Appeal decision

Appeal No. 2017-5688

Switzerland
Appellant WARTSILA SCHWEIZ AG

Tokyo, Japan
Patent Attorney ASAMURA PATENT OFFICE

The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2012-89732 "High Pressure Fluid Rail" [the application published on Nov. 15, 2012: Japanese Unexamined Patent Application Publication No. 2012-225342] has resulted in the following appeal decision:

Conclusion

The appeal of the case was groundless.

Reason

No. 1 History of the procedures

The present application is an application filed on Apr. 10, 2012 (Priority Claim under the Paris Convention: Apr. 15, 2011), a reason for refusal was notified as of Feb. 19, 2016, and a written opinion and a written amendment were submitted on Aug. 12, 2016. However, a decision of refusal was made as of Dec. 15, 2016, and, against this, an appeal against an examiner's decision of refusal was requested on Apr. 20, 2017, and a written amendment (form) to amend the statement of the request of the written demand for trial was submitted on May 24, 2017.

No. 2 Regarding the invention

[1] The Invention

The invention according to claim 1 of the present application (hereinafter, referred to as "The Invention") is as follows as viewed from the description of the initial application, the scope of claims amended by the written amendment submitted on Aug. 12, 2016, and the drawings of the initial application.

"[Claim 1]

A high pressure fluid feed device for a common rail system for a large internal combustion engine, comprising

a pressure accumulator unit for supplying high pressure fluid to a plurality of fluid injectors, the pressure accumulator unit including an outer peripheral surface, a center bore extending substantially along a longitudinal axis of the pressure accumulator unit, an inner peripheral surface, and at least one radial bore extending from the center bore to the outer peripheral surface of the pressure accumulator unit, wherein

the radial bore has a width that is defined by a plane perpendicular to the longitudinal axis of the pressure accumulator unit and in a direction perpendicular to the center axis of the radial bore, the width being greater at the inner peripheral surface than at the outer peripheral surface, and the width being reduced continuously from the inner

peripheral surface to the outer peripheral surface over at least one-half of a distance between the inner peripheral surface and the outer peripheral surface."

[2] Publication
1. Publication 1
(1) Described matters in Publication 1

In Japanese Unexamined Patent Application Publication No. H10-213045 (hereinafter, referred to as "Publication 1") that was cited in the reason of the examiner's decision, and that is a publication distributed before the priority date of present application, there is the following description about "a connection structure of a branch connecting body in a common rail" along with drawings (note that underlines were made by the body for the purpose of facilitating understanding).

1a) "[Claim 1] A connection structure of a branch connecting body in a common rail having a flow passage of an approximately round shaped cross-section in a longitudinal direction, the connection structure being made by: providing a plurality of branch holes in a peripheral wall part of the flow passage of the common rail in an axial direction holding an interval; forming a pressure-receiving seating surface opened outward in a peripheral surface portion of each of the branch holes for consecutively installing branch connecting bodies each having a flow path communicating with the flow passage, and making the pressure-receiving seating surface abut and mate with a pressing seating surface made of a connection head disposed at an end of the branch connecting body; and fastening and connecting the pressure-receiving seating surface and the pressing seating surface along with pressing force at the connection head generated by screwing between a nut embedded in the side of the branch connecting body in advance and a joint part unified with or separated from the common rail, wherein the common-rail-side opening end part of the branch hole is made to be an R-chamfered part formed into a curved surface not having an edge portion, by chamfering into an arc shape.
[Claim 2] The connection structure of the branch connecting body in the common rail according to claim 1, wherein the common-rail-side opening end part formed into a curved surface not having the edge portion has an outline of the R-chamfered part in an inner peripheral surface that is an ellipse shape having a long diameter in a diameter direction of the flow passage.
[Claim 3] The connection structure of a branch connecting body in a common rail according to claim 1 or 2, wherein a cross-section shape of the R-chamfered part is made to be of a shape in which: a tapered surface is connected with a branch hole inner peripheral surface by a smooth curved surface; and the tapered surface is connected with a common rail flow passage inner peripheral surface by a smooth curved surface.
[Claim 4] The connection structure of a branch connecting body in a common rail according to any one of claims 1-3, wherein a cross-section shape of the R-chamfered part is made to be of a shape selected from the group of a circular-arc surface of revolution, an ellipsoid of revolution, a paraboloid of revolution, and a hyperbola surface of revolution." ([Claim 1] to [Claim 4] of [Scope of Claims])

