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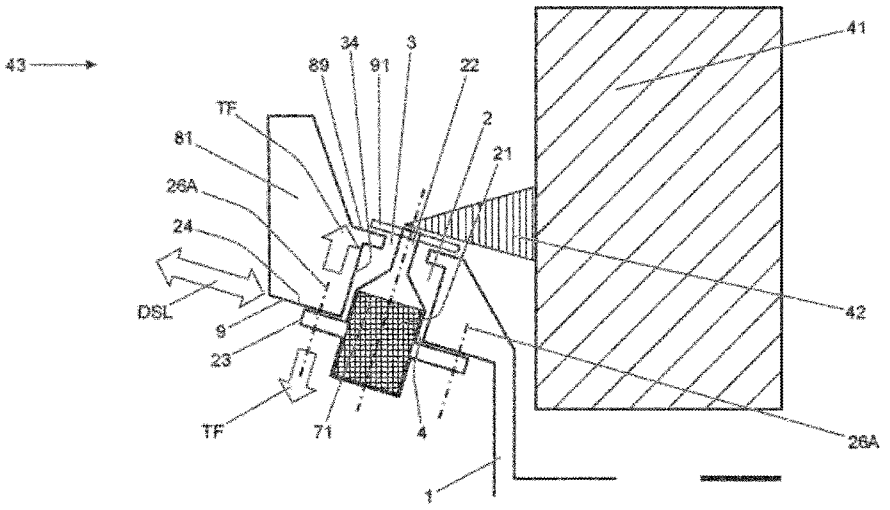


Fig. 2

(57) Abstract: A component (81) for a structural element for a vehicle (31), wherein the component (81) comprises a cavity (2) configured to house at least part of a power unit mount (21) when the power unit mount (21) is coupled to the component (81).

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COMPONENT FOR A STRUCTUAL ELEMENT FOR A VEHICLE

TECHNICAL FIELD

The present disclosure relates to a component for a structural element for a vehicle. Aspects of the invention relate to a cavity within the component, a structural element comprising the component, and a vehicle comprising the component, where the component has been configured to receive at least part of a power unit mount within a cavity of the component.

BACKGROUND

It is known to provide a power unit mount such as an engine mount, for coupling to a structural element such as a sub-frame, for a motor vehicle.

The power unit mount comprises an upper housing, a main spring part, a limb part, a snubber and a base plate. The upper housing is coupled to the base plate. The upper housing at least partially encloses a main spring part of the power unit mount. The limb part protrudes through and above the upper housing.

The power unit mount is then mounted on to an upper mounting surface of a component part for a structural element of a vehicle, so that at least the majority of the upper housing of the power unit mount is above the upper mounting surface of the component part.

To mount the power unit mount on an upper mounting surface of the component requires package space to be available above the upper mounting surface of the component part.

It is an aim of the present invention to address one or more of the disadvantages associated with the prior art.

SUMMARY OF THE INVENTION

Aspects and embodiments of the invention provide a component for a structural element for a vehicle, a sub-frame for a vehicle comprising the component, and a vehicle comprising the component. The component is configured to comprise the upper housing for a power unit mount when the power unit mount is coupled to the component.

According to an aspect of the present invention there is provided a component for a structural element for a vehicle comprising at least one cavity configured to receive at least part of a power unit mount, wherein the cavity comprises an upper opening, the cavity configured to receive a main spring part of a power unit mount, the upper opening configured to receive at least part of a limb part of a power unit mount through it when at least part of a main spring part of a power unit mount is received into the cavity.

Advantageously by the component comprising a cavity which may receive a power unit mount with an upper opening configured to pass at least part of a limb part through it, it may enable a reduction in the package space required above the component for the power unit mount, in comparison to having the power unit mount mounted on top of the component.

It may also advantageously enable the component to integrally comprise the upper housing part of the power unit mount. This may enable the power unit mount not to require an upper housing part when the power unit mount is not fitted to the component.

It may advantageously enable the component to be stronger and stiffer by utilising the package space more efficiently.

By the component providing the upper housing for the power unit mount, this may lead to a reduction in overall parts for a vehicle, and/or a reduction in overall weight of the vehicle. A reduction in weight of a vehicle may enable an improvement in the fuel economy in comparison to a heavier vehicle. An improvement in fuel economy may reduce the overall carbon dioxide emissions produced by the vehicle.

The cavity may comprise a lower opening. The upper opening may be smaller than the lower opening. The lower opening may be configured for passing at least part of a main spring part of a power unit mount when at least part of a power unit mount is received into the cavity.

The larger lower opening may enable the main spring part of the power unit mount to be received into the cavity of the component. This may enable the main spring part of the power unit mount to be received in to the cavity from below the component, which may aid servicing the power unit mount.

The mounting surface of the component may be configured to align at least one opening to the hole in the mounting surface with a corresponding hole of a base plate of a power unit mount, when the component is coupled to the power unit mount.

The component may be configured so that when coupled indirectly to a power unit via a power unit mount which has been fastened to the component by the fastening means, the primary

load applied to a head part of the fastening means due to the mass of the power unit is substantially a tensile load.

The component may be configured so that the cavity comprises at least one containment surface configured for limiting displacement of a main spring part of a power unit mount in at least one of a substantially X direction, Y direction, or Z direction. The X direction is along the longitudinal length of the vehicle so that X- is towards the front of the vehicle and X+ is towards the rear of the vehicle. The Y direction is across the lateral width of the vehicle so that Y- is towards the right hand side of the vehicle and Y+ is towards the left hand side of the vehicle. The Z direction is across the vertical height of the vehicle so that Z- is towards the ground the vehicle is on and Z+ is towards the roof of the vehicle.

Advantageously, by the cavity being configured to comprise at least one containment surface, the component may replace the function of an upper housing for a power unit mount which may enable the power unit mount not to have an upper housing prior to being coupled to the component.

The component may comprise a cavity wherein the at least one containment surface is substantially a continuous surface.

This may advantageously aid containing the spring part of the power unit mount when the forces being applied are not purely in an X direction, or a Y direction, or a Z direction.

The component may comprise a mounting surface in the vicinity of the lower opening of the cavity, the mounting surface may be configured to abut an upper surface of a mounting base plate of a power unit mount when a power unit mount has been coupled to the component.

By the component having a mounting surface in the vicinity of the lower opening of the cavity and configured to abut the upper surface of a mounting base plate, at least part of the power unit mount may be received into the cavity of the component, so that the overall package space required for the component and the power unit mount is less in comparison to if the lower surface of the base plate abutted the upper surface of the component.

The component may comprise a mounting surface in the vicinity of the lower opening of the cavity wherein the mounting surface may comprise at least one opening to a hole. The opening may be positioned so that a fastening means could be inserted and or removed from the at least one opening from below the lower opening of the cavity. The hole may be a threaded hole.

This may enable the power unit mount to be coupled or uncoupled from the component from the underside of the vehicle when the vehicle is having maintenance work undertaken on it, so that potentially a mechanic working on the vehicle may be able to undertake all the necessary coupling and uncoupling of the power unit mount to the component without the requirement to work from above and below the vehicle when uncoupling the component from the power unit mount.

The component may be configured to receive at least part of a fastening structure to allow the component to be coupled to a body of a vehicle.

This may enable the component to be used to couple more than just a power unit mount to the component. For example the component may be able to be coupled via a body mount to a body of the vehicle, via a power unit mount and power unit bracket to a power unit, and or a suspension system of the vehicle, an or via other coupling features to other structural components for example of a sub-frame.

Optionally the component may be made substantially of an aluminium alloy, or a steel.

Optionally, the component may be a substantially cast component.

Optionally, the component may be a substantially extruded component.

Optionally, the component may be a substantially pressed component

Optionally, the component may be a structural component for a structural element of a vehicle, for example the structural element may be a sub-frame for a vehicle, a part of the body part for a vehicle, or a part of a chassis for a vehicle.

In an aspect of the present invention, a sub-frame for a vehicle may comprise the component of the present invention. In some embodiments it may be a component part of the sub-frame assembly, or in an alternative embodiment the component may be a single unitary part comprising all parts of the sub-frame.

Advantageously, the sub-frame comprising the component may aid the assembly process of the vehicle, as the power unit mount may be coupled to the component prior to the sub-frame being coupled directly or indirectly to the body of the vehicle, and or it may be that the component may be coupled to the power unit mount prior to the to the power unit bracket being coupled via a power unit bracket to the power unit. Optionally, a sub-frame for a vehicle may comprise the component configured to couple to a power unit mount, so that when the component is coupled to the power unit mount the component substantially comprises the upper housing of the power unit mount.

A sub-frame may comprise the component integrally.

