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(54) **Hinge arrangement**

(57) The invention relates to a hinge arrangement (16, 52, 66, 76) for a vehicle (10). The hinge arrangement comprises a first hinge member (26), adapted to be attached to a body structure (22) of the vehicle, a second hinge member (28) and a third hinge member (30), adapted to be attached to a bonnet (12) of the vehicle. A second end (40) of the second hinge member is movably connected to the third hinge member (30). The hinge arrangement (16) further comprises a positioning member (46, 54, 68, 78), which is operable between the second and third hinge members (28, 30) to provide at least a first and a second position of the hinge arrangement. A portion (45) of the third hinge member being furthest

away from the connection to the second hinge member has a larger distance to the second hinge member in the second position than in the first position of the hinge arrangement. The positioning member is adapted to restrict relative movement between the second and third hinge members, such that in the second position of the hinge arrangement, the positioning member is adapted to prevent the second and third hinge members from moving closer to each other.

The invention further relates to a vehicle comprising such a hinge arrangement and a method for mounting a windscreen (20) in the vehicle.

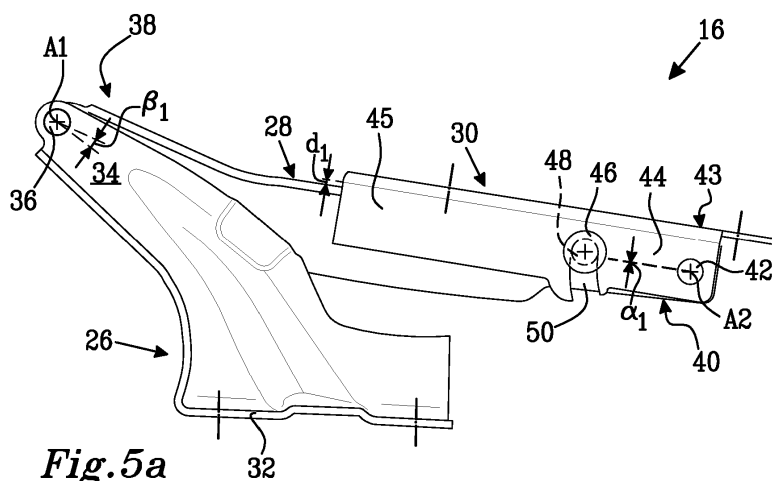


Fig. 5a

Description

TECHNICAL FIELD

[0001] The invention relates to a hinge arrangement for a vehicle according to the preamble of claim 1. The invention further relates to a vehicle comprising such a hinge arrangement. The invention also relates to a method of mounting a windscreen in such a vehicle.

BACKGROUND OF THE INVENTION

[0002] A vehicle, such as a car, is normally provided with a bonnet, which covers an engine compartment. The bonnet is connected to the vehicle by hinge arrangements, such that the bonnet can be opened in order to allow access to the engine compartment for maintenance and/or repair. Moreover, it is to be noted that the bonnet is in American English often termed the hood.

[0003] The position of the rear end of the bonnet is in many vehicles determined by the space utilized when mounting a windscreen of the vehicle. The larger the distance is between the rear end of the bonnet and the windscreen, the easier it is to mount the windscreen, e.g. giving access for tools. On the other hand, it is often desired to have a small gap between the rear end of the bonnet and the windscreen, e.g. for design reasons or in order to avoid, or to reduce, the consequences for a vulnerable road user colliding with the vehicle and being thrown onto the bonnet, e.g. the risk of head injury.

[0004] There is thus a wish for a hinge arrangement allowing a small gap between the rear end of the bonnet and the windscreen, yet allowing easy mounting of the windscreen.

[0005] Document DE 10 2005 008 633 A1 discloses a hinge arrangement for a vehicle. The hinge arrangement comprises a movable pivot axis at the connection to a body structure of the vehicle. The hinge arrangement has two end positions: a closed position and a raised position, in which the bonnet is moved upwards and forwards.

[0006] It is further known to provide a vehicle with a deployable bonnet. If such a vehicle is involved in an accident, in which the front part of the vehicle hits a vulnerable road user, e.g. a pedestrian or bicyclist, it is not uncommon that the vulnerable road user is thrown onto the bonnet of the vehicle and that the head of the vulnerable road user impacts on the bonnet. In order to reduce the severity of these accidents the bonnet is adapted to be deployed when detecting a collision or an imminent collision. By raising at least the rear part of the bonnet to an "impact position", a so called deployed position or pop-up position, the distance between the bonnet and any hard engine parts is increased. The bonnet may be lifted to the deployed position by means of an inflatable member such as an airbag, which may be activated by a pyrotechnical device. The hinge arrangement of such a vehicle is arranged such that the bonnet can be displaced to the deployed position. Different variants of such

hinge arrangement are known to the skilled person.

SUMMARY OF THE INVENTION

[0007] The object of the present invention is to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

[0008] It is desirable to provide a hinge arrangement allowing a small gap between the rear end of the bonnet and the windscreen, yet allowing easy mounting of the windscreen.

[0009] The object above may be achieved by the invention according to claim 1.

[0010] In a first aspect of the present invention there is provided a hinge arrangement for a bonnet of a vehicle. In use, the hinge arrangement provides a hinged connection between the bonnet and the body structure of the vehicle. The hinge arrangement comprises a first hinge member adapted to be attached, directly or indirectly, to the body structure of the vehicle, a second hinge member having a first end and a second end, and a third hinge member adapted to be attached, directly or indirectly, to the bonnet. The first end of the second hinge member is pivotally connected to the first hinge member providing the hinged connection. The second end of the second hinge member is movably connected to the third hinge member. The hinge arrangement further comprises a positioning member, which is operable between the second and third hinge members to provide at least a first and a second position of the hinge arrangement. The hinge arrangement is movable between the first and the second positions, wherein a portion of the third hinge member being furthest away from the connection to the second hinge member has a larger distance to the second hinge member in the second position than in the first position of the hinge arrangement. The positioning member is adapted to restrict relative movement between the second and third hinge members, such that in the second position of the hinge arrangement, the positioning member is adapted to prevent the second and third hinge members from moving closer to each other.

[0011] The first position of the hinge arrangement preferably corresponds to a generally closed bonnet, while the second position of the hinge arrangement preferably corresponds to bonnet being in a mounting position or an alternative mounting position, which positions are further described below. The mounting position and the alternative mounting position are suitable positions of the bonnet when mounting a windscreen in the vehicle. These positions are also suitable for removing the windscreen or exchanging the windscreen. The first and the second position of the hinge arrangement define different positions of the hinge members comprised in the hinge arrangement relative to each other.

[0012] The second position should not be mixed up with the above-mentioned deployed position or pop-up position, which is used in a vehicle with a deployable bonnet. The invention as disclosed herein is applicable

for vehicles with standard bonnets, as well as for vehicles with deployable bonnets. If the vehicle is of the kind having a deployable bonnet, it is to be noted that the second position of the hinge arrangement as disclosed herein is not the same thing as the position of the hinge arrangement which is assumed in the above-mentioned deployed position or pop-up position of the bonnet.

[0013] By utilizing a hinge arrangement according to the invention, a hinge arrangement allowing a small gap between the rear end of the bonnet and the windscreen, yet allowing easy mounting of the windscreen is provided.

[0014] The positioning member is operable between the second and third hinge members to provide at least the first and the second position of the hinge arrangement. The positioning member "being operable" means that the positioning member acts at least between the second and third hinge members. The positioning member may be attached to either of the second and third hinge members or it may be a separate unit intended to be placed between the second and third hinge members. One or both of the second and third hinge members may abut on the positioning member. The positioning member may be arranged to only act between the second and third hinge members, thus not influencing the relative movement between the second hinge member and the first hinge member. The positioning member is typically located in the space between the second and third hinge members or adjacent thereto, at least when the hinge arrangement is in the second position of the hinge arrangement, but preferably also when the hinge arrangement is in the first position and during transitions between the first and second positions.

[0015] Assuming the vehicle is standing on substantially flat ground, the positioning member is arranged to prevent downward movement of the bonnet in the second position of the hinge arrangement. The positioning member may in the second position provide a predetermined minimum distance between the end of the third hinge member and the second hinge member.

[0016] The third hinge member has a larger distance to the second hinge member in the second position of the hinge arrangement than a distance from the third hinge member to the second hinge member in the first position of the hinge arrangement. The distance is defined as the closest distance between the portion of the third hinge member being furthest away from the connection to the second hinge member and the second hinge member.

[0017] The third hinge member may have an elongate shape and comprise a first end and a second end, which is opposite to the first end. In that case, the first end of the third hinge member may be movably connected to the second end of the second hinge member. Then the second end of the third hinge member is the portion being furthest away from the connection. Hence, in that case the second end has a larger distance to the second hinge member in the second position than in the first position of the hinge arrangement. It is possible to connect the

third hinge member to the second hinge member anywhere along the length of the third hinge member.

[0018] The positioning member may further be adapted to in the first position of the hinge arrangement prevent the second and third hinge members from moving away from each other. This helps to avoid, or at least minimize, the risk of a rattling noise arising from the bonnet, e.g. when driving over uneven ground.