1b) "[0001]
[Field of the Invention] The present invention generally relates to a connection structure

of a branch connecting body such as a diverging branch pipe or a branch fitting in a common rail such as a main pipe rail or a block rail made up of manifolds for high pressure fuel in a diesel internal combustion engine." (Paragraph [0001])

1c) "[0004]
[Problem to be solved by the Invention] All of the above-mentioned conventional connection structures of branch connecting bodies have a structure in which: the center of a flow passage 1-1 of a common rail such as a main pipe rail 1, the flow passage 1-1 having a round shape cross section, and the center of a flow path 2-1 of a branch connecting body such as a diverging branch pipe 2 coincide with each other; a branch hole 1-2 communicating with the flow passage 1-1 opens on the center line of the flow passage 1-1 of the main pipe rail 1 as a common rail; and the opening end of the branch hole has an edge. Therefore, when internal pressure acts inside the common rail, the largest stress is caused at an opening end P of the flow passage 1-1 of a round shaped cross-section of the common rail, and a crack is easily formed originating from the opening end P, and therefore there is a possibility of causing fuel leakage.
[0005] The present invention has been made in consideration of such problem of the prior art, and an object of the present invention is to provide a connection structure of a branch connecting body in a common rail for high pressure fuel capable of reducing the maximum stress value occurring in a common-rail-side opening end of the flow path of a branch connecting body to improve internal pressure fatigue strength." (Paragraphs [0004] and [0005])

1d) "[0006]
[Means for solving the problem] In order to achieve the above object, the present invention is a connection structure of a branch connecting body in a common rail having a flow passage of an approximately round shaped cross-section in a longitudinal direction, the connection structure being made by: providing a plurality of branch holes in a peripheral wall part of the flow passage of the common rail in an axial direction holding an interval; forming a pressure-receiving seating surface opened outward in a peripheral surface portion of each of the branch holes for consecutively installing branch connecting bodies each having a flow path communicating with the flow passage, and making the pressure-receiving seating surface abut and mate with a pressing seating surface made of a connection head disposed at an end of the branch connecting body; and fastening and connecting the pressure-receiving seating surface and the pressing seating surface along with pressing force at the connection head generated by screwing between a nut embedded in the side of the branch connecting body in advance and a joint part unified with or separated from the common rail, wherein the common-rail-side opening end part of the branch hole is made to be an R-chamfered part formed into a curved surface not having an edge portion, by chamfering into an arc shape.
[0007] In addition, the common-rail-side opening end part formed into a curved surface not having the edge portion according to the invention is one in which: an outline of the R-chamfered part in an inner peripheral surface is an ellipse shape having a long diameter in a diameter direction of the flow passage; a cross-section shape of the R-chamfered part is made by: providing a tapered surface connected with a branch hole inner peripheral surface by a smooth curved surface; and connecting the tapered surface

with a common rail flow passage inner peripheral surface by a smooth curved surface; and a cross-section shape of the R-chamfered part is made to be of a shape selected from the group of a circular-arc surface of revolution, an ellipsoid of revolution, a paraboloid of revolution, and a hyperbola surface of revolution.
[0008] Furthermore, in the present invention, a joint part having a body separated from the common rail is made of a joint fitting or a cylindrical sleeve nipple attached to the common rail, or a joint part having a body integrated with the common rail is made of a boss or a round shaped groove, and the common rail is a main pipe rail or a block rail, and the branch connecting body is a diverging branch pipe or a branch fitting." (Paragraphs [0006] to [0008])

1e) "[0009] Here, no particular limitation is imposed on a radius R of the R-chamfered part of the common-rail-side opening end part of a branch hole, which is set accordingly depending on the wall thickness of the common rail.
[0010] As mentioned above, according to the present invention, in a common rail of a connection structure in which the center of the flow passage of the common rail, the flow passage having an approximately round-shaped cross-section, and the center of the flow path of a joint part having a body integrated with or separated from the common rail coincide with each other, it is possible to reduce the maximum stress that occurs on a common rail flow passage opening end of the flow path of a joint part by making a common-rail-side opening end part of a branch hole be the R-chamfered part not having an edge." (Paragraphs [0009] and [0010])