Advantageously, this may enable the power unit not to have an upper housing until it is coupled to the component part of the sub-frame.

In an aspect of the present invention, a longitudinal chassis member for a vehicle may comprise the component of the present invention.

Optionally, a vehicle may comprise an embodiment of the component and or the sub-frame comprising the component and or a longitudinal chassis member comprising the component wherein the component is configured to be the upper housing of a power unit mount when a power unit mount is coupled to the component.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and or features of any embodiment can be combined in any way and or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which;

Figure 1 shows a known component part of a sub-frame for a vehicle with a power unit mount mounted on an upper mounting surface of the component;

Figure 2 shows a cross section a component part of a sub-frame according to an embodiment of the present invention for a vehicle with a power unit mount coupled to a lower mounting surface of the component;

Figure 3 shows a cross section of an example embodying the present invention of a component part of a sub-frame for a vehicle with a power unit mount coupled to a lower mounting surface of the component;

Figure 4 shows an embodiment of the present invention looking from below at the component;

Figure 5 shows an embodiment of the present invention looking from beneath the lower mounting surface of the component;

Figure 6 shows an embodiment of the present invention looking from above the upper opening;

Figure 7 shows a sub-frame for a vehicle in accordance with an embodiment of the present invention;

Figure 8 shows a vehicle in accordance with an embodiment of the invention;

Figure 9 shows a schematic representation of a power unit mount configured for use with an embodiment of the present invention.

DETAILED DESCRIPTION

With reference to figure 1, it shows a schematic representation of a known component 181 for a sub-frame 101 for a vehicle. The sub-frame 101 is configured so that at least one power unit mount 121 of a power unit mounting system 143 is coupled to the upper mounting surface 109 of a component 181.

The power unit mount 121 comprises an upper housing 134, a base plate 123, a main spring part 171, snubber 191, and a limb part 122. The upper housing 134 contacts an upper surface 124 of the base plate 123. The upper housing 134 substantially encloses the main spring part 171 of the power unit mount 121

When coupled via a fastening means to a component 181 of a sub-frame 101 for a vehicle, the lower surface 125 of a base plate 123 of the power unit mount 121 contacts the upper mounting surface 109 of the component 181 when the component 181 is coupled to the power unit mount 121.

The power unit mount 121 is connected indirectly to a power unit 141 of a vehicle via a power unit bracket 142.

It is to be appreciated that whilst figure one shows an example of a power unit mounting system 143 with one power mount unit 121, it is known to have more than one power unit mount on a power unit mounting system.

The upper mounting surface 109 of the component 181 contacts the lower surface 125 of the base plate 123 of the power unit mount 121 when the component 181 is coupled to the power mount unit 121.

A fastening means along the fastening means axis 126A secures the component 181 to the power mount unit 121 such that even when the vehicle is stationary a substantially compressive force CF is generated by the power unit 141 on to the component 181 via the power mount unit 121.

Package space is required above the upper mounting surface 109 of the component 181 to be able to package the base plate 123 and the upper housing 134 of the power unit mount 121.

Large dynamic vertical power unit loadings, for example when a vehicle (not shown) with the power unit 141 is driven into a pot hole, are reacted via a load-path through the power unit bracket 142, and the power unit mount 121, into the component 181 of sub-frame 101.

Large dynamic radial power unit loadings, for example when a vehicle (not shown) with the power unit 141 is driven around a bend in a road at speed, are reacted via a load-path through the power unit bracket 142, and the power unit mount 121, resulting in a loading slip-plane on the lower surface 125 of the base plate 123 of the power unit mount 121. These dynamic slip loadings DSL1 must be managed by the fastening means on fastening means axes 126A.

A component in accordance with an embodiment of the present invention is described herein with reference to the accompanying figures 2 to 8.

With reference to Figure 2, there is shown a part representation of a power unit mounting system 43 comprising one embodiment of the component 81 of the present invention on the left hand side of the power unit 41.

Dependent upon the requirement of the power unit mounting system 43 there can be more than one embodiment of the component 81 of the present invention, for example, for use on the right hand side of a vehicle, the left hand side of the vehicle, towards the front of the vehicle or towards the rear of the vehicle.

The power unit 41 is coupled indirectly to the component 81 via a power unit bracket 42 and a power unit mount 21. The power unit 41 is an internal combustion engine.

Alternative types of power unit are known for example (not shown), it is envisaged that the power unit is an electric drive machine that is powered by battery power. In another alternative (not shown) the power unit is a hybrid engine.

The component 81 is for a structural element 61 for a vehicle 31. The structural element 61 is part of a sub-frame 1 for a vehicle 31 (shown on Figure 8). In an alternative (not shown) the structural element is a reinforced part of the body of the vehicle. In another alternative (not shown) the structural element is part of a longitudinal chassis member for a vehicle.

A structural element 61 for example for a sub-frame 1, is a component that is stiff enough not to plastically deform under the static or dynamic loadings transmitted to the component 81 via the power unit mount 21 from the power unit 41 when the vehicle 31 is driving or is stationary.

The component 81 comprises a cavity 2 configured to receive at least part of the power unit mount 21. The cavity 2 comprises an upper region 50 next to an upper opening 3 which is configured to pass through at least part of an limb part 22 of the power unit mount 21 so that at least part of the limb part 22 of the power unit mount 21 is above an upper surface 89 of the component 81 in the vicinity of the upper opening 3 of the cavity 2.

The cavity 2 also comprises a lower opening 4 configured to pass through at the limb part 22 and at least part of a main spring part 71 of a power unit mount 21.The lower opening 4 is adjacent to a lower region 51 of the cavity 2.

The cavity 2 is configured to receive at least part of the power unit mount 21 which has had at least part of a main spring part 71 of a power unit mount 21 received into the cavity 2 so that at least a part of the limb part 22 extends through the upper opening 3 of the cavity. A smaller amount of package space is required for the power unit mount 21 above the upper surface 89

of the component 81 in comparison to having a known power unit mount 121 mounted on a mounting surface 109 of a component 181.

The configuration of the cavity 2 can make the component 81 stronger and stiffer in comparison to the component 181 having a rectangular box section, due to the form and shape of the configuration of the cavity 2

The upper opening 3 and or the lower opening 4 are the appropriate size and shape in order to carry out their function, of one or both of allowing parts of the power unit mount 21 to pass through them, and or constraining the dynamic or static displacement of a main spring part 71 of the power unit mount 22.

It is to be appreciated that the smaller of the two openings of the cavity 2 is considered the upper opening 3 and the larger of the two openings of the cavity 2 is considered the lower opening 4, regardless of their orientation or location in the component 81.

Figure 6 shows an embodiment of the component 81 with a substantially rectangular upper opening 3 with curved corners which is symmetrical in shape.

Figure 4 shows an embodiment of the component 81 with a cavity 2 comprising symmetrical circular upper opening 3 and lower opening 4. The shape of cavity 2 and the upper and lower openings 3, 4 is configured to suit for the function the opening 3, 4 needs to perform.

In alternative embodiments (not shown) the shape of one or both of the upper and lower openings is, asymmetrical.

In another alternative embodiment (not shown) the shape of one or both of the upper and lower openings in non-symmetrical.

The shape of cavity 2 and the upper opening 3 can be tuned in size and or shape during design and or development of the component 81 to accommodate an allowable amount of displacement of the limb part 22, when the vehicle is being driven or is stationary.

The power unit mount 21 (as shown in Figure 9) prior to coupling to the component 81 does not have an upper housing part around at least part of the main spring part 71 of the power unit mount 21.

The cavity 2 is configured suitably to be the upper housing part 34 for the power unit mount 21.

The upper opening 3 of the cavity 2 allows part of the limb part 22 to pass through the upper opening 3 and prevents the larger main spring part 71 of the power unit mount 21 from passing through the upper opening 3.

Part of the main spring part 71 of the power unit mount 21 is inserted into and received by the cavity 2 so that part of the limb part 22 of the power unit mount 21 passes through the upper opening 3 of the cavity 2. The upper mounting surface 24 of the base part 23 of the power unit mount 21 abuts the lower mounting surface 9 of the component 81.

The power unit mount 21 is securely coupled to the component 81 via fastening means 26 in the form of bolts on fastening axes 26A between the component 81 and the power unit mount 21.

The component 81 is configured so that when it is coupled indirectly to a power unit 41 via a power unit mount 21 which has been fastened to the component 81 by a fastening means 26, the primary load applied to a head part 28 of the fastening means 26 due to the mass of the power unit 41 is substantially a tensile force TF.