[0019] The positioning member may be attachable, directly or indirectly, to the second hinge member and/or to the third hinge member. If the positioning member is attached, the risk of dropping it or losing it is avoided, or at least minimized. However, it is also feasible that the positioning member is a separate, loose component, i.e. neither attached to the second hinge member, nor to the third hinge member.

[0020] The positioning member may be adapted to in the second position of the hinge arrangement hold the second and third hinge members in a fixed position relative to each other. This gives a stable position of the bonnet when mounting the windscreen.

[0021] The positioning member may be adapted to in the first position of the hinge arrangement hold the second and third hinge members in a fixed position relative to each other. This helps to avoid, or at least minimize, the risk of a rattling noise arising from the bonnet, e.g. when driving over uneven ground. Further, the risk that the third hinge member is displaced relative to the second hinge member during e.g. adjustment of the bonnet or if a load is applied in the transverse direction T, e.g. due to a side collision, is reduced or avoided.

[0022] The hinge arrangement may be configured such that a displacement between the first and second positions of the hinge arrangement involves a rotational and/or a translational movement of the third hinge member in relation to the second hinge member. The movement may occur around a second pivot axis, e.g. being located at the second end of the second hinge member and/or in slot/s provided in either, or both of, the second and third hinge members. The shape/s of the slot/s may then determine the relative movement between the second and third hinge members.

[0023] The second and third hinge members may in the first position of the hinge arrangement be substantially parallel to each other. Thereby the hinge arrangement may use the available space below the bonnet in an efficient way.

[0024] The second and third hinge members may in the second position of the hinge arrangement assume an angle α_2 in relation to each other, the angle α_2 being between 1 and 40 degrees, preferably between 5 and 25 degrees. The angle α_2 may e.g. be between 10 and 20 degrees. These angle ranges have been found to be suitable to provide space for mounting the windscreen. The angle α_2 may be determined as the angle between the longitudinal axes of the third hinge member and the second hinge member, e.g. at the above-mentioned second pivot axis.

[0025] There may further be an angle β between the longitudinal axes of the second hinge member and the first hinge member. The angle β_2 of the second position of the hinge arrangement may be between 1 and 40 degrees, preferably between 5 and 25 degrees, larger than the angle β_1 of the first position. The angle β_2 may e.g. be between 10 and 20 degrees larger than the angle β_1 . The angle β may be determined at a first pivot axis between the second hinge member and the first hinge member, which first pivot axis provides the above-mentioned hinged connection.

[0026] Suitable values for the angle α between the longitudinal axes of the second hinge member and the third hinge member and for the angle β between the longitudinal axes of the second hinge member and the first hinge member depend on the configuration of the hinge arrangement.

[0027] The second and third hinge members may in the first position of the hinge arrangement be biased in a direction away from each other but retained in the first position by means of the positioning member. This helps to avoid, or at least minimize, the risk of a rattling noise arising from the bonnet, e.g. when driving over uneven ground.

[0028] The biasing may be provided by a spring member or a member of resilient material located between the second and third hinge members biasing the second and third hinge members away from each other at least in the first position of the hinge arrangement.

[0029] The positioning member may comprise a catch attached to one of the second and third hinge members and adapted to hold the other of the second and third hinge members in the first and/or second position of the hinge arrangement. The catch may be located between the second and third hinge members, e.g. adjacent to the end of the third hinge member, or the catch may be located at the end of the third hinge member. The catch may be pivotally attached to the one of the second and third hinge members, such that it can be rotated between two positions corresponding to the first and the second position of the hinge arrangement, e.g. rotated out of the way or rotated between two different abutment positions.

[0030] The positioning member may comprise a fastening member, such as a screw, bolt or biased pin. The fastening member is arranged to in the first position of the hinge arrangement hold the second and third hinge members together in a predefined relative position, and in the second position of the hinge arrangement hold the second and third hinge members together in a different relative position. The fastening member may be attached to either of the second hinge member or the third hinge member or it may be a separate unit.

[0031] The positioning member may comprise an abutment member, such as a screw, bolt or biased pin, the abutment member being arranged such that in the first position of the hinge arrangement the abutment member holds the second and third hinge members together and in the second position of the hinge arrangement, the third

hinge member abuts on the second hinge member via the abutment member.

[0032] One of the second and third hinge members may comprise a positioning portion, which has a shape element, such as a slot or a notch, providing at least one of the first and second positions. In that case, the positioning member is attached to the other of the second and third hinge members, such that the positioning member may be displaced in and out of the shape element. The positioning member may then be biased to stay in the shape element, e.g. by a spring member or a magnet.

[0033] In a second aspect of the present invention there is provided a vehicle comprising a bonnet, a body structure and at least one hinge arrangement according to this disclosure. The first position of the hinge arrangement preferably corresponds to the bonnet being in a generally closed position, and the second position of the hinge arrangement preferably corresponds to the bonnet being in a position suitable for mounting a windscreen, like the above-mentioned mounting position or alternative mounting position. The position is also suitable for removing the windscreen or exchanging the windscreen.

[0034] In the mounting position the rear end of the bonnet may be between 1 mm and 200 mm above the closed position, preferably between 20 mm and 150 mm, more preferably between 50 mm and 120 mm, most preferably between 80 mm and 100 mm. Further, in the mounting position the front end may be between 0 mm and 200 mm above the closed position, preferably between 20 mm and 150 mm, more preferably between 50 mm and 120 mm, most preferably between 70 mm and 90 mm.

[0035] In the alternative mounting position the front end of the front end remains in a similar vertical position as when closed, while the rear end is displaced between 1 mm and 200 mm above the closed position, preferably between 20 mm and 150 mm, more preferably between 50 mm and 120 mm, most preferably between 80 mm and 100 mm.

[0036] In a third aspect of the present invention there is provided a method of mounting a windscreen in a vehicle provided with at least one hinge arrangement according to this disclosure. The method comprises

- displacing the second and third hinge members relative to each other from the first position to the second position of the hinge arrangement,
- mounting the windscreen,
- displacing the second and third hinge members relative to each other from the second position to the first position of the hinge arrangement.

[0037] It may be assumed that the bonnet is in a closed position when the method is started.

[0038] A similar method may be used for dismounting the windscreen or exchanging the windscreen.

[0039] The method may further comprise

- deactivating the positioning member from holding

the second and third hinge members in a relative position corresponding to one of the first position or the second position of the hinge arrangement,

- performing the step of displacing the second and third hinge members relative to each other,
- activating the positioning member to hold the second and third hinge members in a relative position corresponding to the other of the first position or the second position of the hinge arrangement.

[0040] The step of displacing the second and third hinge members relative to each other thus is performed when the positioning member is in a deactivated state.

[0041] Purely as an example, if assuming that the positioning member is a fastening member, such as a screw, and further assuming that the bonnet is in a closed position and hence the hinge arrangement in its first position, the screw may first be deactivated such that relative movement between the second and third hinge members is allowed. Thereafter the second and third hinge members are displaced relative to each other from the first position to the second position of the hinge arrangement. When in the second position, the screw is tightened, such that the second and third hinge members are held in a stable position when mounting the windscreen. When the mounting of the windscreen is ready, the screw may be deactivated again, thereafter the second and third hinge members are displaced relative to each other from the second position to back to the first position and the screw is tightened again.

[0042] Other kinds of positioning members, as exemplified below in the detailed description, may be deactivated by being moved out of a slot or notch or being displaced from a stable abutment position.

[0043] When displacing the second and third hinge members relative to each other and/or when activating or deactivating the positioning member, it may be helpful to open the bonnet further upwards, i.e. above the mounting position and the alternative mounting position, in order to more easily access the hinge members and/or the positioning member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] The present invention will hereinafter be further explained by means of non-limiting examples with reference to the appended figures wherein:

- Figure 1 is a schematic side view of a front portion of a vehicle with a hinge arrangement according to the invention and illustrating the bonnet in a closed position,
- Figure 2 illustrates the front portion of Figure 1 with the bonnet in an open position,
- Figure 3 illustrates the front portion of Figure 1 with the bonnet in a mounting position,

Figure 4 illustrates the front portion of Figure 1 with the bonnet in an alternative mounting position,

5 Figure 5a is a schematic side view of a hinge arrangement according to a first embodiment of the invention assuming the bonnet is in its closed position,

10 Figure 5b illustrates the hinge arrangement of Figure 5a assuming the bonnet is in its open position,

Figure 6 illustrates the hinge arrangement of Figure 5a assuming the bonnet is in the mounting position,

Figure 7 is a schematic side view of the hinge arrangement according to a second embodiment of the invention assuming the bonnet is in its closed position,

Figure 8 illustrates the hinge arrangement of Figure 7 assuming the bonnet is in the mounting position,

Figure 9 is a schematic side view of the hinge arrangement according to a third embodiment of the invention assuming the bonnet is in its closed position,

Figure 10 is a schematic side view of the hinge arrangement according to a third embodiment of the invention assuming the bonnet is in its mounting position,

Figure 11 is a schematic side view of the hinge arrangement according to a fourth embodiment assuming the bonnet is in its mounting position, and

Figure 12 illustrates a method of mounting a windscreen in a vehicle comprising a hinge arrangement according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0045] The invention will, in the following, be exemplified by embodiments. It should however be realized that the embodiments are included in order to explain principles of the invention and not to limit the scope of the invention, defined by the appended claims. Details from two or more of the embodiments may be combined with each other.