1f) "[0011]
[Embodiments of the Invention] FIG. 1 is an expanded sectional view indicating an example of a connection structure of a branch connecting body in a common rail according to the present invention in a manner of cutting part of the side of a main pipe rail as a common rail. FIG. 2 is an arrow view for FIG. 1 showing an example of an outline of a common-rail-side opening end part of a branch hole in the connection structure example shown in FIG. 1 in the inner peripheral surface of an R-chamfered part. FIG. 3 is a diagram illustrating a cross-section shape of the R-chamfered part of a branch hole in the connection structure example shown in FIG. 1, and (A) is a sectional view of a common-rail-side opening end part indicating a cross-section shape of the R-chamfered part made by: providing a tapered surface connected with a branch hole inner peripheral surface by a smooth curved surface; and connecting the tapered surface with a common rail flow passage inner peripheral surface by a smooth curved surface, (B) is a sectional view of a common-rail-side opening end part indicating the cross-section shape of an R-chamfered part configured by a paraboloid of revolution, and (C) is a sectional view of a common-rail-side opening end part indicating the cross-section shape of an R-chamfered part configured by a hyperbola surface of revolution. FIG. 4 is a perspective view indicating a block rail as a common rail, and finally FIG. 5 is a sectional view of FIG. 4, in which (A) is a sectional view taken in the line A-A' of FIG. 4, and (B) is a sectional view taken in the line B-B' of FIG. 4. Note that, here, description will be made taking a case in which the present invention is applied to a connection structure of a branch connecting body shown in FIG. 8 configured by using a cylindrical sleeve nipple as a joint part having a body separated from a main pipe rail made of a manifold as a common rail, and welding this sleeve nipple directly to the

main pipe rail as an example.
[0012] The connection structure of a branch connecting body shown in FIG. 1 is one, as with one shown in FIG. 8, in which, making a cylindrical sleeve nipple 3b having a screw surface 3-1b for being screwed with a nut 4 integrated in the side of the diverging branch pipe 2 as a branch connecting body on its inner peripheral surface in advance be a joint part, the base end thereof is welded to an outer peripheral wall of the main pipe rail 1 near the pressure-receiving seating surface 1-3 in such a way that the pressure-receiving seating surface unit is surrounded and in a manner of being concentric with the branch hole 1-2, a pressing force seating surface 2-3 formed by a connection head 2-2 in the diverging branch pipe 2 side be abutted and engaged to a pressure-receiving seating surface 1-3 in the main pipe rail 1 side, and connection and configuration is achieved by fastening the nut 4 that screws with the sleeve nipple 3b. Here, the main pipe rail 1 as a common rail is a relatively thick-walled and small-diameter metal pipe, about a tube diameter of 20 m/m, and a wall thickness of 8m/m, for example, and is configured such that its inner shaft core is made to be the flow passage 1-1 of a cross-sectional circular shape, and a plurality of branch holes 1-2 that make their peripheral surfaces opening outward be the pressure-receiving seating surface 1-3 are provided on a peripheral wall in the axial direction in a manner of holding an interval and being in communication with the flow passage 1-1. On the other hand, a branch connecting body is one that is made of the diverging branch pipe 2 or a branch fitting as described above, has the flow path 2-1 that communicates with the flow passage 1-1 in its inside, and has the pressing force seating surface 2-3 of a tapered conically shape formed of the connection head 2-2 whose diameter has been enlarged by buckling on its end." (Paragraphs [0011] and [0012])

1g) "[0013] In the present invention, an R-chamfered part 1-2a formed as a curved surface not having an edge portion is formed in such a way that a peripheral surface opening outward in a peripheral wall of the main pipe rail 1 is made to be the pressure-receiving seating surface 1-3, and a flow passage 1-1 side opening end of the branch hole 1-2 in communication with the flow passage 1-1 of a cross-sectional circular shape of the main pipe rail 1 is chamfered into an arc shape. In addition, the outline of this R-chamfered part 1-2a in its inner peripheral surface is not limited to a perfect circle, and, as shown in FIG. 2, the outline may be of an ellipse shape having the long diameter in the diameter direction of the flow passage 1-1 having an approximately round shaped cross-section. Furthermore, the cross-section shape of an R-chamfered part can be made to be: as indicated in FIG. 3 (A), a shape connecting a tapered surface 1-2d connected with an inner peripheral surface 1-2b in the vertical portion of a branch hole by a smooth curved surface 1-2c of a radius r1 with a main pipe rail flow passage inner peripheral surface 1-1a by a smooth curved surface 1-2e of a radius r2; or, as indicated in (B), a paraboloid of revolution made by connecting a smooth curved surface 1-2f of a radius r3 connected with the inner peripheral surface 1-2b in the vertical portion of a branch hole with the main pipe rail flow passage inner peripheral surface 1-1a by a smooth curved surface 1-2g of a radius R1; or, as indicated in (C), a hyperbola surface of revolution made by connecting a smooth curved surface 1-2h of a radius R2 connected with the inner peripheral surface 1-2b in the vertical portion of a branch hole with the main pipe rail flow passage inner peripheral surface 1-1a by a smooth curved surface 1-2i of a radius r4. Note that no particular limitation is imposed on each of the

