaft 17.

**[0052]** As illustrated in FIGs. 9 and 10, bent part 24d in contact with side wall 13a of base plate 13 is formed in first leg part 24b. When antirattle latch 22 shifts from one position to another from the latched position (refer to FIG. 9) to an unlatched position (refer to FIG. 10), bent part 24d moves while sliding on side wall 13a.

**[0053]** As illustrated in FIG. 1, attachment hole 14 is formed in fixing plane 13c bulging rearward on both sides of base plate 13. Fixing plane 13c is almost parallel to the rotating plane of latch body 18, and vertical side wall 13a on which first leg part 24b abuts is formed on the side plane that is closer to the inner side of fixing plane 13c (refer to FIG. 11).

**[0054]** To assemble second latch spring 24 onto latch unit 11, an assembler first locks an end part of second leg part 24c onto locking hole 22f of antirattle latch 22, and locks coil part 24a onto spring-locking bent piece 22j of antirattle latch 22.

**[0055]** First leg part 24b that is opened largely from second leg part 24c, is brought into contact with or placed in front of horizontal upper wall 13d formed on an upper part of fixing plane 13c of base plate 13. Inclined plane 13b is formed between upper wall 13d and fixing plane 13c of base plate 13. Inclined plane 13b is inclined gradually rearward from upper wall 13d toward fixing plane 13c.

**[0056]** The assembler moves first leg part 24b that has been brought into contact with upper wall 13d rearward to release the contact with upper wall 13d, and then moves the first leg part 24b to fixing plane 13c by use of inclined plane 13b. In this state, the assembler further deflects first leg part 24b and locks it onto side wall 13a on the side of fixing plane 13c.

**[0057]** Thus, first leg part 24b can be smoothly moved over rearwardly protruding fixing plane 13c, and be locked onto side wall 13a.

**[0058]** Antirattle latch 22 rotates by angle A (refer to FIGs. 9 and 10) and changes between the latched position (refer to FIGs. 3 and 9) and the unlatched position (refer to FIGs. 1 and 10). As mentioned earlier, center X of coil part 24a is shifted from the shaft center of latch shaft 17. For this reason, the rotation of antirattle latch 22 causes coil part 24a to move in an arc in such a manner as to revolve around the shaft center of latch shaft 17. The amount by which second latch spring 24 can be twisted is determined by twist angle B (refer to FIGs. 9 and 10) that is formed of a line that connects a contact point between first leg part 24b and side wall 13a and center X of coil part 24a, and a line that connects the end part

(locking hole 22f) of second leg part 24c and center X of coil part 24a.

**[0059]** When antirattle latch 22 rotates from the unlatched position (refer to FIG. 10) to the latched position (refer to FIG. 9), coil part 24a moves while revolving around the shaft center of latch shaft 17, and therefore coil part 24a moves away from side wall 13a. Accordingly, since coil part 24a moves away from side wall 13a, first leg part 24b that is in contact with side wall 13a is less twisted relative to coil part 24a. As a result, twist angle B of second latch spring 24 in the case of the embodiment can be made smaller than a case where center X of coil part 24a is aligned with the shaft center of latch shaft 17.

**[0060]** When antirattle latch 22 rotates from the unlatched position (refer to FIG. 10) to the latched position (refer to FIG. 9), first leg part 24b becomes twisted relative to coil part 24a. Hence, the energizing force of second latch spring 24 increases in proportion to twist angle B. As a result, if coil part 24a is decentered from latch shaft 17 as in the case of the embodiment, twist angle B of second latch spring 24 when antirattle latch 22 rotates from the unlatched position to the latched position can be made smaller than a case where coil part 24a is not decentered from latch shaft 17.

**[0061]** With the configuration described above, the embodiment can make the energizing force of second latch spring 24 in the latched state smaller than a case of in which coil part 24a is not decentered from the shaft center of latch shaft 17, under the same conditions of energizing force of second latch spring 24 in the unlatched state. Hence, bonnet latch device 10 of the embodiment can reduce the energizing force of second latch spring 24 when being closed from the unlatched state to the latched state, while ensuring a spring torque for lifting up the bonnet. Accordingly, bonnet latch device 10 of the embodiment can improve closing operability of the bonnet.