[0046] The words front and rear used herein relate to a vehicle, where front is the part coming first in the normal forward driving direction. The terms denoting directions,

such as longitudinal, transverse and vertical, also relate to the vehicle. Longitudinal is along the normal driving direction. Transverse is perpendicular to the longitudinal direction but in the same horizontal plane, i.e. sideways or laterally in the vehicle. Vertical is perpendicular to that plane. Terms denoting locations and directions, which are used for vehicle parts, such as for a bonnet and a hinge arrangement, relate to when mounted in the vehicle.

[0047] Figures 1-4 are schematic side views of a front portion of a vehicle 10, here a car. The vehicle 10 has a longitudinal direction L, a transverse direction T and a vertical direction V. The vehicle 10 is provided with a bonnet 12, which covers an engine compartment 14 and allows access to the engine compartment 14 for maintenance and/or repair. The bonnet 12 is connected to the vehicle 10 by a hinge arrangement 16, normally one hinge arrangement 16 adjacent to each lateral side of the bonnet 12. A rear end 18 of the bonnet 12 is directed towards a windscreen 20 of the vehicle 10. The hinge arrangement 16 provides a hinged connection of the bonnet 12 in relation to a body structure 22 of the vehicle 10. The hinge arrangement 16 is located adjacent to the rear end 18 of the bonnet 12. During normal operation of the vehicle 10, the bonnet 12 is in a closed position covering the engine compartment 14, see Figure 1. The bonnet 12 can be displaced to an open position allowing access to the engine compartment 14 for maintenance and/or repair, see Figure 2. The vehicle 10 is normally stationary when displacing the bonnet 12 to the open position.

[0048] When mounting the windscreen 20, there is a need for a certain space around the windscreen 20 in order to be able to handle the windscreen 20, e.g. space needed to operate tools. According to the present invention, this space may be provided by allowing the windscreen 20 to assume a mounting position, see Figure 3. The mounting position involves raising the whole bonnet 12 at a front end 24 and at the rear end 18 and is e.g. advantageous when mounting the windscreen 20 in the vehicle manufacturing plant. The mounting position provides extra space around the windscreen 20, such that the windscreen 20 may be easily handled. The front end 24 may be raised by a distance y_f being between 0 mm and 200 mm above the closed position, preferably between 20 mm and 150 mm, more preferably between 50 mm and 120 mm, most preferably between 70 mm and 90 mm. The rear end 18 may be raised by a distance y_r being between 1 mm and 200 mm above the closed position, preferably between 20 mm and 150 mm, more preferably between 50 mm and 120 mm, most preferably between 80 mm and 100 mm.

[0049] Figure 4 illustrates an alternative mounting position, which e.g. may be used in a workshop during repair or exchange of the windscreen 20. The bonnet 12 is then only raised at the rear end 18, which saves work for the staff at the workshop not lifting the front end 24. The rear end 24 may be raised by a distance y_r being between 1 mm and 200 mm above the closed position, preferably

between 20 mm and 150 mm, more preferably between 50 mm and 120 mm, most preferably between 80 mm and 100 mm.

[0050] Although the positions illustrated in Figures 3 and 4 are called mounting positions, they are also suitable positions for removing the windscreen 20 or exchanging the windscreen 20.

[0051] To be able to raise the bonnet 12 to the mounting position, or to the alternative mounting position, the hinge arrangement 16 moves in a different way as compared to how it moves when the bonnet 12 is opened to the open position. Therefore, the hinge arrangement 16 is adapted for these two different ways of movement, as described below. It should be noted that the hinge arrangement 16 showed in Figures 1 to 4 is not drawn to scale. The details of the hinge arrangement 16 will be described in more detail with reference to Figures 5a, 5b and 6.

[0052] Figure 5a is a side view of the hinge arrangement 16 in accordance with a first embodiment of the invention, assuming that the bonnet 12, to which the hinge arrangement 16 is arranged, is in the closed position. The hinge arrangement 16 then assumes a first position. The hinge arrangement 16 comprises a first hinge member 26, a second hinge member 28 and a third hinge member 30. In the illustrated embodiment, the first hinge member 26 is in front of the second hinge member 28, which in turn is behind the third hinge member 30. It would also be possible to have the third hinge member 30 behind the second hinge member 28.

[0053] The first hinge member 26 comprises an attachment portion 32 for attachment to the body structure 22 of the vehicle 10. The first hinge member 26 may be attached to the body structure 22 of the vehicle 10 by any suitable fastening means, for example by screwing or by welding at the attachment portion 32. It may be attached directly to the body structure 22, or indirectly via an additional member, such as a bracket. The first hinge member 26 further comprises an upper portion 34. A first pivot pin 36 located at the upper portion 34 provides the hinged connection between the first 26 and second hinge member 28 around a first pivot axis A1. The pivot pin 36 may be fixedly attached to the first hinge member 26 or the second hinge member 28, or it may be a separate unit.

[0054] The second hinge member 28 comprises a hinge arm extending substantially in the longitudinal direction L of the vehicle 10. A first end 38 is connected to the first hinge member 26 at the first pivot axis A1. The opposite end of the second hinge member 28, i.e. the second end 40, is pivotally connected to the third hinge member 30, by means of e.g. a second pivot pin 42, forming a second pivot axis A2.

[0055] The third hinge member 30 is fixedly attachable to the bonnet 12 by any suitable fastening means in an attachment portion 43, for example by screwing or by welding. The third hinge member 30 may be attached directly to the bonnet 12, or via an additional member.

The third hinge member 30 has a first end 44, which is pivotally connected to the second hinge member 28, and a second opposite end 45.

[0056] By rotating around the first pivot axis A1, the hinge arrangement 16 may be displaced from a first position illustrated in Figure 5a, corresponding to that the bonnet 12 is closed as in Figure 1, to a position illustrated in Figure 5b corresponding to that the bonnet 12 is open as in Figure 2. This displacement may be performed to open the bonnet 12 for maintenance or repair. During normal opening of the bonnet 12, there is normally substantially no relative movement between the second hinge member 28 and the third hinge member 30. The relative movement occurs between the second hinge member 28 and the first hinge member 26, in this case by rotation around the first pivot axis A1.

[0057] It would further be possible, however not illustrated, that the movement of the second hinge member 28 relative to the first hinge member 26 is a combination of rotation and translation, e.g. in a slot in either, or both of, the first hinge member 26 and the second hinge member 28.

[0058] The hinge arrangement 16 also comprises a positioning member 46, here illustrated as a fastening member in the form of a screw. The positioning member 46 may be attached to either of the second hinge member 28 or the third hinge member 30 or it may be a separate unit. In the illustrated example the positioning member 46 is a separate unit, which fits in a threaded opening 48 in the second hinge member 28. The third hinge member 30 is provided with a slot 50, which allows the third hinge member 30 to move in relation to the positioning member 46 and thus in relation to the second hinge member 28.

[0059] Normally the positioning member 46 is activated, i.e. the screw 46 is tightened, when the hinge arrangement 16 assumes its first position, as in Figures 5a and 5b. Thereby the third hinge member 30, and hence the bonnet 12 to which it is connected, is retained in a fixed position relative to the rest of the hinge arrangement 16, avoiding, or at least minimizing, the risk of a rattling noise arising from the bonnet 12, e.g. when driving over uneven ground. Further, the risk that the third hinge member 30 is displaced relative to the second hinge member 28 during e.g. adjustment of the bonnet 12 or if a load is applied in the transverse direction T, e.g. due to a side collision, is reduced or avoided. In the first position of the hinge arrangement 16 the longitudinal axes of the second hinge member 28 and the third hinge member 30 are substantially parallel to each other. Hence an angle α_1 between the longitudinal axes of the third hinge member 30 and the second hinge member 28 is substantially 0 degrees. The angle α_1 is preferably determined at the second pivot axis A2. There is further an angle β_1 , in the illustrated example about 15 degrees, between the longitudinal axes of the second hinge member 28 and the first hinge member 26 determined at the first pivot axis A1.

[0060] When it is desired to displace the bonnet 12 to

the mounting position, or the alternative mounting position, see Figures 3 and 4, e.g. in order to mount or exchange the windscreen 20, the positioning member 46 is deactivated, i.e. the screw is untightened. Thereby, the third hinge member 30 is allowed to rotate at the second pivot axis A2. The positioning member 46 then moves within the slot 50. When a desired second position of the hinge arrangement 16 is reached, the positioning member is activated again, i.e. the screw 46 is tightened again holding the third hinge member 30 in a new fixed position in relation to the second hinge member 28, i.e. the second position of the hinge arrangement 16, see Figure 6. In the second position there is an angle α_2 between the longitudinal axes of the third hinge member 30 and the second hinge member 28. The angle α_2 is preferably determined at the second pivot axis A2. In the first embodiment, the angle α_2 is about 15 degrees. In the second position there is further an angle β_2 between the longitudinal axes of the second hinge member 28 and the first hinge member 26 at the first pivot axis A1 being about 20 degrees, i.e. about 5 degrees larger than the angle β_1 of the first position.