radiuses R, R1, R2, r1, r2, r3, and r4 of an R-chamfered part, which are set accordingly depending on the wall thickness of a main pipe rail or a block rail as a common rail.
[0014] When the flow passage 1-1 side opening end of the branch hole 1-2 in communication with the flow passage 1-1 of an approximately round-shaped cross-section of the main pipe rail 1 is made to be an R-chamfered part not having an edge in this way, the maximum stress generated on a flow passage 1-1 side opening end of the branch hole 1-2 when internal pressure acts in the main pipe rail 1 is mitigated to a large degree. Accordingly, the problem that a crack is generated in a manner of originating from the opening end P is mostly solved." (Paragraphs [0013] and [0014])

1h)"[0016]
[Advantage of the Invention] As described above, according to a connection structure of a branch connecting body in a common rail according to the present invention, by forming a curved surface not having an edge portion by chamfering the flow passage side opening end of a branch hole that is in communication with the flow passage of an approximately round-shaped cross-section of a common rail into an arc shape, the maximum stress generated on the common rail side opening end of the flow path of a joint part of a separated body such as a branch fitting or sleeve nipple or a joint part of an integrated body such as a boss or a round shaped groove can be mitigated to a large degree. Therefore, internal pressure fatigue strength in each branch hole is high, durability is superior, and thus it is possible to reduce fuel leakage due to occurrence of a crack, to reliably demonstrate a stable function. In addition, a connection structure of a branch connecting body according to the present invention is capable of being applied also to a branched pipe joint except for a common rail, and to a hydraulic manifold and a water pressure manifold." (Paragraph [0016])

1i) "[FIG. 1] FIG. 1 is an expanded sectional view of an example of a connection structure of a branch connecting body in a common rail according to the present invention, the view indicating the structure in a manner of cutting part of the side of the main pipe rail as a common rail.
[FIG. 2] FIG. 2 is an arrow view for FIG. 1 showing an example of an outline of a common-rail-side opening end part of a branch hole in the connection structure of the example shown in FIG. 1 in the inner peripheral surface of an R-chamfered part.
[FIG. 3] FIG. 3 a diagram illustrating a cross-section shape of an R-chamfered part of a branch hole in the connection structure example shown in FIG. 1, and (A) is a sectional view of a common-rail-side opening end part indicating a cross-section shape of the R-chamfered part made by: providing a tapered surface connected with a branch hole inner peripheral surface by a smooth curved surface; and connecting the tapered surface with a common rail flow passage inner peripheral surface by a smooth curved surface, (B) is a sectional view of a common-rail-side opening end part indicating the cross-section shape of an R-chamfered part configured by a paraboloid of revolution, and (C) is a sectional view of a common-rail-side opening end part indicating the cross-section shape of an R-chamfered part configured by a hyperbola surface of revolution." (The column of [Brief Description of Drawings])

(2) Matters understood from the above-mentioned (1) and drawings
1j) According to the above-mentioned (1) 1i), FIG. 2 is a figure indicating the branch

hole 1-2 of FIG. 1 in a manner of seeing from the arrow direction (from the lower side). In addition, according to the above-mentioned (1) 1g), an outline of the R-chamfered part 1-2a in the inner peripheral surface thereof in a flow passage 1-1 side opening end of the branch hole 1-2 is a perfect circle or an ellipse shape having the long diameter in the diameter direction of the flow passage 1-1. Therefore, in FIG. 2, it can be seen that, in a plane perpendicular to the longitudinal axis of the main pipe rail 1 (the flow passage 1-1), when seen in the direction perpendicular to the center axis of the branch hole 1-2, the width of the branch hole 1-2 is smaller than the width of the R-chamfered part 1-2a of a branch hole opening to the inner peripheral surface of the flow passage 1-1, and such width of the R-chamfered part 1-2a of a branch hole decreases continuously toward the peripheral wall side of the main pipe rail 1 from the flow passage inner peripheral surface 1-1a of the flow passage 1-1. Furthermore, also in a case where the outline of the R-chamfered part 1-2a in the inner peripheral surface is a perfect circle, the same thing applies also in such case when taking FIG. 1 and FIG. 3 into consideration.