The power unit mount 21 configured for use with the component 81 for a sub-frame 1 of a vehicle 31 comprises a main spring part 71, which is attached at least in part to a mounting base plate 23. Prior to the power unit mount 21 being coupled to the component 81 for a sub-frame 2, the power unit mount does not have an upper housing. The lack of an upper housing would allow the main spring part 71 under loading to be deflected when a force is applied to it.

The power unit 41 system can apply a static loading due to gravity when the vehicle is stationary and the power unit 41 is not running, and or a dynamic loading when the engine is running, or the vehicle 31 is accelerating or deaccelerating, cornering, driving over pot holes or other events that may put dynamic load forces into the power unit mount 21.

For vehicle refinement reasons the main spring part 71 of the power unit mount 21 is designed to resist the dynamic loading forces transferred to the main spring part 71 by the power unit mount 21.

The deflection of the main spring part 71 of the power unit mount 21 needs to be limited to ensure that no damage occurs to the power unit 41 or other mechanisms that may be directly

or indirectly coupled to it for example the sub-frame of the vehicle 31 or the power unit mount bracket 42 or other components or mechanisms (not shown) for example the gear box and drive transmission shafts of the vehicle.

The deflection of the main spring part 71 of the power unit mount 21 needs to be limited to ensure that a clearance is maintained where required between the power unit 41 and other parts of the vehicle for example the body 33 of the vehicle 31 when dynamic loading forces are applied to the main spring part 71 of the power unit mount 21.

Physical constraining surfaces needs to be put in place around the main spring part 71 due to the dynamic loading forces that can be experienced by the power unit 41 of the vehicle 31 and transferred to the power unit mount 21 main spring part 71.

With reference to primarily to Figure 3, the component 81 is configured to be coupled to the power unit mount 21 without the power unit mount 21 having its own separate upper housing prior to coupling to the component for constraining the amount of displacement of the main spring part 71 of the power unit mount 21 in at least one of an X, Y or Z direction. The displacement limited may be a static loading displacement, for example due to gravity acting on the power unit 41, or a dynamic displacement, for example due to acceleration or de-acceleration of the vehicle 31.

The X direction is along the longitudinal length of the vehicle 31 so that X- is towards the front of the vehicle 31 and X+ is towards the rear of the vehicle 31. The Y direction is across the lateral width of the vehicle 31 so that Y- is towards the right hand side of the vehicle and Y+ is towards the left hand side of the vehicle 31. The Z direction is across the vertical height of the vehicle 31 so that Z- is towards the ground the vehicle 31 is on and Z+ is towards the top of the vehicle 31.

The lower region 51 and the upper region 51 of the cavity 2 each comprise two opposing containment surfaces 5A, 5B, and 5C, 5D respectively, configured to constrain the main spring part 71 of the power unit mount 21 in at least one X direction when the main spring part 71 deflects in a substantially X direction when dynamic loading substantially in the X direction is applied to the main spring part 71 of the power unit mount 71. For example upper region 50 containment surface 5D and lower region containment surface 5B would constrain the main spring part 71 if it moved in an X- direction and came into contact with the containment surfaces 5B, 5D, or if the main spring part 71 moved in a X+ direction containment surfaces 5A, 5C would constrain it when contact was made.

It is to be appreciated that contact may be made with just one of the containment surfaces 5A, 5B, 5C, 5D depending on the amount of displacement in an X direction of the main spring part 71.

It is to be appreciated that in an alternative embodiments (not shown) the cavity could be configured so that only two opposing surfaces of the cavity are configured to be containment surfaces to constrain the main spring part in a substantially X direction.

When coupled to the power unit mount 21 the containment surface 5A, 5B, 5C, 5D will constrain the main spring part 71 of the power unit mount 21 in at least one X direction, when the main spring part 71 tries to deflect in a substantially X direction. Dynamic loading can occur in an X direction for example when the vehicle 31 accelerates and or de-accelerates in a straight line.

The lower region 51 and the upper region 51 of the cavity 2 each comprise four opposing containment surfaces 6A, 6B, 6C, 6D (6A and 6C only shown in Figure 3 which is symmetrical to an opposing surface, not shown) configured to constrain the main spring part 71 of the power unit mount 21 in at least one Y direction when the main spring part 71 deflects in a substantially Y direction when dynamic loading substantially in the Y direction is applied to the main spring part 71 of the power unit mount 71. When coupled to the power unit mount 21 the containment surface 6A, 6B, 6C, 6D will constrain movement of the main spring part 71 of the power unit mount 21 in at least one Y direction when the main spring part 71 tries to deflect in a substantially Y direction. Dynamic loading can occur substantially in the Y direction for example when the vehicle 31 is turns a corner.

For example upper region 50 containment surface 6D and lower region containment surface 6B would constrain the main spring part 71 if it moved in an Y- direction and came into contact with the containment surfaces 6B, 6D, or if the main spring part 71 moved in a Y+ direction containment surfaces 6A, 6C would constrain it when contact was made.

It is to be appreciated that contact may be made with just one of the containment surfaces 6A, 6B, 6C, 6D depending on the amount of displacement in an X direction of the main spring part 71.

It is to be appreciated that in an alternative embodiment (not shown) the cavity could be configured so that only two surfaces of the cavity are configured to be containment surfaces to constrain the main spring part in a substantially Y direction.

Large dynamic power unit loadings in –Z direction are reacted via a load-path through power unit bracket 42, snubber 91, efficiently into the component 81.

By the component 81 cavity 2 comprising the X direction constraining surfaces 5A, 5B, 5C, 5D and the Y direction constraining surfaces 6A, 6B, 6C, 6D the fixings 26A are not required to react to large dynamic loadings in the +/-X or +/-Y directions, as the power unit loadings are reacted via a load-path through bracket 42, power unit mount 21 efficiently into the component 81. Resulting dynamic slip loadings DSL along the loading slip-plane surface 24 are low in comparison to a known power unit mount 121 which is mounted on the upper surface 109 of the component 181.

The component 81 comprises a containment surface 7 configured to constrain the main spring part 71 of the power unit mount 21 in the Z+ direction when the main spring part 71 deflects in a substantially Z+ direction when dynamic loading substantially in the Z+ direction is applied to the main spring part 71 of the power unit mount 71. So that when coupled to the power unit mount 21 a containment surface 7 will constrained the main spring part 71 of the power unit mount 21 in the Z+ direction when the main spring part 71 tries to deflect in a substantially Z direction. Dynamic loading can occur substantially in the Z+ direction for example when the vehicle 31 drives into a pot hole.

One or more containment surfaces 5A, 5B, 5C, 5D, 6A, 6B, 6C, 6D, 7 may be tuned in size and shape during design and or development of the component to accommodate an allowable amount of displacement of the main spring part 71 of the power unit mount 21.

It is to be appreciated when talking about an X, Y, or Z direction of loading or movement of the main spring part 71 of the power unit mount 81 the direction referred to is substantially the primary direction that the majority of the loading is being applied to the power unit mount 21.

For example under braking the loading being applied to the main spring part 71 of a power unit mount 22 can initially be in the X- direction as the inertia of the power unit 41 tries to continue moving forwards at a given velocity, but as the vehicle de-accelerates the power unit 41 can have less forwards momentum in comparison to the rest of the vehicle 33 and therefore the power unit 41 can apply a loading in the X+ direction of the vehicle.

Alternatively for example, if the direction of force being applied is lateral for example when the vehicle goes around a tight bend at speed the primary loading could be considered to be in a Y direction. Alternatively for example, a vertical loading in the Z direction can be received into the power unit 41 and subsequently the power unit mount 21 when the vehicle 31 drives over a pot hole or drives up and over a kerb.

It further to be appreciated that the direction of the loading is not likely to be purely in a singular X, Y, Z direction, but is likely to be at any vector of them, with the direction closest being considered the primary direction of the loading experienced.

It is further to be appreciated that whilst the containment surfaces 5A, 5B, 5C, 5D, 6A, 6B, 6C, 6D, 7 are configured to constrain the main spring part of the power unit mount, they can be configured to allow an amount of displacement of the main spring part 71 of the power unit mount 21 before a containment surface 5A, 5B, 5C, 5D, 6A, 6B, 6C, 6D constrains any further displacement of the main spring part 71.

It should be further appreciated that the containment surfaces 5A, 5B, 5C, 5D, 6A, 6B, 6C, 6D, 7 can be configured to allow a different displacement of the main spring part 71 in one direction in comparison to the opposing direction, for example but not limited to in a X- direction the displacement allowed is greater than in the X+ direction due to location of the surrounding bodywork of the body 33 in the X+ direction.

The containment surfaces 5A, 6A, 5B, 6B, 5C, 6C, 5D, 6D, 7 are configured to function as an upper housing 34 for the power unit mount 21 when the power unit mount 21 is coupled to the component 81.