[0061] In the second position of the hinge arrangement 16, the third hinge member 30 has a larger distance d_2 to the second hinge member 28, see Figure 6, than a distance d_1 between the third hinge member 30 and the second hinge member 28 in the first position of the hinge arrangement 16, see Figure 5a. The distance is defined as the closest distance between the portion of the third hinge member 30 being furthest away from the connection A2 to the second hinge member 28, in the illustrated embodiment between the second end 45 of the third hinge member 30 and the second hinge member 28.

[0062] The movement of the third hinge member 30 relative to the second hinge member 28 may as an alternative to the illustrated rotation be a combination of rotation and translation, e.g. in a slot in either, or both of, the second hinge member 28 and the third hinge member 30. It would also be possible that the movement of the third hinge member 30 relative to the second hinge member 28 is a translation without rotation, e.g. by using a slot in either, or both of, the second hinge member 28 and the third hinge member 30, wherein the shape of the slot determines the relative movement.

[0063] As yet an alternative, or as a complement, there could be a multi-link arrangement between the first hinge member 26 and the second hinge member 28 and/or between the second hinge member 28 and the third hinge member 30 having multiple pivot axes.

[0064] Figure 7 and 8 illustrate a second embodiment of the invention with a hinge arrangement 52 being in the first position, see Figure 7, and the second position, see Figure 8. The hinge arrangement 52 is similar to the hinge arrangement 16 of the first embodiment. However the positioning member 54 differs from that of the first embodiment. The positioning member 54 is configured to function as a locking member by in an active state locking a positioning portion 56 of the third hinge member 30 in

a specified relative position. The positioning portion 56 comprises an upper slot 58 and a lower slot 60. The upper slot 58 corresponds to the first position of the hinge arrangement 52, while the lower slot 60 corresponds to the second position of the hinge arrangement 52. There may in addition be additional slots. The positioning member 54 is biased towards being locked. In the illustrated embodiment, the positioning member 54 is pre-tensioned by a spring 62.

[0065] The hinge arrangement 52 further comprises a resilient member 64, here a block of viscoelastic material, e.g. rubber, biasing the third hinge member 30 and the second hinge member 28 away from each other when in the first position of the hinge arrangement 52, as in Figure 7. Thereby the third hinge member 30, and hence the bonnet 12 to which it is connected, is retained in a fixed position relative to the rest of the hinge arrangement 52, avoiding, or at least minimizing, the risk of a rattling noise arising from the bonnet 12, e.g. when driving over uneven ground.

[0066] In the first position, see Figure 7, the longitudinal axes of the second hinge member 28 and the third hinge member 30 are substantially parallel to each other, corresponding to an angle α_1 between the longitudinal axes of the third hinge member 30 and the second hinge member 28 being substantially 0 degrees.

[0067] In the second position, see Figure 8, the angle α_2 between the longitudinal axes of the third hinge member 30 and the second hinge member 28 is about 15 degrees. In addition, there will be a rotation around the first pivot axis, not illustrated for this embodiment, of about 15 degrees between the first and second positions of the hinge arrangement 52.

[0068] It would be possible to dispense with the upper slot 58, such that the third hinge member 30 abuts on the second hinge member 28, when the hinge arrangement 52 assumes its first position.

[0069] In addition, or as an alternative, it would be possible to dispense with the lower slot 60, such that the positioning portion 56 of the third hinge member 30 abuts on the positioning member 54, e.g. on top of the positioning member 54, when the hinge arrangement 52 assumes its second position.

[0070] Figures 9 and 10 illustrate a hinge arrangement 66 according to a third embodiment. The positioning member 68 is located adjacent to the second end 45 of the third hinge member 30. The positioning member 68 is pivotally connected to the third hinge member 30 at a third pivot axis A3 and may function as a catch.

[0071] In the first position of the hinge arrangement 66 illustrated in Figure 9 corresponding to the closed position of the bonnet 12, the positioning member 68 is substantially parallel to the third hinge member 30 and the second hinge member 28, such that the third hinge member 30 abuts on the second hinge member 28 via side walls 70, 72 of the positioning member 68. The third pivot axis A3 may be located at the third hinge member 30 adjacent to the second end 45 as in the third embodiment.

The angle α_1 is substantially 0 degrees.

[0072] In the second position of the hinge arrangement 66 illustrated in Figure 10 corresponding to the mounting position or the alternative mounting position of the bonnet 12, the positioning member 68 has been rotated around the third pivot axis A3 to reach a position between the third hinge member 30 and the second hinge member 28, such that the third hinge member 30 abuts on the second hinge member 28 via an end 74 of the positioning member 68. The angle α_2 is about 10 degrees.

[0073] In the illustrated embodiment, the third pivot axis A3 is located at the third hinge member 30 adjacent to the second end 45. In the first position of the hinge arrangement 66, the positioning member 68 is rotated out of the way, such that the third hinge member 30 may abut on the second hinge member 28. The positioning member 68 may be pre-tensioned by e.g. a spring. Further, instead of the third hinge member 30 abutting via the lower end 74 of the positioning member 68, the positioning member 68 may be provided with a slot, corresponding to the lower slot 60 of the second embodiment.

[0074] The resilient member 64 of the second embodiment is applicable also for other kinds of positioning members 46, 68, e.g. like the first and the third illustrated embodiments.

[0075] Figure 11 illustrates a hinge arrangement 76 according to a fourth embodiment. The positioning member 78 is a distance member providing the desired second position of the hinge arrangement 76 when inserted between the third hinge member 30 and the second hinge member 28. The distance member 78 may be at least partly wedge-shaped, e.g. having a wedge angle corresponding to the desired angle α_2 between the longitudinal axes of the third hinge member 30 and the second hinge member 28 at the second pivot axis A2.

[0076] The above embodiments all show bonnets 12 and hinge arrangements 16 allowing the bonnet 12 to be displaced between the closed position and the open position.

[0077] However, the invention is also applicable for a vehicle with deployable bonnet. When mounting a windscreen in such a vehicle, a mounting position or an alternative mounting position of the bonnet as disclosed herein may be used, assuming that the hinge arrangement comprises the features disclosed herein.

[0078] The illustrated embodiments disclose a bonnet having the hinge arrangement adjacent to its rear end, i.e. normally being opened at its front end to reach the open position. However there are also vehicles, which are oppositely arranged, i.e. the bonnet being opened at its rear end, i.e. adjacent to the windscreen and having the hinge arrangement at the front end. In that case, there will be one or more bonnet latches located at the rear end of the bonnet used for holding the bonnet in the closed position. In such a case, the features of the hinge arrangement described herein could be incorporated into the bonnet latch instead. In the case a bonnet openable at its rear end is deployable, a raising arrangement pro-

viding deployment may be arranged at the rear end of the bonnet, possibly incorporated into the bonnet latch. Such a raising arrangement may include the features of the hinge arrangement described herein.

[0079] Figure 12 shows a method of mounting a windscreen 20 in a vehicle 10 provided with at least one hinge arrangement as disclosed herein. Optional steps are illustrated by dashed boxes.

[0080] The method comprises

110: displacing the second and third hinge members 28, 30 relative to each other from the first position to the second position of the hinge arrangement 16, 52, 66, 76,

130: mounting the windscreen 20,

150: displacing the second and third hinge members 28, 30 relative to each other from the second position to the first position of the hinge arrangement 16, 52, 66, 76.

[0081] It may be assumed that the bonnet 12 is in a closed position when the method is started.

[0082] A similar method may be used for dismounting the windscreen 20 or exchanging the windscreen 20.

[0083] The method may further comprise

100: deactivating the positioning member 46, 54, 68, 78 from holding the second and third hinge members 28, 30 in a relative position corresponding to the first position of the hinge arrangement 16, 52, 66, 76,

120: activating the positioning member 46, 54, 68, 78 to hold the second and third hinge members 28, 30 in a relative position corresponding to the second position of the hinge arrangement 16, 52, 66, 76.

[0084] Step 100 is performed before step 110 and step 120 is performed after step 110. The step 110 of displacing the second and third hinge members 28, 30 relative to each other thus is performed when the positioning member 46, 54, 68, 78 is in a deactivated state. The mounting of the windscreen, step 130 is performed when the positioning member 46, 54, 68, 78 is in an activated state.

[0085] The method may further comprise

140: deactivating the positioning member 46, 54, 68, 78 from holding the second and third hinge members 28, 30 in a relative position corresponding to the second position of the hinge arrangement 16, 52, 66, 76,

160: activating the positioning member 46, 54, 68, 78 to hold the second and third hinge members 28, 30 in a relative position corresponding to the first position of the hinge arrangement 16, 52, 66, 76.

[0086] Step 140 is performed before step 150 and step 160 is performed after step 150. The step 150 of displacing the second and third hinge members 28, 30 relative to each other thus is performed when the positioning

member 46, 54, 68, 78 is in a deactivated state.

[0087] Purely as an example, if assuming that the positioning member is a fastening member, such as a screw 46, and further assuming that the bonnet 12 is in a closed position and hence the hinge arrangement 16 in its first position, the screw 46 may first be deactivated, step 100, such that relative movement between the second and third hinge members 28, 30 is allowed. Thereafter the second and third hinge members 28, 30 are displaced relative to each other from the first position to the second position of the hinge arrangement 16, step 110. When in the second position, the screw 46 is tightened, i.e. activated, step 120, such that the second and third hinge members 28, 30 are held in a stable position when mounting the windscreen 20, step 130. When the mounting of the windscreen 20 is ready, the screw 46 may be deactivated again, i.e. untightened, step 140, thereafter the second and third hinge members 28, 30 are displaced relative to each other from the second position to back to the first position, step 150, and the screw 46 is tightened again, step 160.