1k) According to the above-mentioned (1) 1b) and 1f), it can be seen that the main pipe rail 1 including a plurality of branch holes 1-2 is for a fuel injection device provided with a common rail in a diesel internal combustion engine. Then, as viewed from the matter that the main pipe rail 1 includes a plurality of branch holes 1-2 and from the common general technical knowledge, it is obvious that the main pipe rail 1 supplies high pressure fuel to a plurality of fuel injection valves, and belongs to an injection device of high pressure fuel.

(3) The Cited Invention

As viewed from the statements of the above-mentioned (1), (2), and drawings, there is described in Publication 1 the following invention (hereinafter, referred to as "the Cited Invention").

"An injection device of high pressure fuel for a fuel supply apparatus provided with a common rail for use in a diesel internal combustion engine, the injection device comprising

the main pipe rail 1 for supplying high pressure fuel to a plurality of fuel injection valves, the main pipe rail 1 comprising: a peripheral wall; the flow passage 1-1 extending to an axis direction of the main pipe rail 1; the flow passage inner peripheral surface 1-1a; the branch hole 1-2 extending to the peripheral wall of the main pipe rail 1 from the flow passage 1-1; and the pressure-receiving seating surface 1-3, wherein

out of the branch hole 1-2 and the pressure-receiving seating surface 1-3, in the branch hole 1-2, when seen in a plane perpendicular to the longitudinal axis of the main pipe rail 1 in a direction perpendicular to the center axis of the branch hole 1-2, the R-chamfered part 1-2a of the branch hole 1-2 has a width decreasing continuously toward the peripheral wall side of the main pipe rail 1 from the flow passage inner peripheral surface 1-1a of the main pipe rail 1."

2. Publication 2

(1) Described matters in Publication 2

In Japanese Unexamined Patent Application Publication No. 2011-33190

(hereinafter, referred to as "Publication 2") that was cited in the reason of the examiner's decision, and is a publication distributed before the priority date for present application, there are the following statements relating to "high pressure connecting part and connection configuration" along with drawings (Note that underlines were made by the body for the purpose of facilitating understanding).

2a) "[Claim 1]

The high-pressure connection part for connecting a device operated by using a pressurized fluid to a pressure storage tank for the pressurized fluid, wherein

the pressure storage tank has at least one connection bore opened on a seating surface, wherein

the high-pressure connection part has a body extended in the direction of a longitudinal axis from a first end face to a second end face, the first end face is formed to cooperate with the seating surface in a sealing manner and has an inlet opening, the second end face is formed to be received by the device, and has an outlet opening connected with the inlet opening through a passage bore, and wherein

the second end face has a larger activity surface for the pressurized fluid than an activity surface of the first end face." ([Claim 1] of [Scope of Claims])

2b) "[0001]

The present invention relates to a high-pressure connection part and a connection configuration having a pressure storage tank according to the preamble of an independent claim of each category. In addition, the present invention relates to a large diesel engine having such high-pressure connection part and/or such connection configuration." (Paragraph [0001])

2c) "[0005]

An object of the present invention is to provide high-pressure connection parts that are of different structures, are structurally simple, are reliable, and are capable of transporting pressurized liquid from a pressure storage tank to a device. Further, such connection configuration needs to be provided. Specifically, the high-pressure connection should be suitable for use in a large diesel engine." (Paragraph [0005])

2d) "[0028]

The pressure storage tank 2 can be fabricated as a pressure pipe having a pipe shape; that is, a cylindrical shape in concrete terms, with a cylinder axis L such as a pressure storage tank for use in a today's common rail system. The pressure storage tank 2 includes a wall 21, and the inside thereof has a storage space 22 for pressurized liquid. The pressure storage tank 2 includes at least one connection bore 23, and the connection bore 23 extends outward in the diameter direction through the wall 21 from the storage space 22 and is opened to a seating surface 24. The seating surface 24 is fabricated into a conical shape.