**[0062]** In addition, as mentioned earlier, along with the rotation of antirattle latch 22, bent part 24d of first leg part 24b moves upward while sliding on side wall 13a of base plate 13. To be specific, along with the rotation of antirattle latch 22 from the unlatched position (refer to FIG. 10) to the latched position (refer to FIG. 9), bent part 24d moves upward while sliding on side wall 13a. As a result, the embodiment can make twist angle B of second latch spring 24 smaller than when bent part 24d cannot move upward along with the rotation of antirattle latch 22.

**[0063]** Note that the moving distance of bent part 24d along with the rotation of antirattle latch 22 increases by decentering coil part 24a even more from latch shaft 17. Hence, twist angle B of second latch spring 24 can be made even smaller, by causing coil part 24a to decenter from latch shaft 17 to a larger degree. Accordingly, lift up torque can be ensured, and closing operability of the bonnet can be further improved.

**[0064]** Since bonnet latch device 10 is in a substantially exposed state, it is susceptible to salt injury (antifreezing admixture) and the like. For this reason, sufficient rust-proofing measures need to be taken not only for latch

body 18 and ratchet 20, but also sub latch 26 and base plate 13, in particular, which are arranged on the front side of the vehicle.

**[0065]** Conventionally, as the above-mentioned rust proofing measures, sub latch 26, base plate 13, and other parts have undergone a process of applying galvanized coating to the primary film, a trivalent chromate filming process, and a cathodic electrodeposition process for coating film, in this order. However, since a cathodic electrodeposition film has higher adhesion to a zinc phosphate film than a trivalent chromate film, it is desirable to perform rust proofing surface processes including galvanization coating of primary film, zinc phosphate coating, and cathodic electrodeposition process for coating film.

#### Cross Reference

**[0066]** This application is based on and claims priority based on Japanese Patent Application No. 2017-251847, which is a Japanese Application filed on December 27, 2017, the entirety of which is incorporated herein by reference.

#### **Claims**

1. A bonnet latch device (10) that engages a striker (12) attached to a bonnet and closes the bonnet, the bonnet latch device (10) comprising:

a main latch (21) that is attached to a vehicle body, rotates from an unlatched position to a latched position around a latch shaft (17), and engages the striker (12);

a ratchet (20) that is axially supported on a ratchet shaft (19), engages the main latch (21) rotated from the unlatched position to the latched position, and holds the main latch (21) to the latched position; and

an antirattle latch (22) that is energized by a spring (23, 24) to push the striker (12) that engages the main latch (21) in an unlatching direction, wherein

a ratchet retainer (22e) that overlaps the ratchet (20) in a direction of a shaft center of the ratchet shaft (19) is provided in the antirattle latch (22).

2. The bonnet latch device (10) according to claim 1, wherein

a main latch-striker holder (21c) that is wider than a diameter of the striker (12) and engages the striker (12) is provided in the main latch (21).

3. The bonnet latch device (10) according to any one of claims 1 and 2, wherein:

an antirattle latch-holder (22c) that is a groove surrounded by an U-shaped wall having a first

wall and a second wall that are opposite to and face each other, and configured to engage the striker (12) to hold the striker (12) is provided in the antirattle latch; and

the first wall is a pushing wall (22g) that abuts on the striker (12) and pushes the striker (12) in the unlatching direction, while the second wall is a restriction wall (22h) that restricts movement of the striker (12) in the unlatching direction.

4. A bonnet latch device (10) that engages a striker (12) attached to a bonnet and closes the bonnet, the bonnet latch device comprising:

a main latch (21) that is attached to a vehicle body, rotates from an unlatched position to a latched position around a latch shaft (17), and engages the striker (12);

a ratchet (20) that is axially supported on a ratchet shaft (19), engages the main latch (21) rotated from the unlatched position to the latched position, and holds the main latch to the latched position; and

an antirattle latch (22) that is energized by a spring (23, 24) to push the striker (12) engaged the main latch (21) in an unlatching direction, wherein:

an antirattle latch-holder (22c) that is a groove surrounded by an U-shaped wall having a first wall and a second wall that are opposite to and face each other, and configured to engage the striker (12) to hold the striker (12) is provided in the antirattle latch (22); and

the first wall is a pushing wall (22g) that abuts on the striker (12) and pushes the striker (12) in the unlatching direction, while the second wall is a reinforcement wall (22h) that restricts movement of the striker (12) in the unlatching direction.