[0088] Other kinds of positioning members 54, 68, 78, as exemplified below in the detailed description, may be deactivated by being moved out of a slot or notch or being displaced from a stable abutment position.

[0089] When displacing the second and third hinge members 28, 30 relative to each other and/or when activating or deactivating the positioning member 46, 54, 68, 78 it may be helpful to open the bonnet 12 further upwards, i.e. above the mounting position and the alternative mounting position, in order to more easily access the hinge members 28, 30 and/or the positioning member 46, 54, 68, 78.

[0090] Further modifications of the invention within the scope of the appended claims are feasible. As such, the present invention should not be considered as limited by the embodiments and figures described herein. Rather, the full scope of the invention should be determined by the appended claims, with reference to the description and drawings.

Claims

1. A hinge arrangement (16, 52, 66, 76) for a vehicle (10), in use said hinge arrangement (16, 52, 66, 76) providing a hinged connection between a bonnet (12) and a body structure (22) of said vehicle (10), said hinge arrangement (16, 52, 66, 76) comprising
 - a first hinge member (26) adapted to be attached, directly or indirectly, to said body structure (22) of said vehicle (10),
 - a second hinge member (28) having a first end (38) and a second end (40), and
 - a third hinge member (30) adapted to be attached, directly or indirectly, to said bonnet (12),

said first end (38) of said second hinge member (28) being pivotally connected to said first hinge member (26) providing said hinged connection, said second end (40) of said second hinge member (28) being movably connected to said third hinge member (30),

characterized by

said hinge arrangement (16, 52, 66, 76) further comprising a positioning member (46, 54, 68, 78), which is operable between said second and third hinge members (28, 30) to provide at least a first and a second position of said hinge arrangement (16, 52, 66, 76), said hinge arrangement (16, 52, 66, 76) being movable between said first and said second positions,

wherein a portion (45) of said third hinge member (30) being furthest away from said connection to said second hinge member (28) has a larger distance to said second hinge member (28) in said second position (d_2) than in said first position (d_1) of said hinge arrangement (16, 52, 66, 76),

said positioning member (46, 54, 68, 78) being adapted to restrict relative movement between said second and third hinge members (28, 30), such that in said second position of said hinge arrangement (16, 52, 66, 76), said positioning member (46, 54, 68, 78) is adapted to prevent said second and third hinge members (28, 30) from moving closer to each other.

2. The hinge arrangement (16, 52) according to claim 1, wherein said positioning member (46, 54) in said first position of said hinge arrangement (16, 52) is adapted to prevent said second and third hinge members (28, 30) from moving away from each other.
3. The hinge arrangement (16, 52, 66) according to any one of the preceding claims, wherein said positioning member (46, 54, 68) is attachable, directly or indirectly, to said second hinge member (28) and/or to said third hinge member (30).
4. The hinge arrangement (16, 52) according to any one of the preceding claims, wherein said positioning member (46, 54) in said second position of said hinge arrangement (16, 52) is adapted to hold said second and third hinge members (28, 30) in a fixed position relative to each other.
5. The hinge arrangement (16, 52) according to any one claims 2-4, wherein said positioning member (46, 54) in said first position of said hinge arrangement (16, 52) is adapted to hold said second and third hinge members (28, 30) in a fixed position relative to each other.
6. The hinge arrangement (16, 52, 66, 76) according

to any one of the preceding claims, wherein the hinge arrangement (16, 52, 66, 76) is configured such that a displacement between said first and said second positions of said hinge arrangement (16, 52, 66, 76) involves a rotational and/or a translational movement of said third hinge member (30) in relation to said second hinge member (28).

7. The hinge arrangement (16, 52, 66, 76) according to any one of the preceding claims, wherein in said second position of said hinge arrangement (16, 52, 66, 76) said second and third hinge members (28, 30) assume an angle (α_2) in relation to each other, said angle (α_2) being between 1 and 40 degrees, preferably between 5 and 25 degrees.
8. The hinge arrangement (52) according to any one of the preceding claims, wherein in said first position of said hinge arrangement (52) said second and third hinge members (28, 30) are biased in a direction away from each other but retained in said first position by means of said positioning member (54).
9. The hinge arrangement (66) according to any one of the preceding claims, wherein said positioning member (68) comprises a catch, attached to one of said second and third hinge members (28, 30), and adapted to hold said other of said second and third hinge members (28, 30) in said first and/or second position of said hinge arrangement (66).
10. The hinge arrangement (16) according to any one of the preceding claims, wherein said positioning member (46) comprises a fastening member, such as a screw, bolt or biased pin, in said first position of said hinge arrangement (16) said fastening member (46) is arranged to hold said second and third hinge members (28, 30) together in a predefined relative position, and in said second position of said hinge arrangement (16) said fastening member (46) is arranged to hold said second and third hinge members (28, 30) together in a different relative position.
11. The hinge arrangement (16) according to any one of the preceding claims, wherein said positioning member comprises an abutment member, such as a screw, bolt or biased pin, said abutment member being arranged such that in said first position of said hinge arrangement (16) said abutment member holds said second and third hinge members (28, 30) together and in said second position of said hinge arrangement (16), said third hinge member (30) abuts on said second hinge member (28) via said abutment member.

12. The hinge arrangement (52) according to any one of the preceding claims,
 wherein one of said second and third hinge members (28, 30) comprises a positioning portion (56), said positioning portion (56) has a shape element, such as a slot (58, 60) or a notch, providing at least one of said first and second positions, said positioning member being attached to the other of said second and third hinge members (28, 30), such that said positioning member (54) may be displaced in and out of said shape element (58, 60).
13. A vehicle (10) comprising
- a bonnet (12),
 - a body structure (22), and
 - at least one hinge arrangement (16, 52, 66, 76) according to any one of the preceding claims,
- wherein said first position of said hinge arrangement (16, 52, 66, 76) corresponds to said bonnet (12) being in a closed position,
 said second position of said hinge arrangement (16, 52, 66, 76) corresponds to said bonnet (12) being in a position suitable for mounting a windscreen (20).
14. A method of mounting a windscreen (20) in a vehicle according to claim 13, said method comprising
- displacing said second and third hinge members (28, 30) relative to each other from said first position to said second position of said hinge arrangement (16, 52, 66, 76),
 - mounting the windscreen (20),
 - displacing said second and third hinge members (28, 30) relative to each other from said second position to said first position of said hinge arrangement (16, 52, 66, 76).
15. The method according to claim 14 further comprising
- deactivating said positioning member (46, 54, 68, 78) from holding said second and third hinge members (28, 30) in a relative position corresponding to one of said first position or said second position of said hinge arrangement (16, 52, 66, 76),
 - performing said step of displacing said second and third hinge members (28, 30) relative to each other,
 - activating said positioning member (46, 54, 68, 78) to hold said second and third hinge members (28, 30) in a relative position corresponding to the other of said first position or said second position of said hinge arrangement (16, 52, 66, 76).