[0029]

Typically, a plurality of the connection bores 23 are provided for the pipe-shaped pressure storage tank 2 of a common rail system, and they are disposed, in accordance with the illustration (FIG. 1), behind each other taking the cylinder axis L as the standard. The following description will be limited only to one connection bore 23.

Because, it is sufficient for the purpose of understanding." (Paragraphs [0028] and [0029])

2e) "[0039]

In the second embodiment, a large diesel engine that is important application to be implemented will be referred to. In a large diesel engine of the day, fuel injection, gas exchange, and, selectively, water injection and an auxiliary system are operated by a common rail system. Regarding this point, each fluid such as fuel for injection, an oil pressure medium such as servo oil for operation of exhaust valves, or a working medium for injection control are transported into a pressure storage tank also known as an accumulator, using a pump under a high pressure. In that case, all cylinders of an internal-combustion engine are provided with pressurized fluid from each accumulator and/or a valve, and a fuel injection device is controlled by such pressurization liquid. Typically, the pressure storage tanks are fabricated as pipe-shaped components, respectively, and the pipe-shaped components are occluded at both ends, and extend along the engine at approximately the level of the cylinder head.

[0040]

In a common rail system, the maximum pressure typically occurs for the purpose of fuel injection. In related pressure storage tanks, the pressure can reach 2000 bar, for example. The pressure of an oil pressure medium (for example, servo oil) can reach up to 300 bar in a pressure storage tank of a common rail system for the purpose of operation of an exhaust valve." (Paragraphs [0039] and [0040])

(2) Technology of Publication 2

As viewed from the statements of the above-mentioned (1) and the drawings, there is described in Publication 2 the following technology (hereinafter, referred to as "Technology of Publication 2").

"A technology using a common rail system having a pressure storage tank in a large diesel engine."

[3] Comparison / judgment between the Invention and the Cited Invention

"High pressure fuel" of the Cited Invention corresponds to "high pressure fluid" in the Invention as viewed from their functions, constitutions, and technical significance. In a similar fashion, "fuel injection valve" corresponds to "fluid injector", "the main pipe rail 1" to "pressure accumulator unit", "peripheral wall" to "outer peripheral surface", "extending to an axis direction" to "extending substantially along a longitudinal axis", "the flow passage 1-1" to "center bore", "flow passage inner peripheral surface 1-1a" to "inner peripheral surface", "the branch hole 1-2 and the pressure-receiving seating surface 1-3" to "radial bore", "fuel supply apparatus provided with a common rail" to "common rail system", and "injection device of high pressure fuel" to "high pressure fluid feed device".

Then, "fuel supply apparatus provided with a common rail for use in a diesel internal combustion engine" in the Cited Invention and "common rail system for a large internal combustion engine" in the Invention are identical to the extent of being a "common rail system for an internal-combustion engine".

Therefore, the corresponding features and the different features of the two are as follows.

[Corresponding features]
"A high pressure fluid feed device for a common rail system for an internal-combustion engine, comprising

a pressure accumulator unit for supplying high pressure fluid to a plurality of fluid injectors, the pressure accumulator unit including an outer peripheral surface, a center bore extending substantially along a longitudinal axis of the pressure accumulator unit, an inner peripheral surface, and a radial bore extending from the center bore to the outer peripheral surface of the pressure accumulator unit."

[The different feature 1]

A point that, regarding a "common rail system for an internal-combustion engine", it is a "common rail system for a large internal combustion engine" in the Invention, whereas, in the Cited Invention, it is a "fuel supply apparatus provided with a common rail for use in a diesel internal combustion engine" (hereinafter, referred to as "The different feature 1).

[The different feature 2]

A point that, in the Invention, "the radial bore has a width that is defined by a plane perpendicular to the longitudinal axis of the pressure accumulator unit and in a direction perpendicular to the center axis of the radial bore, the width being greater at the inner peripheral surface than at the outer peripheral surface", whereas,

in the Cited Invention, the magnitude relation between: the width of the opening end of the R-chamfered part 1-2a of the branch hole 1-2 at the flow passage 1-1 when seen in a plane perpendicular to the longitudinal axis of the main pipe rail 1 in a direction perpendicular to the center axis of the branch hole 1-2; and the width of the pressure-receiving seating surface 1-3 at the peripheral wall of the main pipe rail 1 is not clear (hereinafter, referred to as "The different feature 2").