5. The bonnet latch device (10) according to claim 4, wherein

a ratchet retainer (22e) that overlaps the ratchet (20) in a direction of a shaft center of the ratchet shaft (19) is provided in the antirattle latch (22).

6. The bonnet latch device (10) according to any one of claims 1 to 5, wherein

the antirattle latch (22) is axially supported on the latch shaft (17).

7. The bonnet latch device (10) according to claim 6, wherein

the main latch (21) and the antirattle latch (22) are connected so as to rotate in an interlocked manner with predetermined play (27) in between.

8. The bonnet latch device (10) according to any one of claims 3 to 6, wherein:

the antirattle latch (22) is axially supported on the latch shaft (17);  
an upper structure (21g) is provided in the main latch (21);  
an engaging wall (21f) of the main latch-striker holder (21c) is formed in a side wall of the upper structure (21g);  
an upper structure (22k) is provided in the anti-rattle latch (22);  
the reinforcement wall (22h) is provided in a side wall of the upper structure (22k); and  
the upper structure (21g) and the upper structure (22k) overlap one another in the direction of the shaft center of the latch shaft (17).

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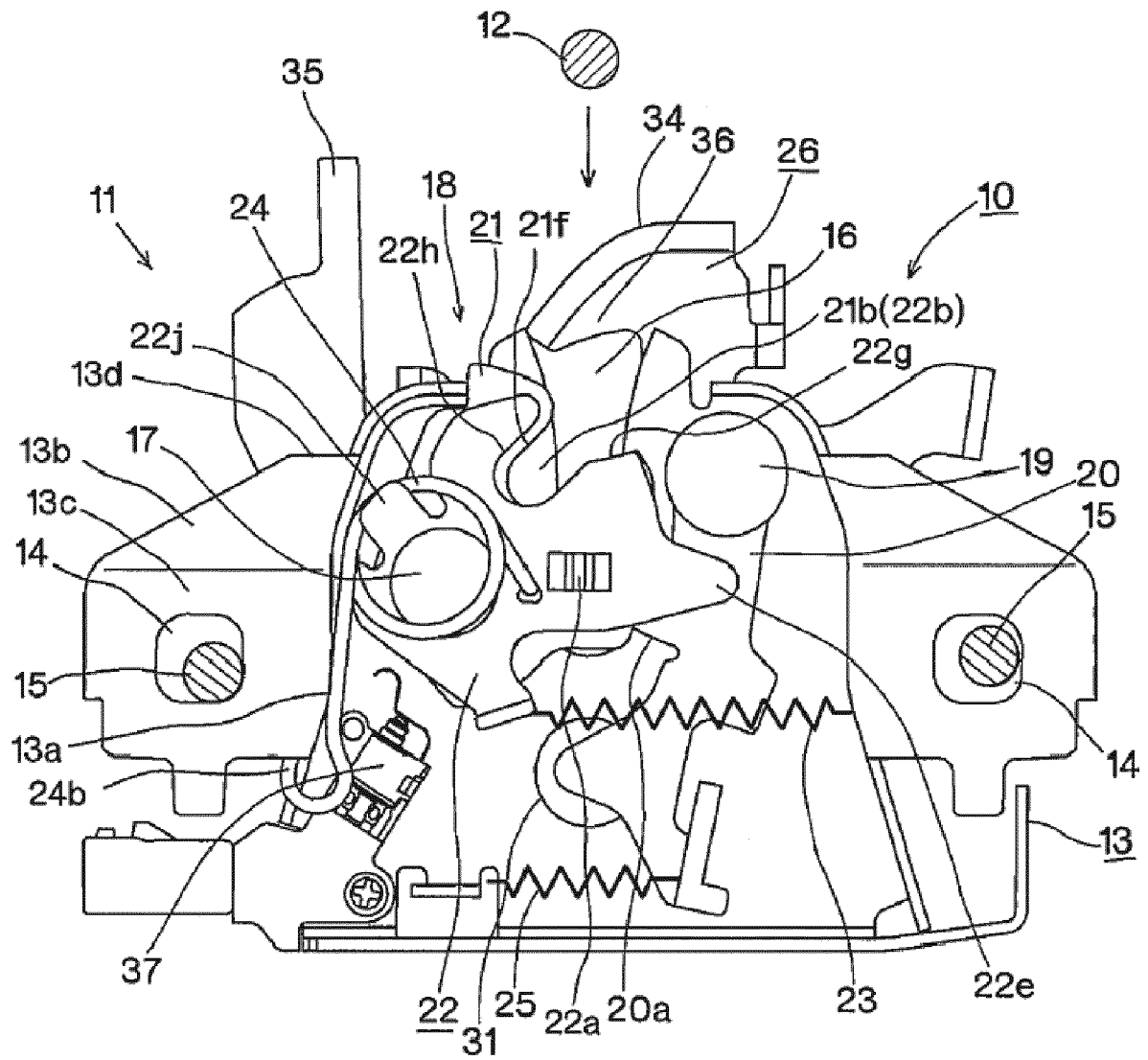