Figure 4 shows the constraining surfaces of the component 81 for the X and Y directions to be one continuous surface 8 in the lower region of the cavity 2, and one continuous surface 58 in the upper region of the cavity 2, which is symmetrical around the centre lines A, B of the cavity 2. For example the lower region 51 continuous surface 8 comprises constraining surfaces 5A, 5B, 6A, 6B for constraining the main spring part 71 in X and Y directions, and the upper region 50 continuous surface 58 comprises constraining surfaces 5C, 5D, 6C, 6D for constraining the main spring part 71 in X and Y directions.

It is to be appreciated that the opposing containment surfaces are configured appropriately for the function they perform. It is envisaged that in alternative designs (not shown) of the constraining surfaces they are asymmetrical and or non-symmetrical dependent on the design requirements for the dynamic displacement of the main spring part 71 of the power unit mount 21 in one direction in comparison to the opposite direction.

It should also be appreciated that in an alternative embodiment (not shown), the constraining surfaces for the X and Y directions are not one continuous surface. For example there could be a slot in the side of the constraining surface to allow tool access into the cavity of the component.

In some embodiments it is to be appreciated that there is not a constraining surface for at least one direction. For example by design there may be no excessive dynamic movement of the main spring part in a Z+ direction of the power unit mount, therefore to aid reducing the overall weight of the vehicle it could be appropriate for there to be less of a constraining surface for a particular direction of main spring part 71 of the power unit mount 21.

With reference to figures 3 to 5, the component 81 comprises a mounting surface 9 in the vicinity of the lower opening 4 of the cavity 2. The mounting surface 9 is configured to abut the upper mounting surface 24 of the base plate 23 of the power unit mount 21 when the power unit mount 21 is coupled to the component 81.

The component 81 is fastened to the power unit mount 21 by fastening means 26 in the form of three bolts that have being insert through a corresponding hole 27 in the base plate 23 of the power unit mount 22 (see Figure 9). The component 81 mounting surface 9 have openings 66 to holes 64 which are threaded, configured to align up with the holes 27 in the base plate 23 of the power unit mount 21 when the component 81 is coupled to the power unit mount 21. The fastening means 26 being fastened to the threaded hole until the required torque is obtained.

It is to be appreciated that in an alternative embodiment (not shown) the hole is open on both sides of the hole and the bolt is coupled to a nut at the opposing end of the fastening means head of the hole to clamp the component to the power unit mount.

When the component 81 has received the part of the power unit mount 21 that the cavity 2 has been configured to receive. The fastening means 26 is inserted through the hole 27 in the base plate 23 of the power unit mount 21 and into the opening 66 of the hole 64 which is threaded. The fastening means 26 is inserted or removed for the hole 64 from below the lower opening 4 of the cavity 2. This aids access from below the component 81 when coupling or uncoupling the fastening means 26 and subsequently the power unit mount 21.

Having access from below the component 81 can be beneficial when servicing the power unit mount, as it would not require access to both sides of the power unit mount 21 to replace the power unit mount 21 from the component 81, before connecting to or after disconnecting the power unit mount 21 from the power unit bracket 42.

With reference to figures 5 to 7, the component 81 comprises a hole 52 configured for a fastening 53 to couple the component 81 to the body 33 of a vehicle (shown Figure 8). The fastening 53 is a bolt, but in an alternative embodiment (not shown) a body mount and bolt are inserted in to the hole 52. The body mounts are used to aid the refinement of the drive for

occupants of the vehicle, by isolating some of the inputs between the body and a sub-frame of a vehicle.

The component 81 is an aluminium component. The component is substantially a cast component, with subsequent machining operations being undertaken to finish configuring the component 81. As a cast component there can be some inclusions in the aluminium from the casting process, but these do not exclude the component from being considered to be substantially made of aluminium.

Alternatively, the component 81 is a substantially an extruded component.

In another alternative the component 81 is a substantially a pressed steel fabricated component.

With reference to figures 5 to 7, the component is a substantial cast component 81 which is a structural part of the sub-frame 1 of a vehicle 31 (shown in Figure 8). The component 81, as well as having a cavity 2 configured to receive at least part of an power unit mount 21, and a hole 52 to receive a fastening means to couple the component 81 to the body 33 of the vehicle 31, also has features 55 in the component 81 for coupling the component 81 to other parts 59 of the sub-frame assembly 1 and or to other parts 69 of a chassis for the vehicle.

Figure 7 shows the component 81 when configured to be an integral part of the sub-frame 1, when the component 81 is coupled to other parts 59 of the sub-frame 1 to make the sub-frame 1.

The component 81 has additional coupling features 56 for coupling to part of the suspension system (not shown) of the vehicle 31 (shown in Figure 8).

In an alternative embodiment (not show) the component could be a single unitary component including at least one cavity configured to receive at least part of the main spring part and part of the limb part of a power unit mount, when the component is coupled to the power unit mount along with all other features of a sub-frame.

Figure 7 shows a sub-frame 1 which comprises two components 81 configured to be coupled to two power unit mounts 21 so that the components 81 substantially comprise the upper housing 34 of the power unit mount 34.

Figure 8 shows a vehicle 31 comprising a component 81 coupled to a power unit mount 21. The component 81 comprises a cavity 2 comprising at least part of a limb part 22 and a main spring part 71 of a power unit mount 21. The component 81 being an integral part of a sub-frame 1 that is coupled to the body 33 of a vehicle 31 by a fastening means 53, and is indirectly

coupled to a power unit 41 for the vehicle 31 via a intermediary power unit bracket 42 which has been secured to the limb part 22 of the power unit mount 71 via a fastening means 44 in the form of a nut.

Figure 9, shows a power unit mount 21 that has been configured for coupling to a component 81 for a sub-frame 1 of a vehicle 31 where the component 81 (not shown)is configured to comprise the upper housing 34 for the power unit mount 21. The power unit mount 21 does not have an upper housing to dynamically contain the main spring part 71, prior to the component 81 (not shown) being coupled to the power unit mount 21.

The power unit mount 21 comprises a mounting base plate 23 with an upper surface 24, the upper surface 24 configured to abut to a mounting surface 9 of the component 81.

The mounting base plate 23 of the power unit mount 21 comprises at three holes 27 configured so that a fastening means 26 can be inserted into the each hole 27 so that a head part 28 of the fastening means 26 applies a clamping force directly or indirectly via a washer for example to the lower surface 25 of the mounting base plate 23 when the fastening means 26 are fastened to couple the component 81 to the power unit mount 21.

The component 81 is configured so that when the power unit mount 21 is coupled directly or indirectly to a power unit 41 and the power unit mount 21 is coupled to a component 81 of a sub-frame 1 for a vehicle 31 via a fastening means 26, the primary load applied to a head part 28 of the fastening means 26 due to the mass of the power unit 41 is substantially a tensile load TF due to gravity.

It will be appreciated that various changes and modifications can be made to the present invention without departing from the scope of the present application.

CLAIMS

1. A component for a structural element for a vehicle comprising, at least one cavity configured to receive at least part of a power unit mount,

wherein the cavity comprises an upper opening, and a lower opening, wherein, the upper opening is smaller than the lower opening,

the cavity configured to receive a main spring part of a power unit mount,

the lower opening is configured for passing at least part of a main spring part of a power unit mount when at least part of a power unit mount is received into the cavity,

the upper opening configured to receive at least part of a limb part of a power unit mount through it when at least part of a main spring part of a power unit mount is received into the cavity,

the component comprises a mounting surface in the vicinity of the lower opening of the cavity, the mounting surface configured to abut an upper surface of a mounting base plate of a power unit mount when a power unit mount has been coupled to the component,

the mounting surface comprises at least one opening to a hole, the opening positioned so that a fastening means could be inserted and or removed from the at least one opening from below the lower opening of the cavity.

2. The component of claim 1, wherein the mounting surface is configured to align the at least one opening to the hole in the mounting surface with a corresponding hole of a base plate of a power unit mount, when the component is coupled to the power unit mount.

3. The component of any of claim 1 or claim 2, is configured so that when coupled indirectly to a power unit via a power unit mount which has been fastened to the component by the fastening means, the primary load applied to a head part of the fastening means due to the mass of the power unit is substantially a tensile load.

4. The component of any preceding claim, wherein the cavity comprises at least one containment surface configured for limiting displacement of a main spring part of a power unit mount in at least one of a substantially X direction, a substantially Y direction and a substantially Z direction when at least part of a power unit mount is received into the cavity.

5. The component of any preceding claim, wherein the cavity comprises at least one containment surface configured for limiting displacement of a main spring part of a power unit

mount in at least one of a substantially Y direction and a substantially Z direction, when at least part of a power unit mount is received into the cavity.