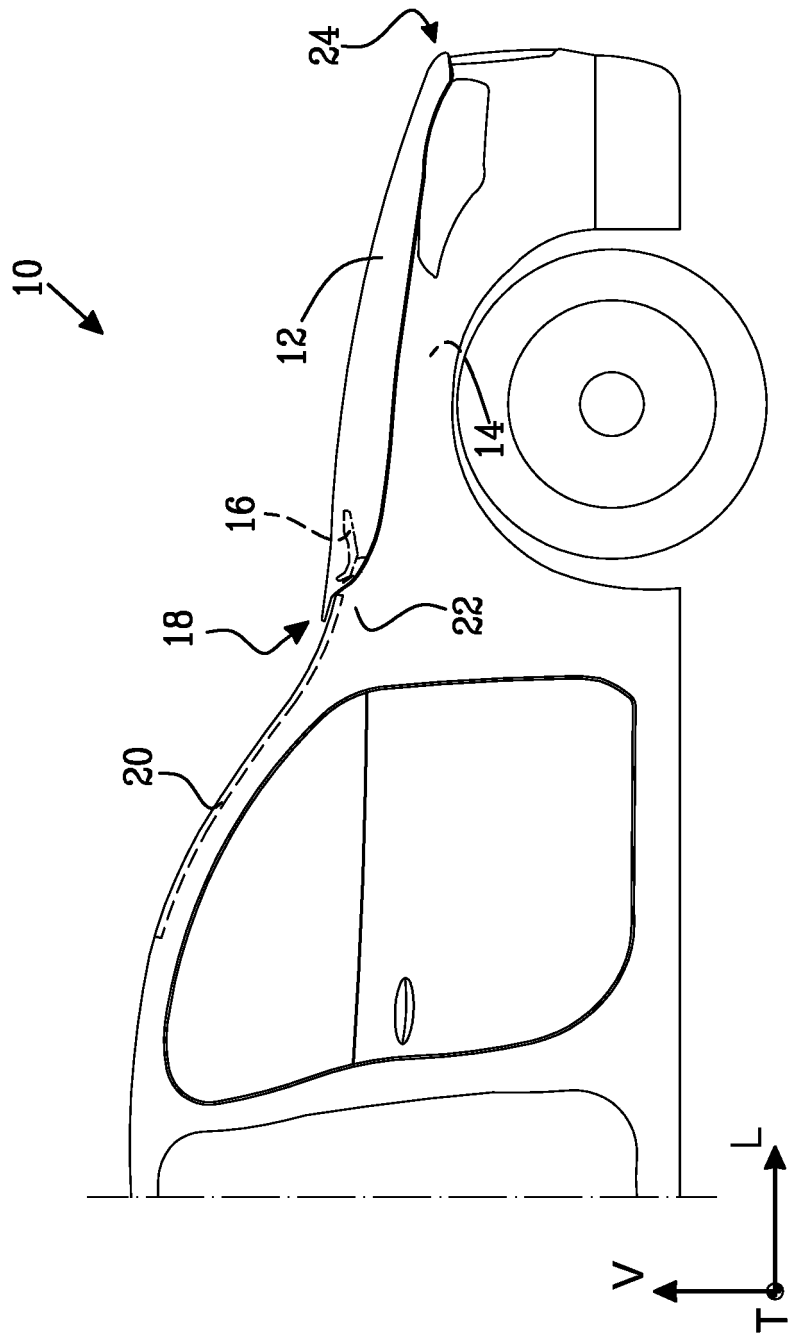


Fig. 1

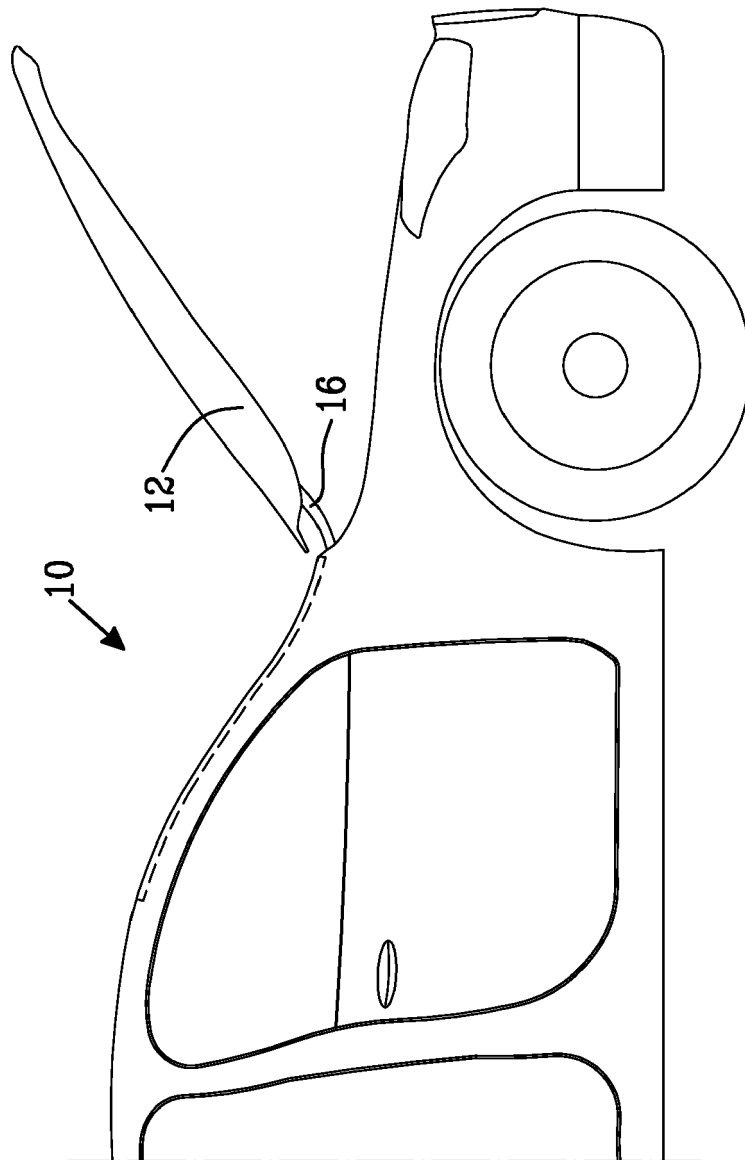


Fig. 2

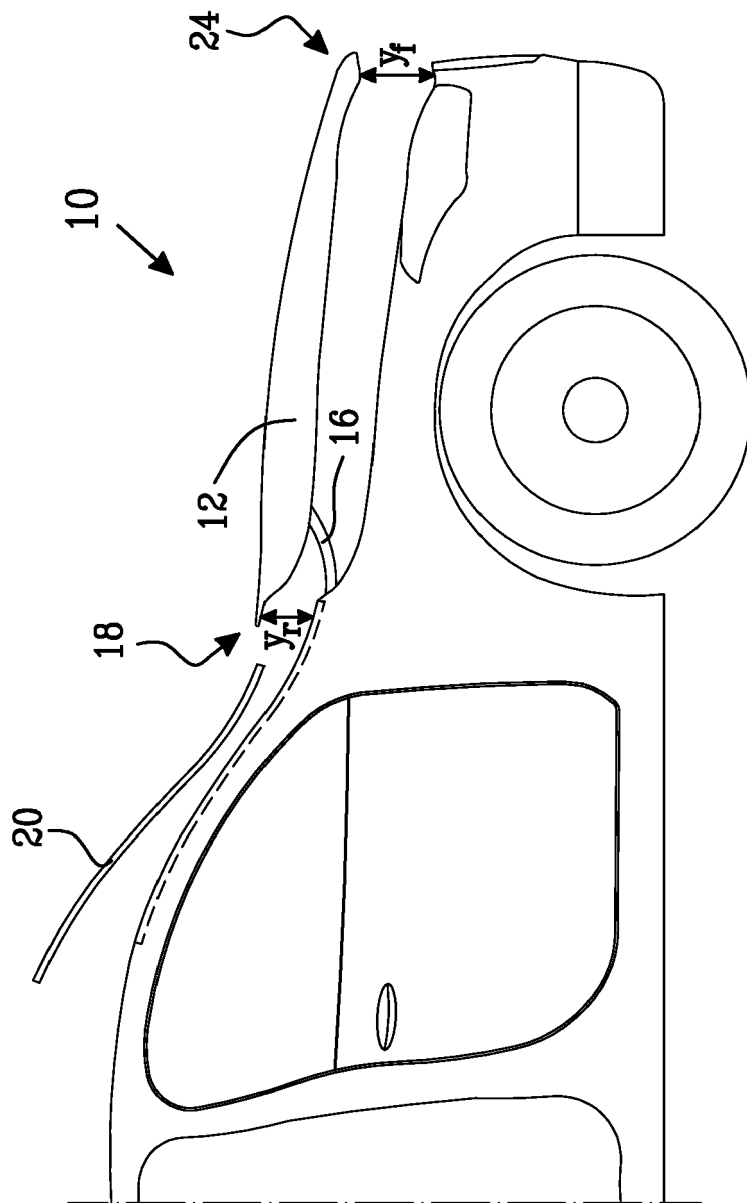