FIG.1

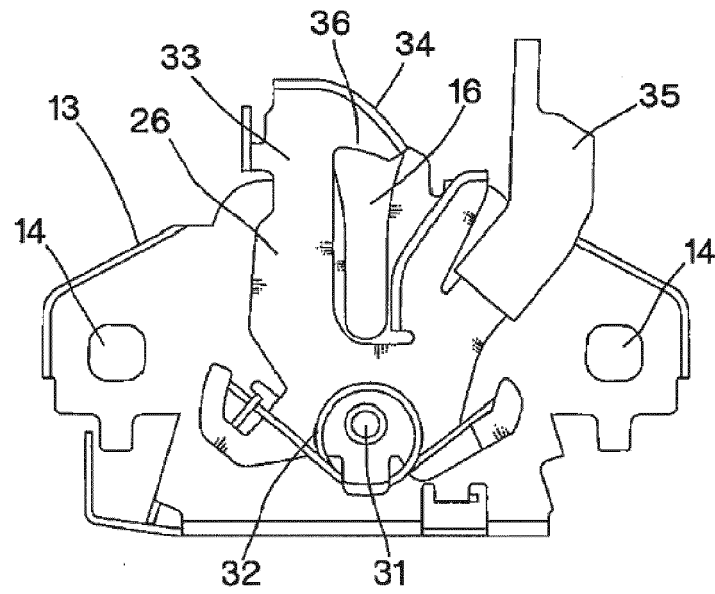


FIG. 2

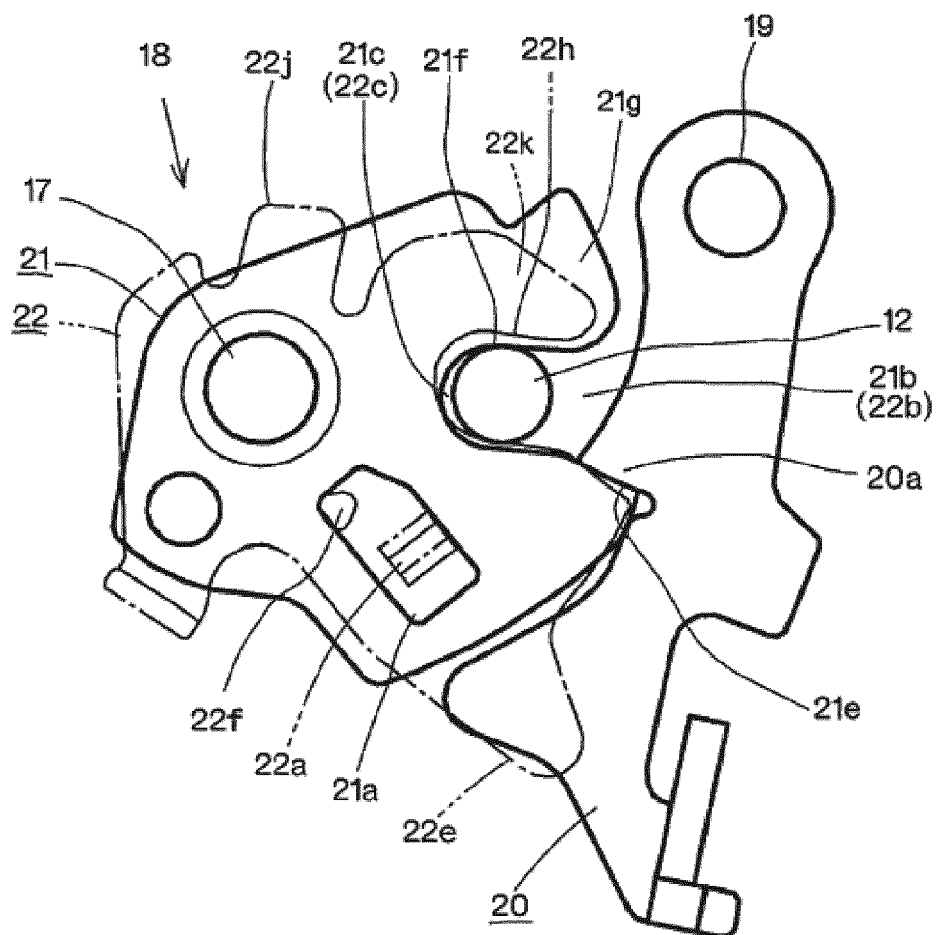


FIG. 3

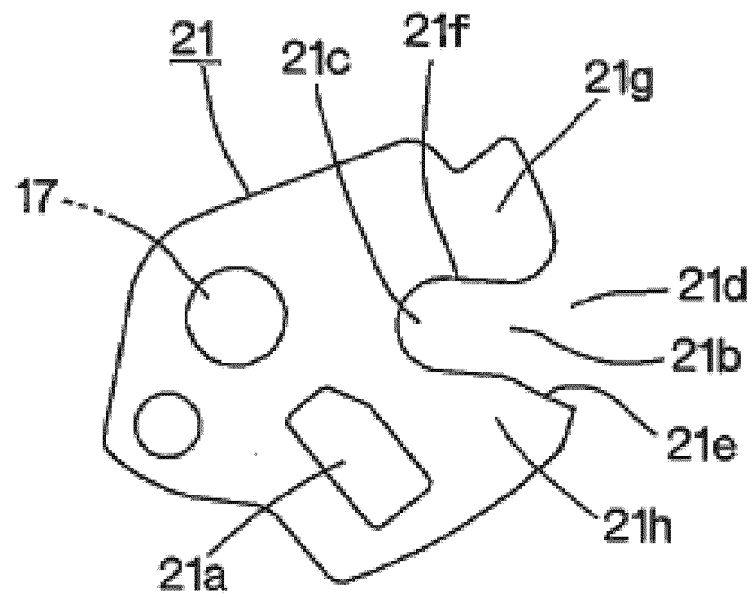


FIG. 4

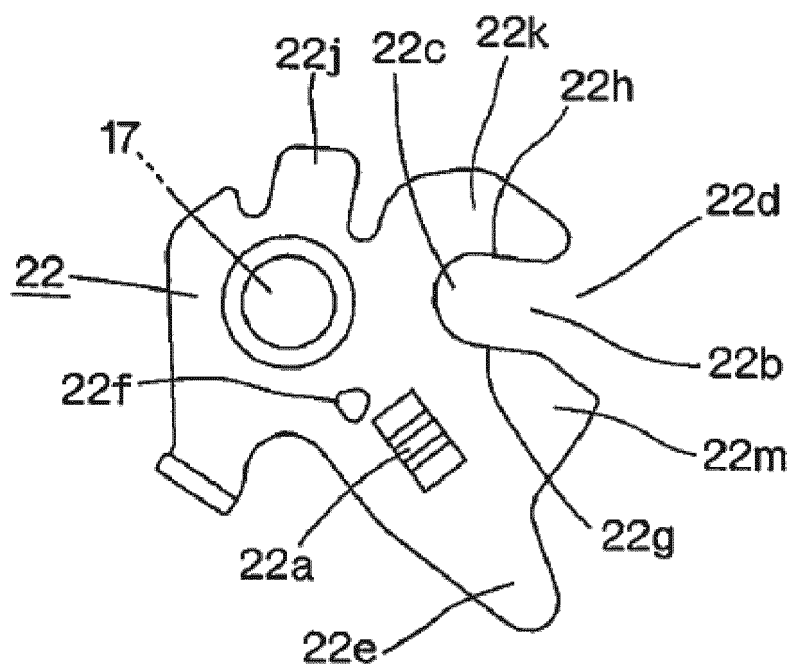


FIG. 5

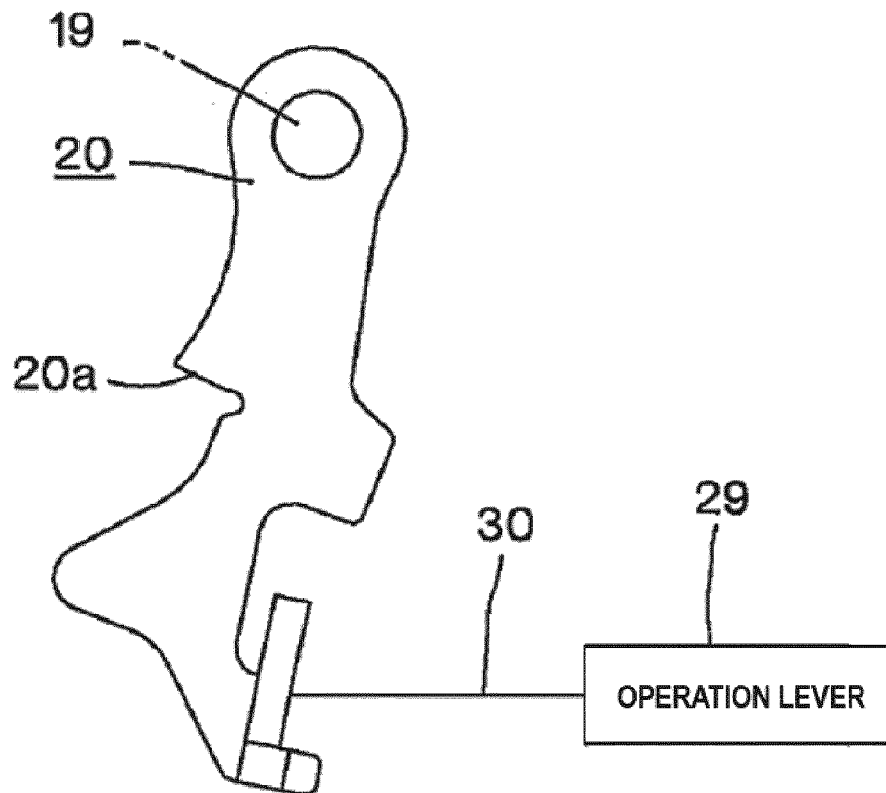