6. The component of any proceeding claim, wherein the component comprises a hole configured to receive at least part of a fastening structure to allow the component to be coupled to a body of a vehicle.

7. The component of any proceeding claim wherein the component is made of an aluminium alloy, or a steel.

8. The component of any proceeding claim wherein the component is one of a substantially cast component, a substantially extruded component, or a substantially pressed component.

9. A sub-frame for a vehicle comprising the component of any one of claims 1 to 8 configured to couple to a power unit mount, so that when the component is coupled to the power unit mount the component substantially comprises the upper housing of the power unit mount.

10. A vehicle comprising the component of any one of claims 1 to 8 and or the sub-frame of claim 9.

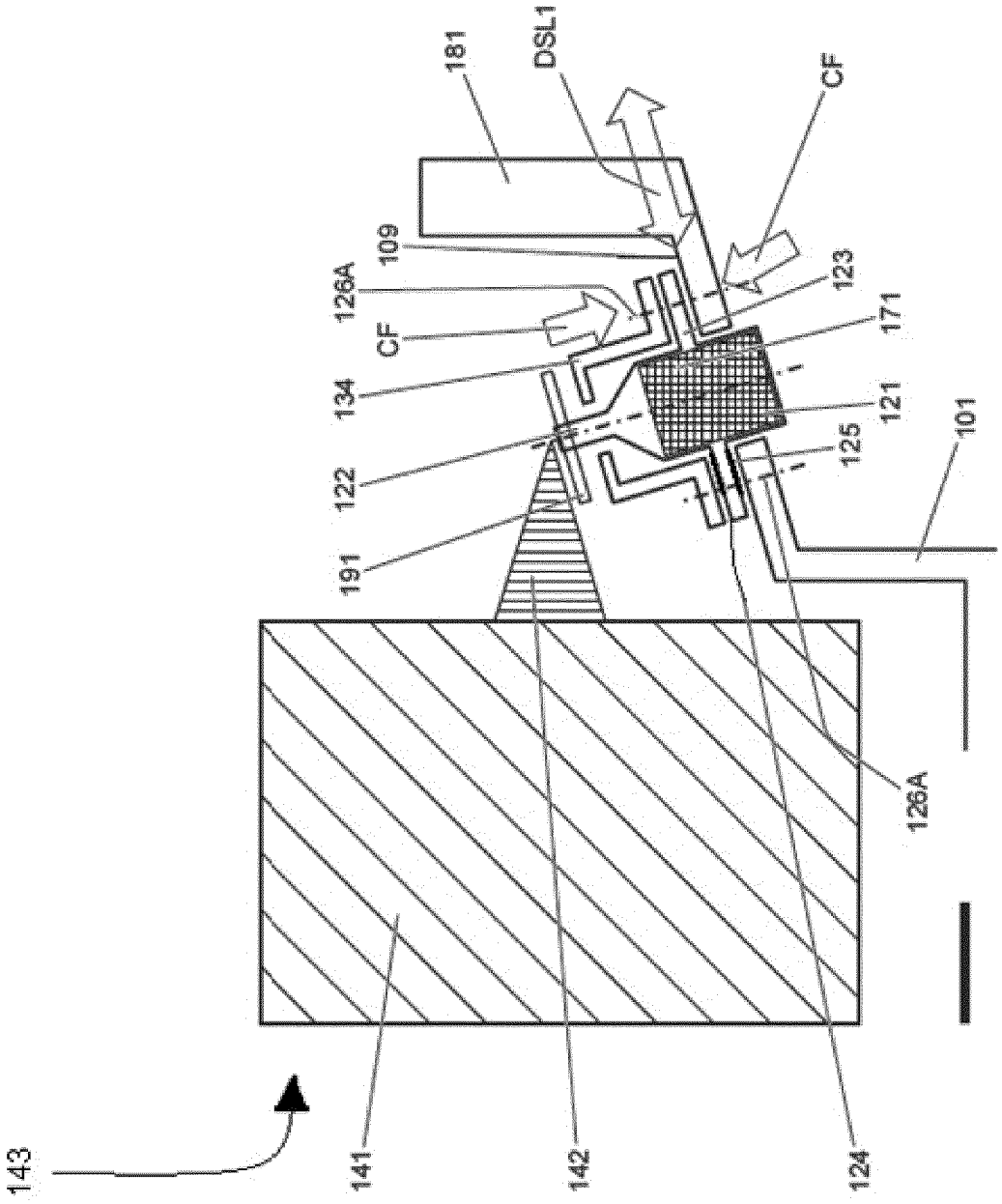


Fig. 1 PRIOR ART

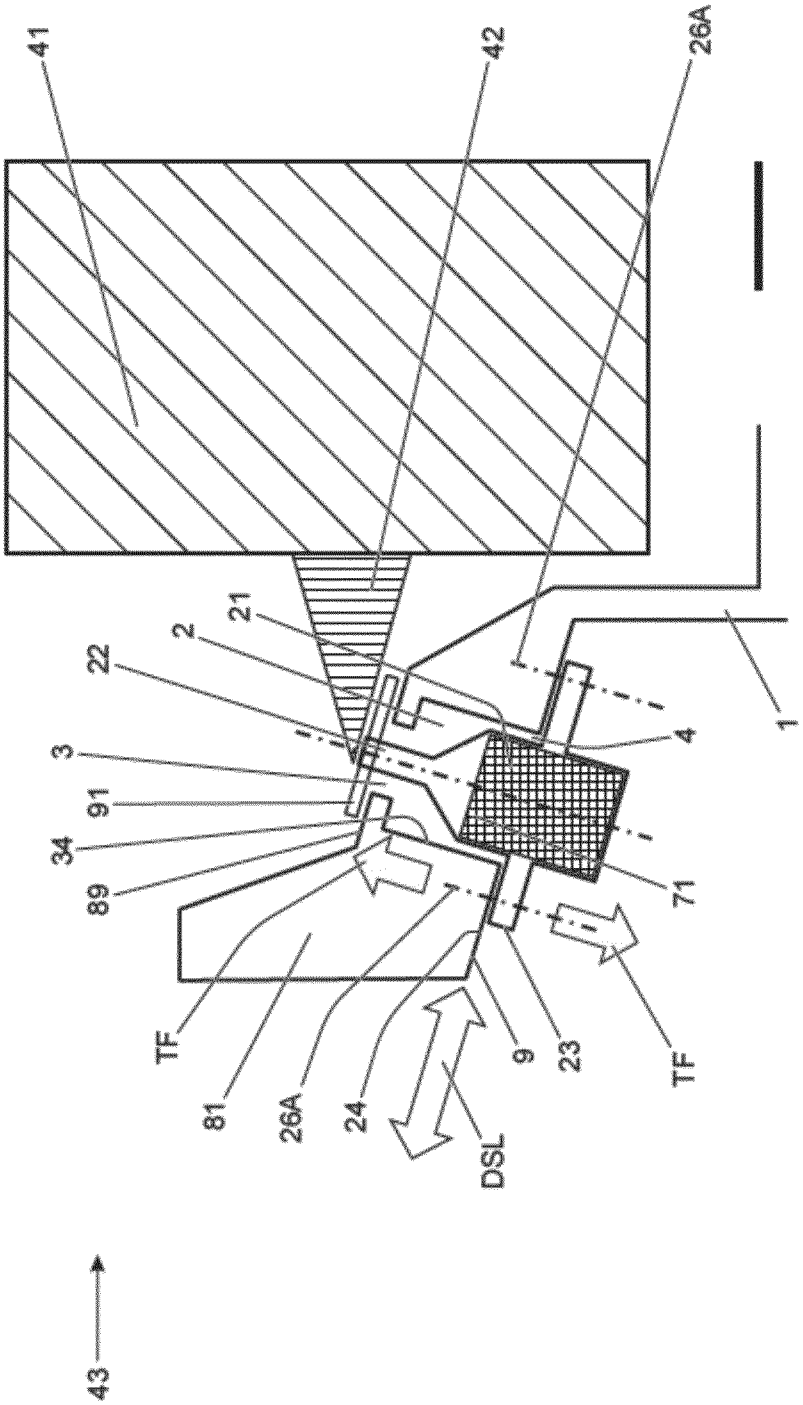


Fig. 2

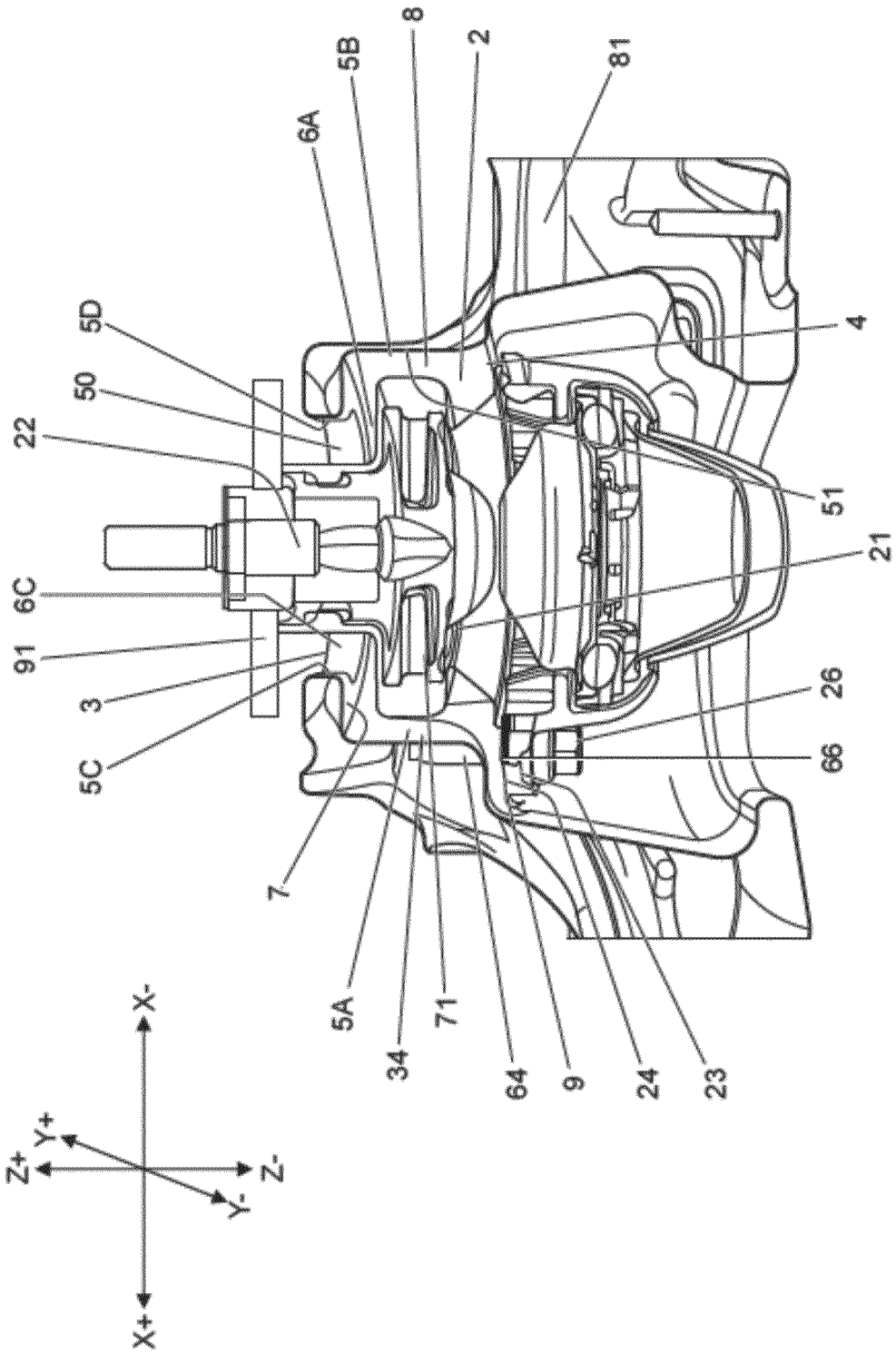

8
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X-
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Z-
Y-
X+