Fig.3

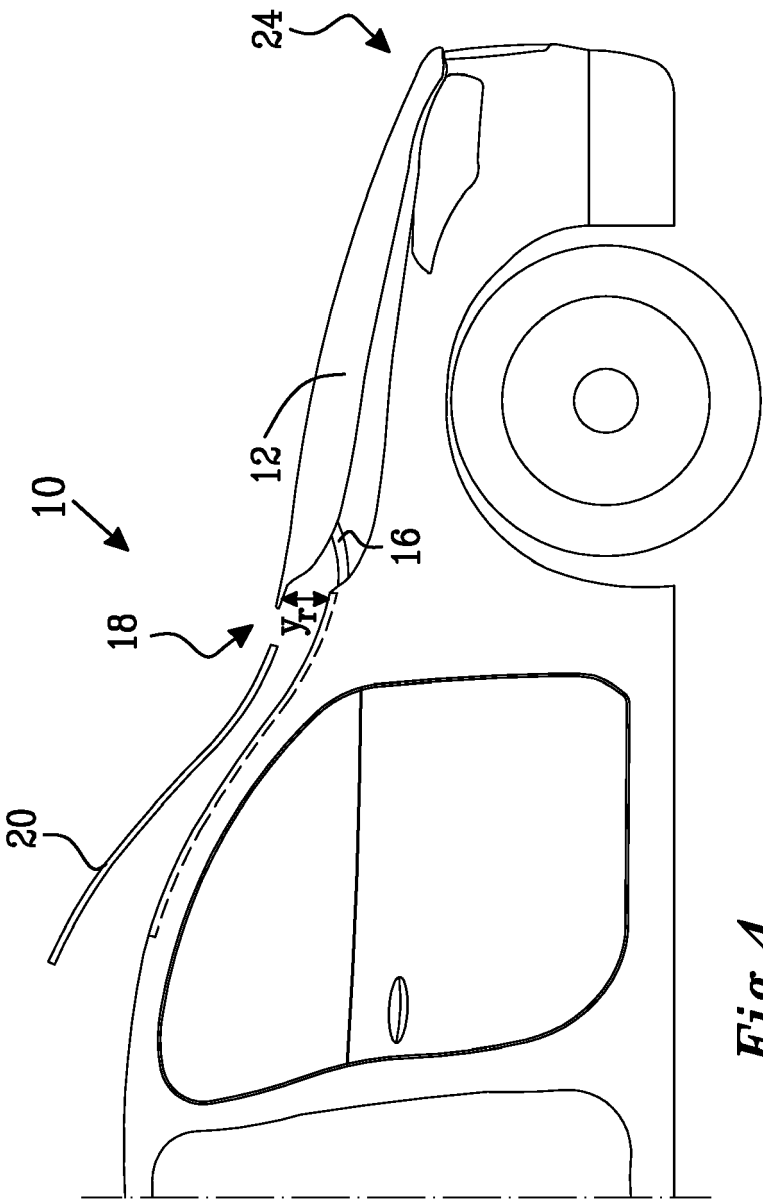
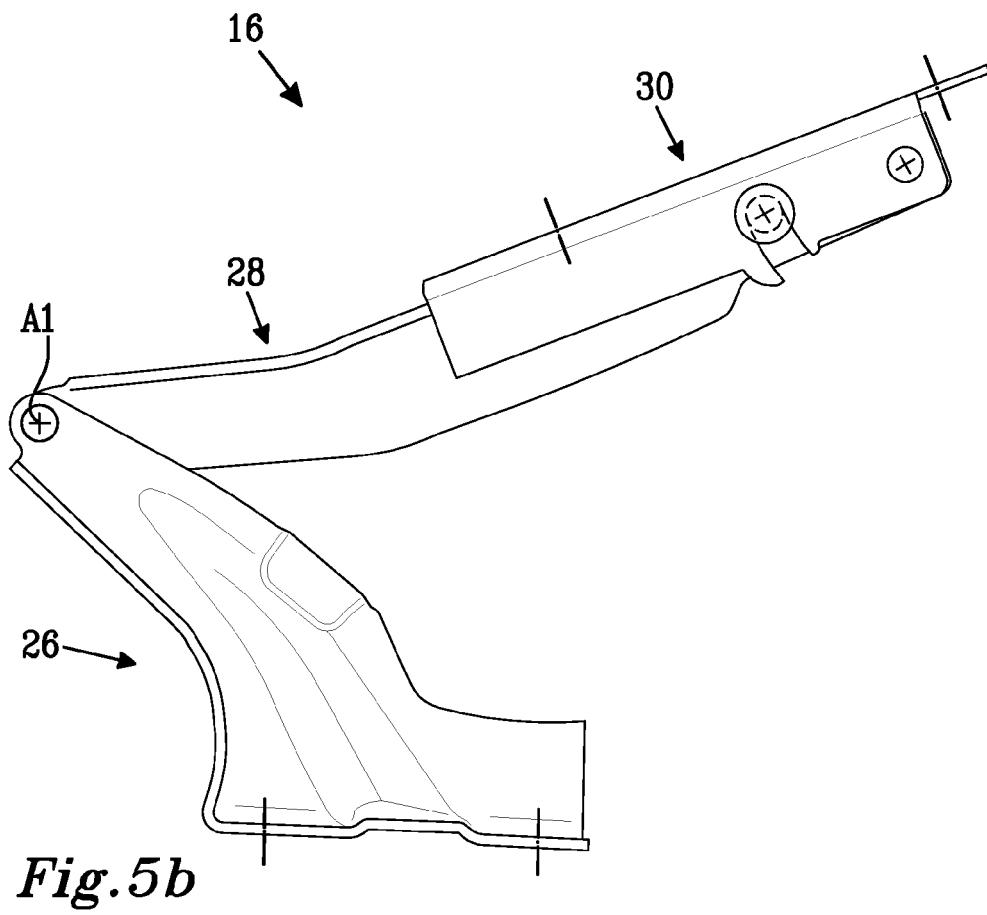
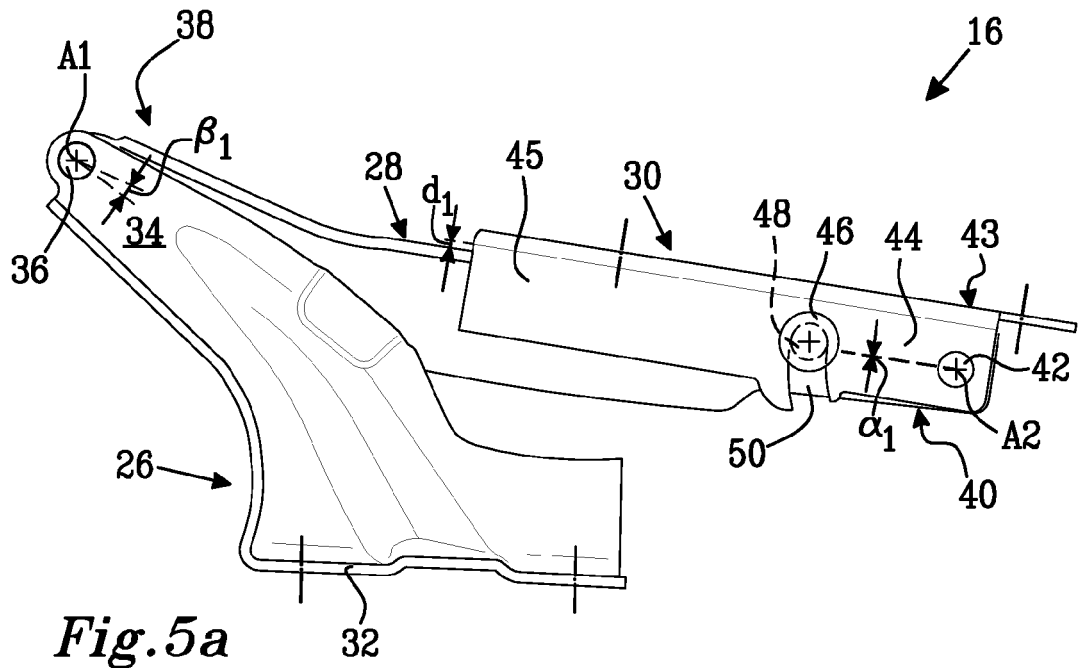