[The different feature 3]

A point that, in the Invention, it is such that "the radial bore has a width that is defined by a plane perpendicular to the longitudinal axis of the pressure accumulator unit and in a direction perpendicular to the center axis of the radial bore", and "the width being reduced continuously from the inner peripheral surface to the outer peripheral surface over at least one-half of a distance between the inner peripheral surface and the outer peripheral surface", whereas,

in the Cited Invention, "out of the branch hole 1-2 and the pressure-receiving seating surface 1-3, in the branch hole 1-2, when seen in a plane perpendicular to the longitudinal axis of the main pipe rail 1 in a direction perpendicular to the center axis of the branch hole 1-2, the R-chamfered part 1-2a of the branch hole 1-2 has a width decreasing continuously toward the peripheral wall side of the main pipe rail 1 from the flow passage inner peripheral surface 1-1a of the main pipe rail 1" (hereinafter, referred to as "The different feature 3").

Hereinafter, judgment will be made regarding the different features.

[Regarding the different feature 1]

Technology of Publication 2 is "a technology using a common rail system having a pressure storage tank in a large diesel engine", and, therefore, it can be said that Technology of Publication 2 suggests to apply a "common rail system" to a "large internal combustion engine".

Then, it could have been achieved by a person skilled in the art with ease to apply, in the Cited Invention, Technology of Publication 2 related to a common rail system, and, as a result, apply "fuel supply apparatus provided with a common rail for use in a diesel internal combustion engine" to a "large internal combustion engine" to implement the matters specifying the invention of the Invention concerning the different feature 1.

[Regarding the different features 2 and 3]

According to statements of Publication 1 in the above-mentioned No. 2 [2] 1. (1) 1e), the R-chamfered part 1-2a of the branch hole 1-2 is for mitigating the maximum stress that occurs on a common rail flow passage opening end. Then, as viewed from the common general technical knowledge, the maximum stress is determined also by the pressure within the main pipe rail 1.

Also, it is obvious to a person skilled in the art that, in order to effectively decentralize stress generated on the opening end of the branch hole 1-2 of the main pipe rail 1, it is necessary to secure a greater pressure-receiving area within the realms of possibility on the inner surface of the branch hole 1-2 in consideration of a wall thickness of the main pipe rail and the strength of the material and the like, and standards for enlarging the pressure-receiving area of the inner surface of the branch hole 1-2 can be determined accordingly regarding the width of the R-chamfered part 1-2a and a distance from the flow passage inner peripheral surface 1-1a toward the peripheral wall side of the main pipe rail 1, and so on.

For this reason, it could have been achieved by a person skilled in the art with ease to make, in the Cited Invention, the width of the opening end of the R-chamfered part 1-2a in the flow passage 1-1 be larger than the width of the pressure-receiving seating surface 1-3 in the peripheral wall of the main pipe rail 1 in order to further enlarge the pressure-receiving area of the branch hole 1-2, thereby implementing the matters specifying the invention of the Invention concerning the different feature 2 mentioned above.

Furthermore, it could have been achieved by a person skilled in the art with ease to make, in the Cited Invention, in order to further enlarge the pressure-receiving area of the R-chamfered part 1-2a of the branch hole 1-2, the distance from the flow passage inner peripheral surface 1-1a toward the peripheral wall side of the main pipe rail 1 in the R-chamfered part 1-2a of the branch hole 1-2 be at least one-half of the distance from the flow passage inner peripheral surface 1-1a to the peripheral wall of the main pipe rail 1, thereby implementing the matters specifying the invention of the Invention concerning the different feature 3 mentioned above.

Also, the Invention does not provide specific effect beyond the effect predicted on the basis of the Cited Invention and Technology of Publication 2.

No. 3 Closing

Accordingly, the Invention could have been invented by a person skilled in the art with ease based on the Cited Invention and Technology of Publication 2, and, therefore, the appellant should not be granted a patent for this under the provisions of Article 29(2) of the Patent Act, and the present application should be rejected.

Therefore, the appeal decision shall be made as described in the conclusion.

Nov. 14, 2017

Chief administrative judge: KANAZAWA, Toshio
Administrative judge: MATSUSHITA, Akira
Administrative judge: YAGI, Makoto