FIG. 6

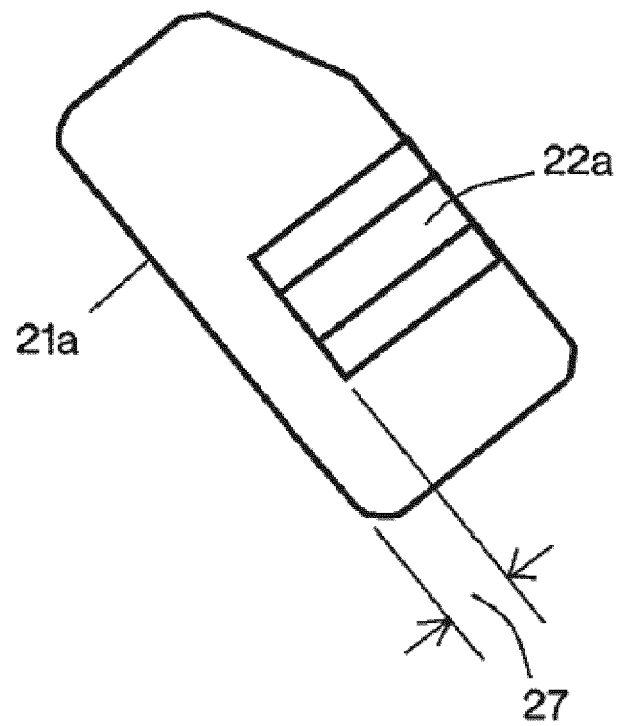


FIG. 7

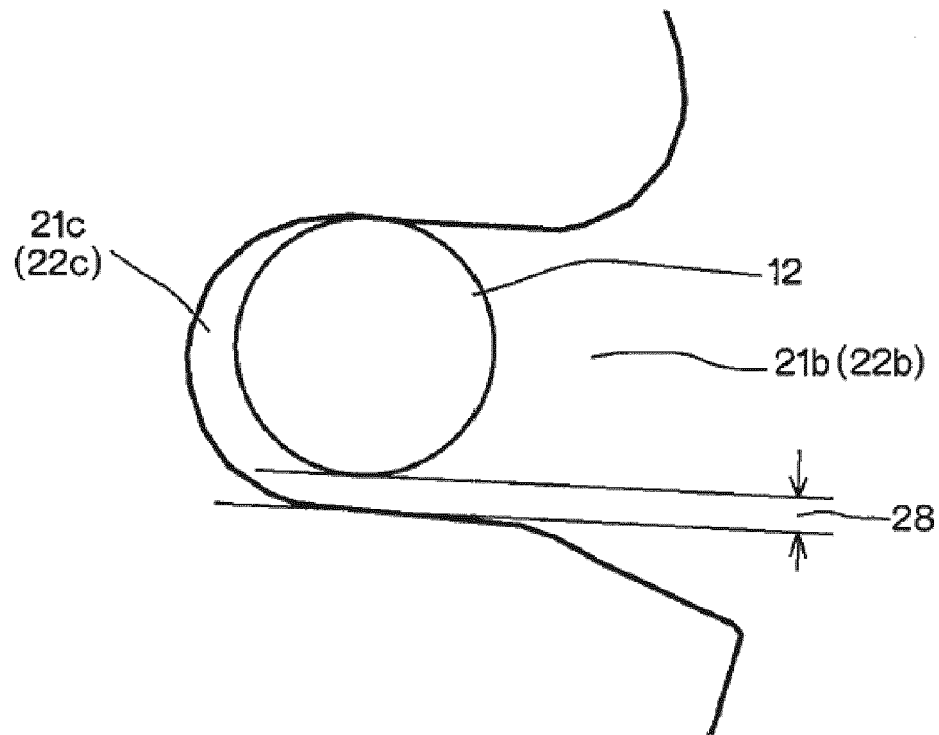


FIG. 8

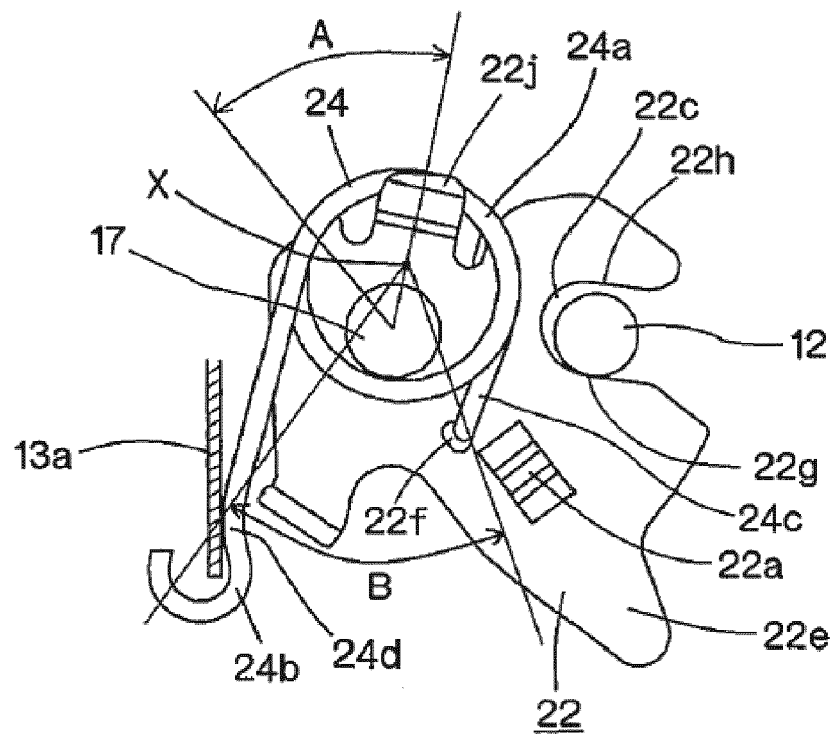


FIG. 9

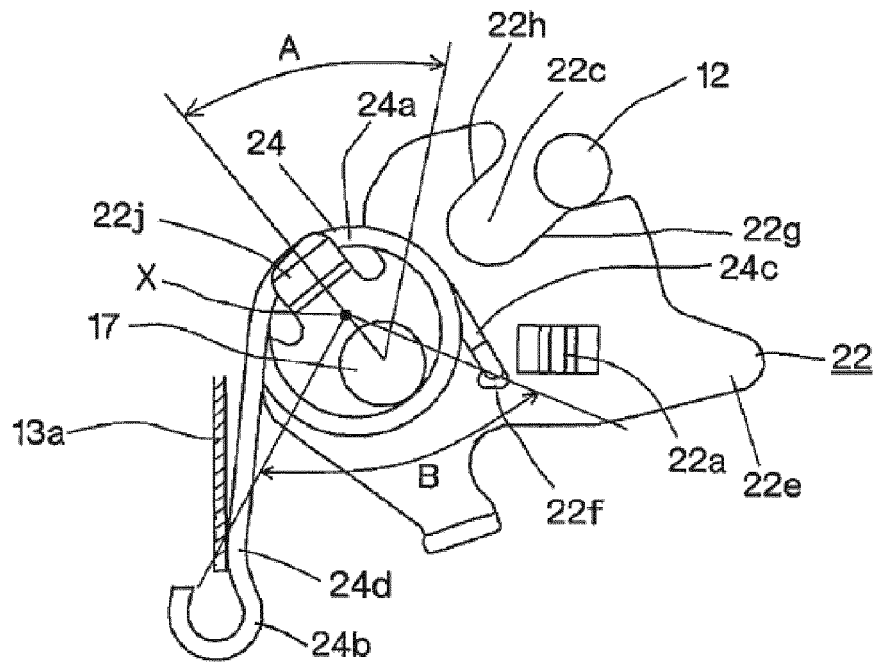


FIG.10

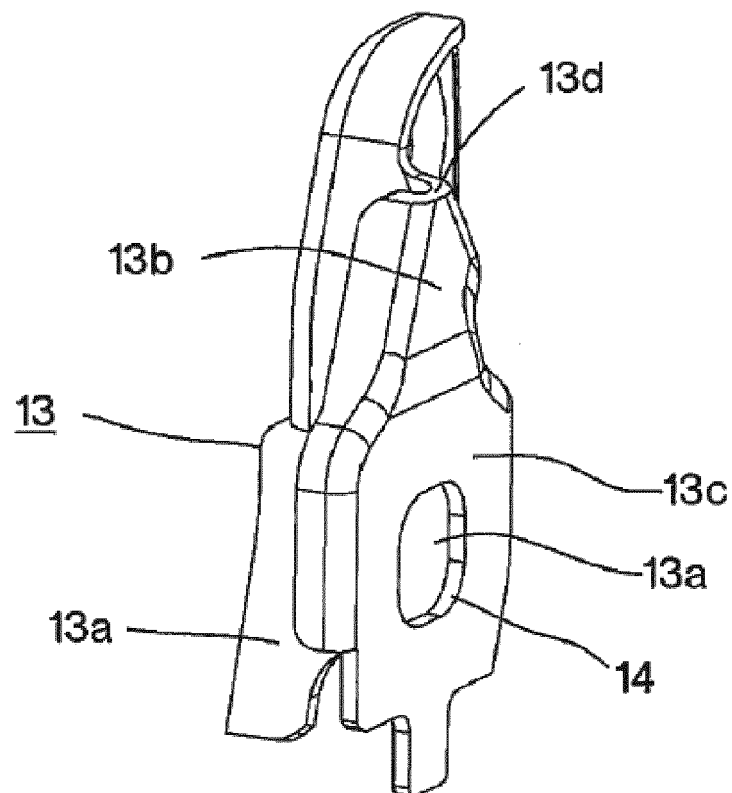


FIG.11



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Application Number  
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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |                                                        |                                                |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                  |                                                        |                                                |
| Place of search<br><b>The Hague</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  | Date of completion of the search<br><b>10 May 2019</b> | Examiner<br><b>Boufidou, Maria</b>             |
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