Fig. 4



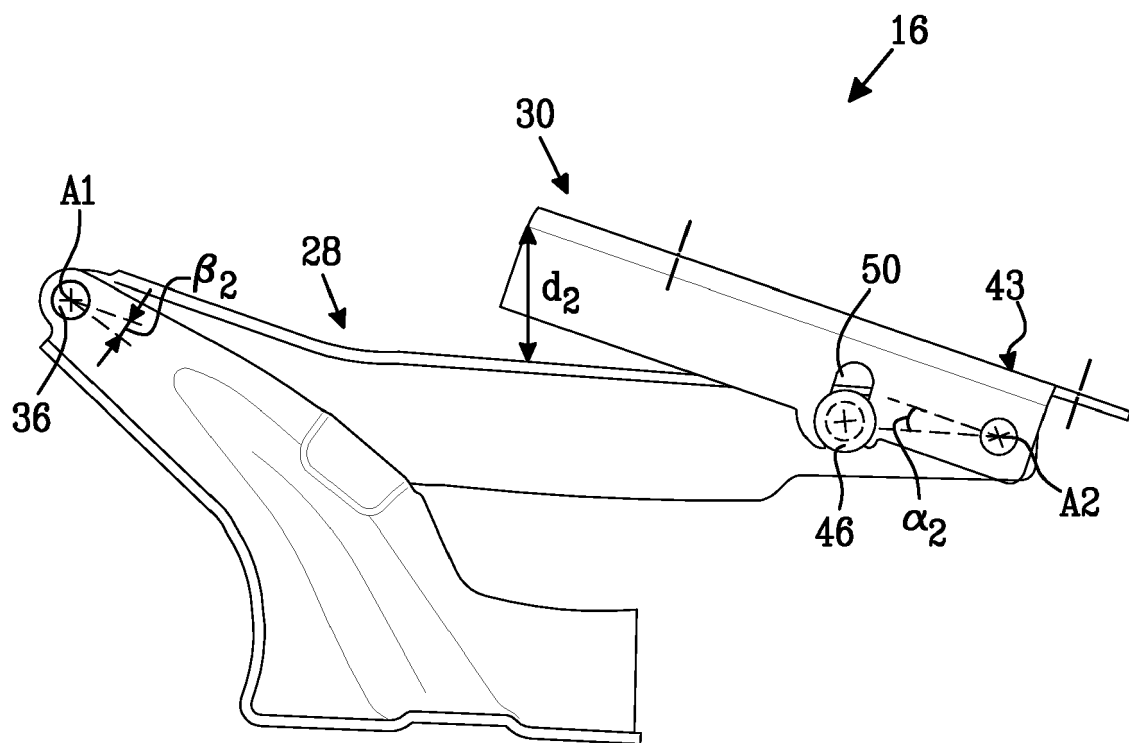


Fig. 6

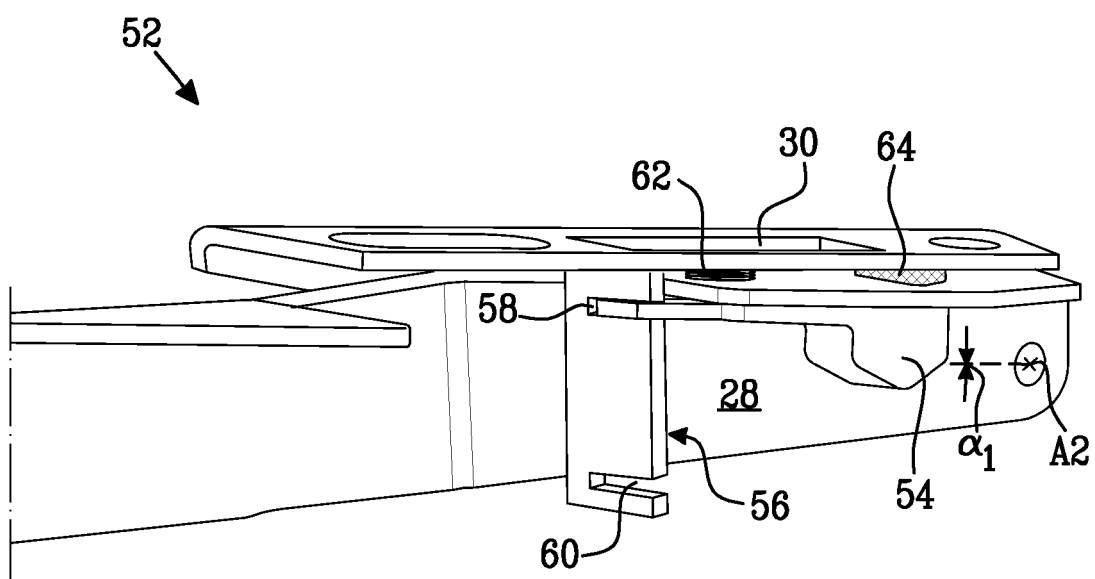


Fig. 7

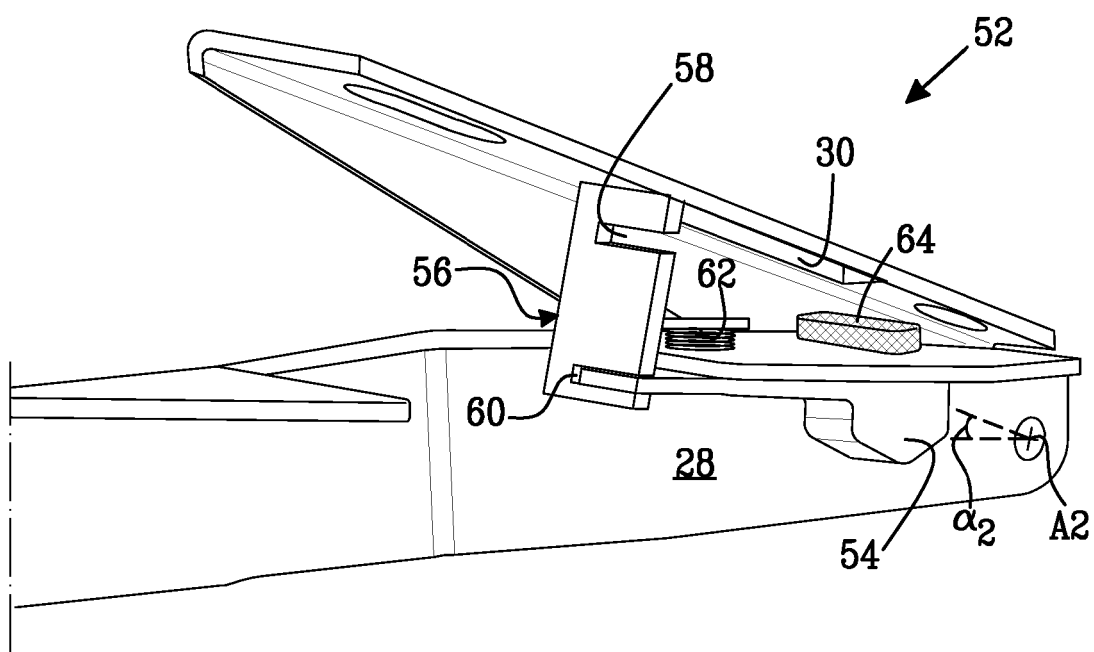


Fig. 8

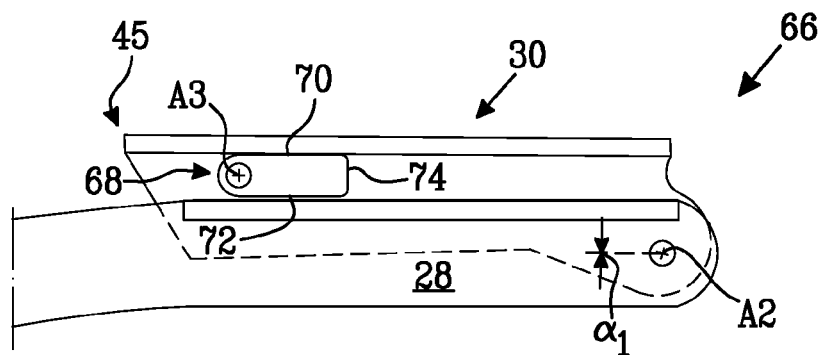


Fig. 9

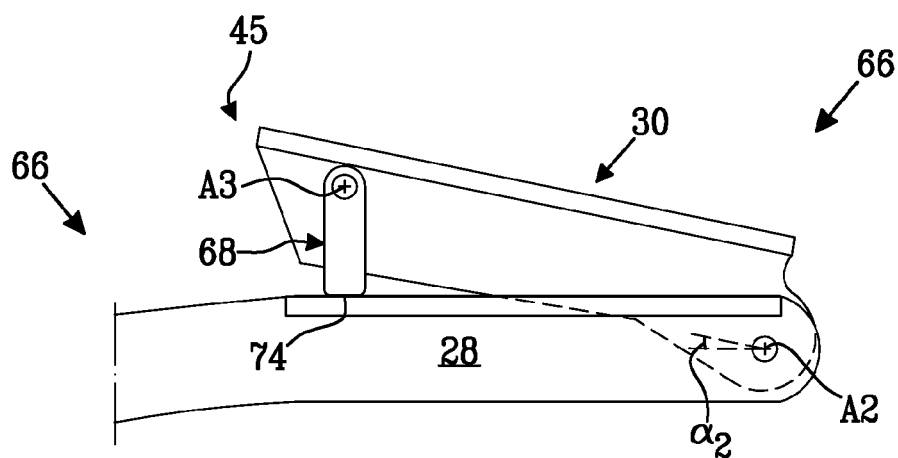


Fig. 10

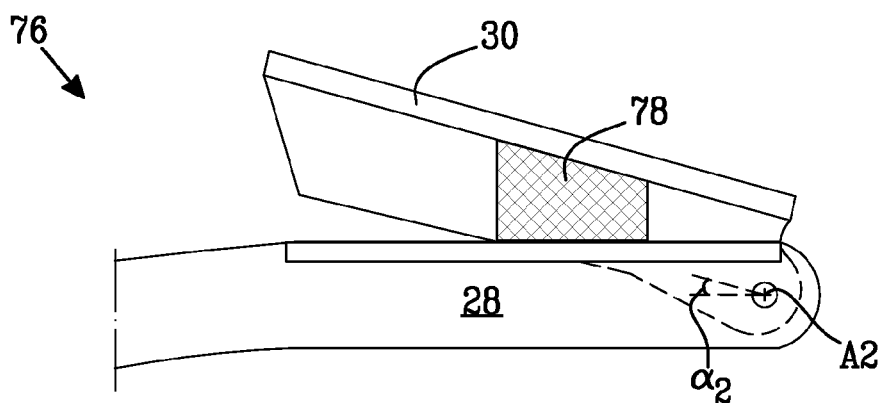


Fig. 11

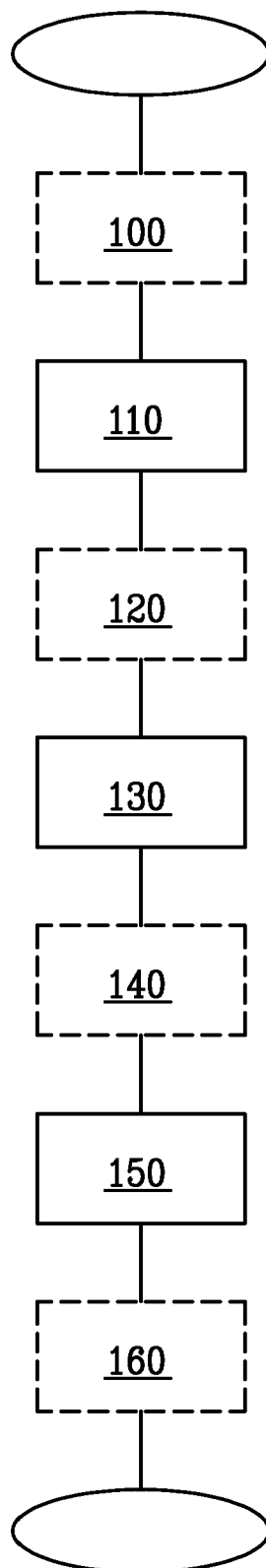


Fig.12



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Y	* paragraph [0005] *	14,15	
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Place of search The Hague		Date of completion of the search 26 September 2014	Examiner Mund, André
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