Fig. 3

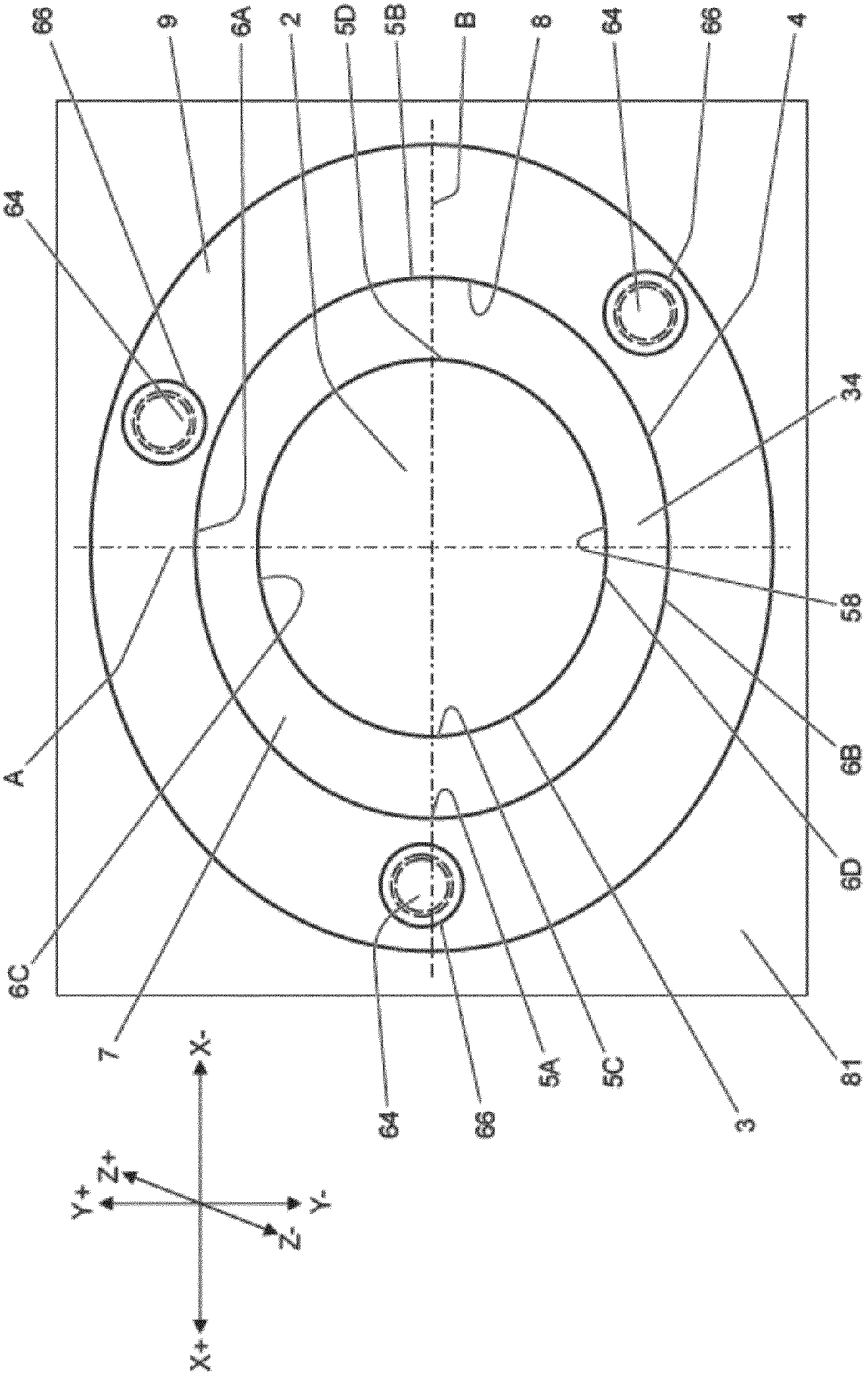


Fig. 4

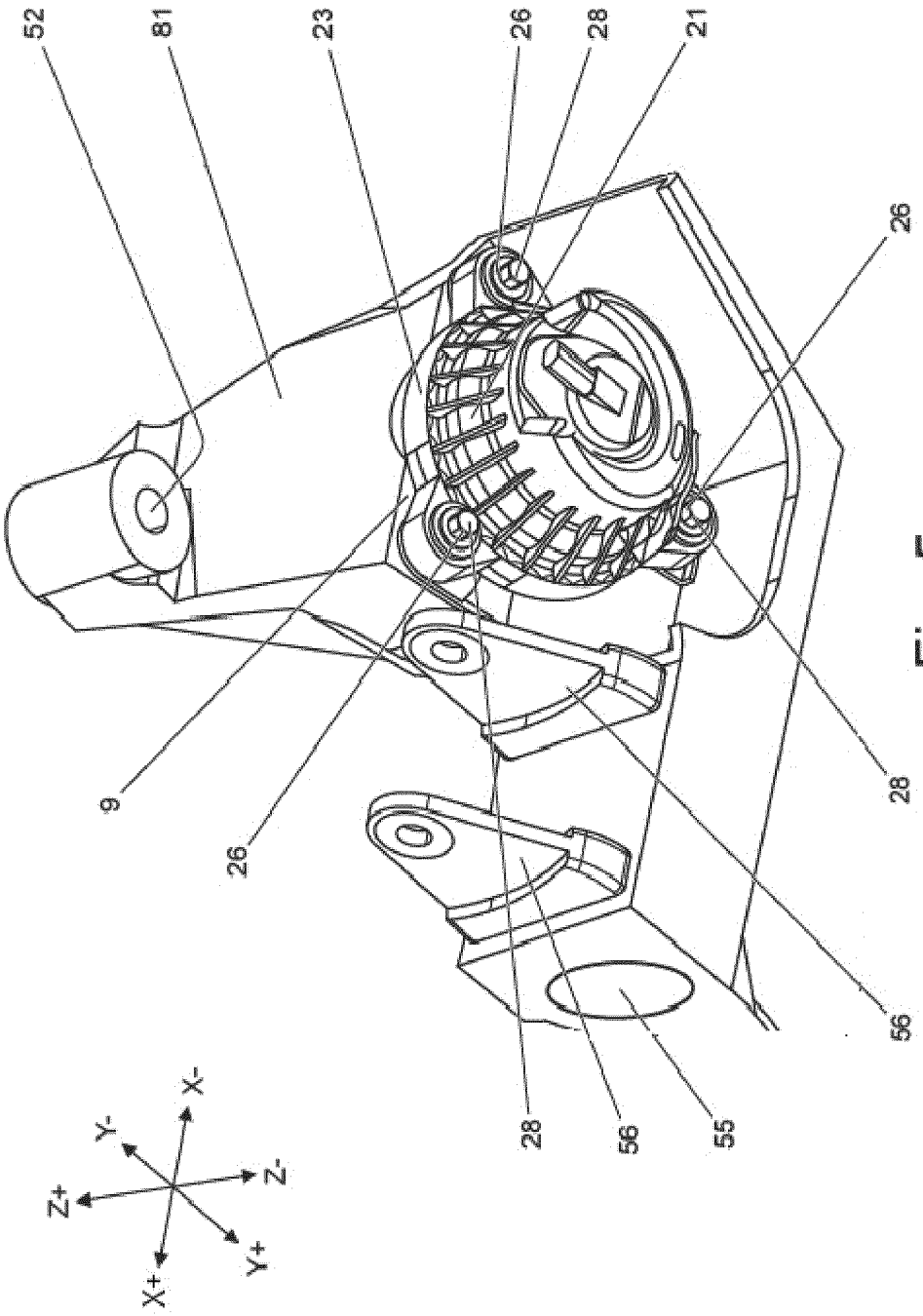


Fig. 5

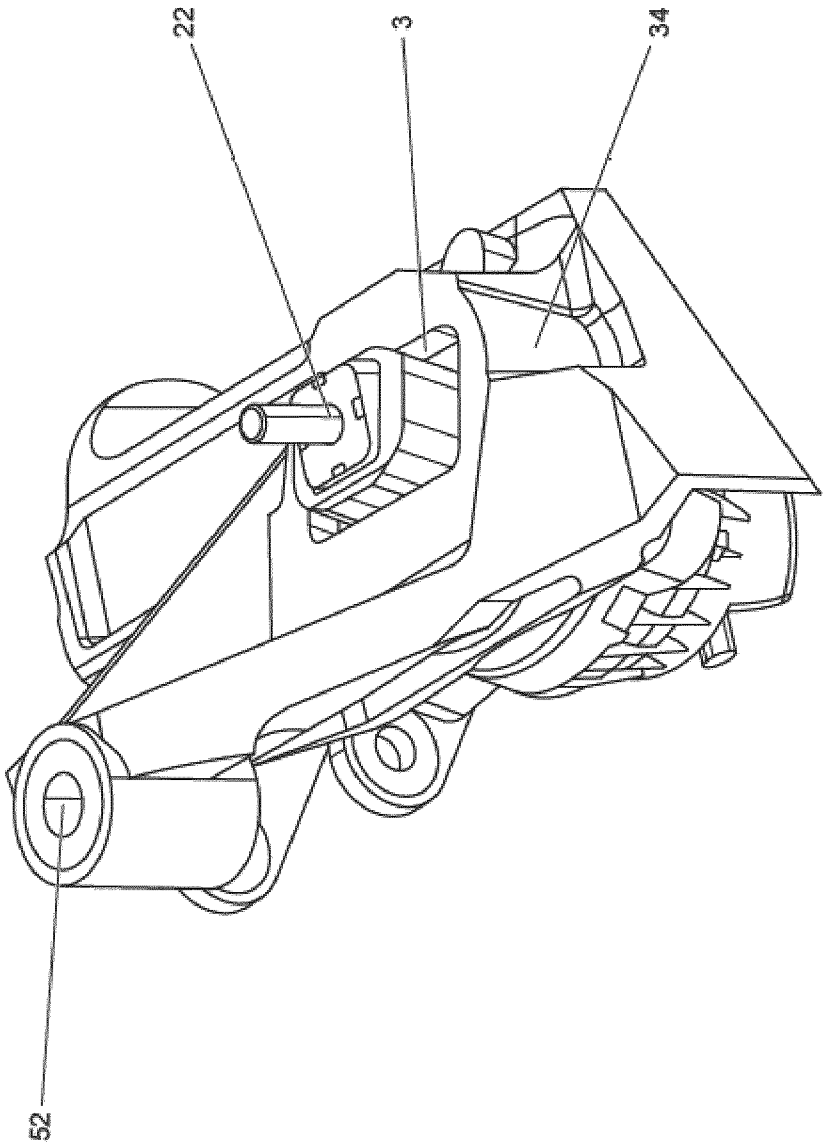


Fig. 6

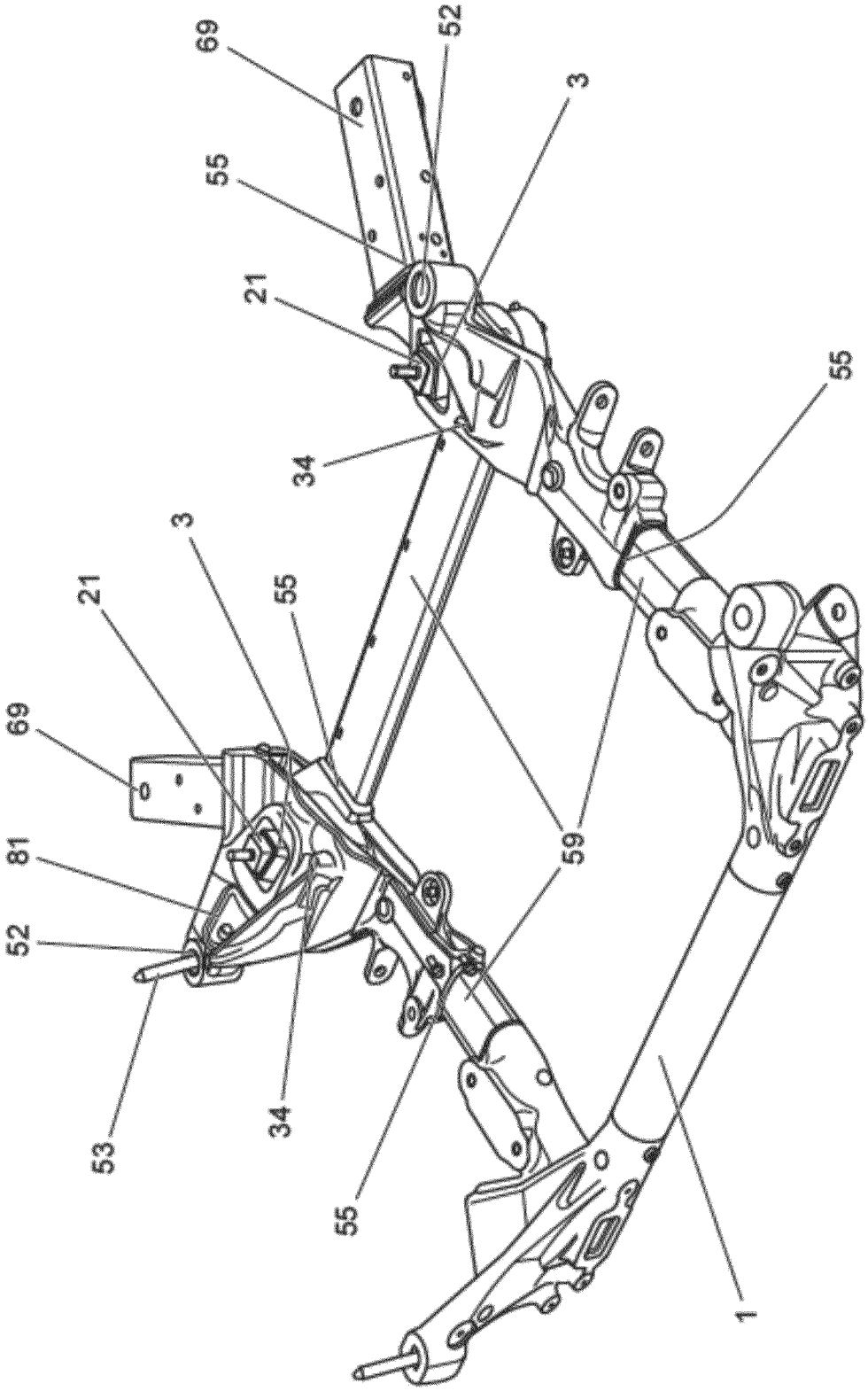


Fig. 7

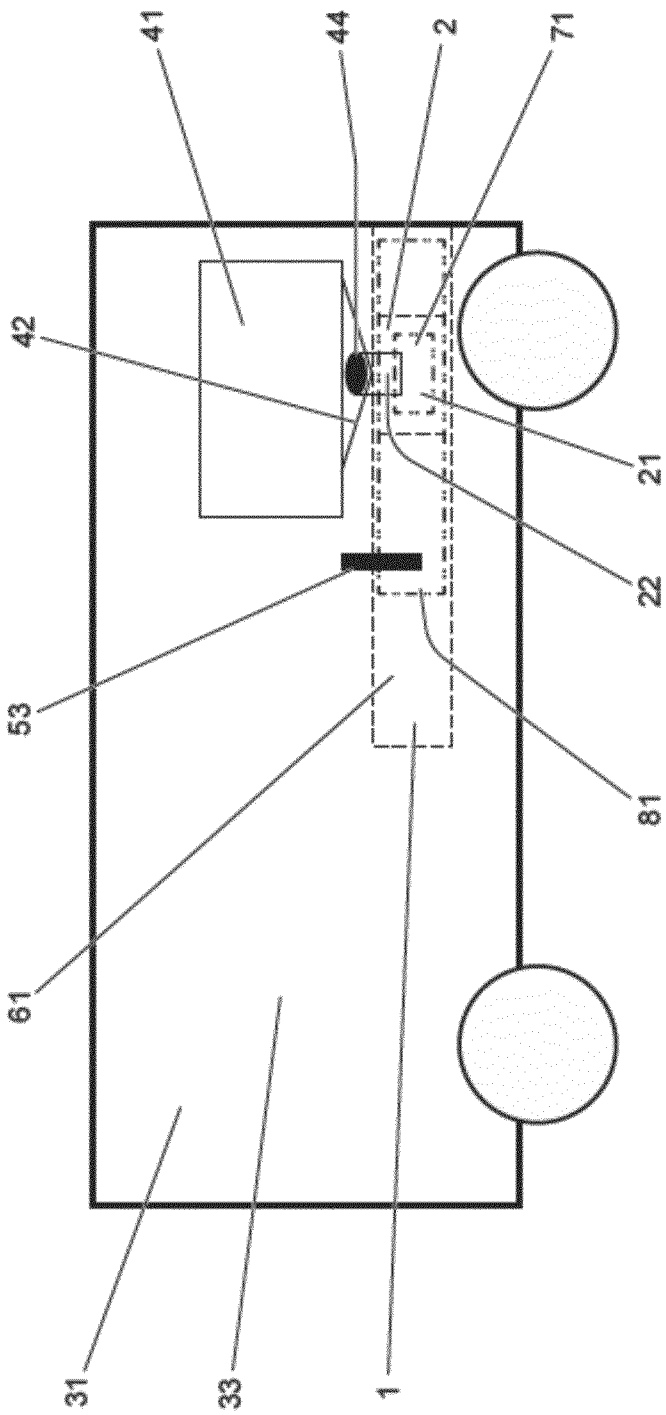


Fig. 8

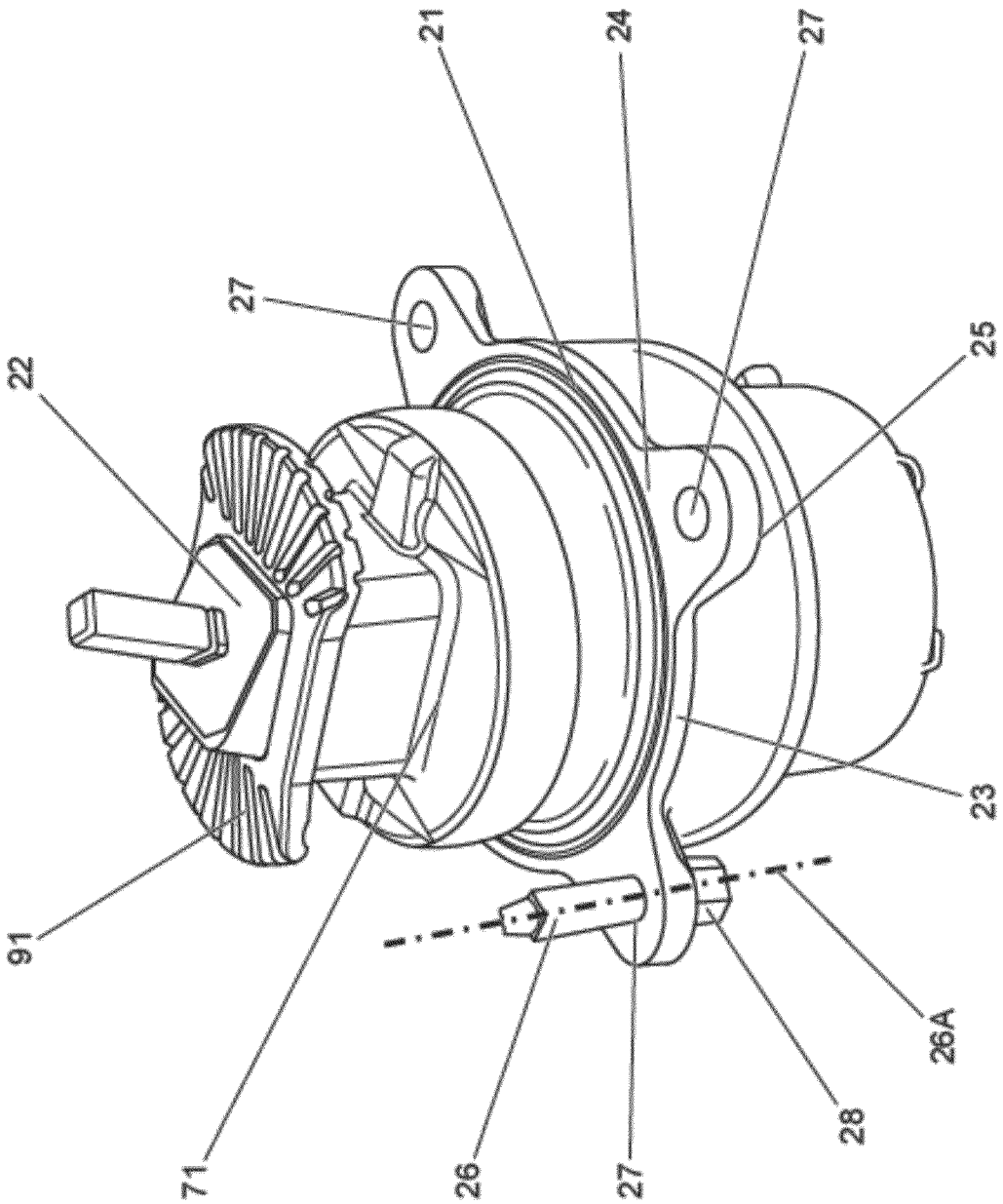


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/050268

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60K5/12 B60K1/00 B62D21/11
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60K B62D

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2007 007942 A1 (DAIMLER AG [DE]) 21 August 2008 (2008-08-21) paragraphs [0014] - [0022] figures 1-4	1-10
X	DE 10 2009 021930 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 25 November 2010 (2010-11-25) paragraphs [0011] - [0012] figure	1-8,10
X	US 2012/118660 A1 (TAMURA TSUTOMU [JP]) 17 May 2012 (2012-05-17) paragraphs [0021] - [0049] figures 1-3	1,4-10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 May 2020	20/05/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Adacker, Jürgen

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/050268

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2011 086165 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 16 May 2013 (2013-05-16) paragraph [0016] figures 1, 2 -----	1-10

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Information on patent family members

International application No
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