

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ROBERT BOSCH LLC and MERCEDES-BENZ USA, LLC,
Petitioner,

v.

WESTPORT FUEL SYSTEMS CANADA INC.,
Patent Owner.

IPR2023-00293
Patent 6,575,138 B2

Before NEIL T. POWELL, CARL M. DEFRANCO, and
FRANCES L. IPPOLITO, *Administrative Patent Judges*.

IPPOLITO, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Robert Bosch LLC and Mercedes-Benz USA, LLC (collectively, “Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–3, 6, 13, 14, 17–21, 26–28, and 41 of U.S. Patent No. 6,575,138 B2 (Ex. 1001, “the ’138 patent”). Westport Fuel Systems Canada Inc. (“Patent Owner”) filed a Preliminary Response to the Petition (Paper 7, “Prelim. Resp.”).

Under 35 U.S.C. § 314(a), an *inter partes* review may not be instituted unless the information presented in the Petition and any response thereto shows “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” Upon consideration of the Petition, Preliminary Response, and the evidence of record, we determine that the information presented in the Petition does not establish a reasonable likelihood that Petitioner would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we do not institute *inter partes* review of claims 1–3, 6, 13, 14, 17–21, 26–28, and 41 of the ’138 patent based on the grounds raised in the Petition.

II. BACKGROUND

A. Related Matters

The parties identify the following United States District Court actions as involving the ’138 patent: *Westport Fuel Systems Canada Inc. v. Ford Motor Company*, No. 2:21-cv-00453 (E.D. Tex.); *Westport Fuel Systems Canada Inc. v. Mercedes-Benz USA, LLC*, No. 2:21-cv-00454 (E.D. Tex.) (dismissed); *Westport Fuel Systems Canada Inc. v. Nissan North America, Inc.*, No. 2:21-cv-00455 (E.D. Tex.) (dismissed); *Westport Fuel Systems Canada Inc. v. General Motors, LLC*, No. 2:21-cv-00456 (E.D. Tex.);

Westport Fuel Systems Canada Inc. v. FCA USA LLC d/b/a FCA Group US LLC, No. 2:21-cv-00457 (E.D. Tex.) (dismissed); and *Robert Bosch, LLC v. Westport Fuel Systems Canada Inc.*, No. 1:22-cv-00370 (E.D. Va.). Pet. 4–5; Paper 5, 2.¹

In addition to the instant Petition, Petitioner filed a second petition challenging the '138 patent in IPR2023-00351. Petitioner also filed petitions challenging related U.S. Patent 6,298,829 B1 in IPR2023-00292 and IPR2023-00352.

B. Real Parties in Interest

Petitioner identifies itself, Robert Bosch GmbH, Mercedes-Benz Intellectual Property GmbH & Co. KG, Mercedes-Benz AG, Ford Motor Company, and General Motors LLC as the real parties in interest. Pet. 4. Patent Owner identifies only itself as the real party in interest. Paper 5, 2.

C. The '138 Patent

The '138 patent, titled “Directly Actuated Injection Valve,” relates “to high pressure fuel injection valves or injectors for internal combustion engines.” Ex. 1001, code (54), 1:16–18. The '138 patent discloses “an injection valve that is directly controllable by a position actuating material (such as, for example, a piezoelectric or magnetostrictive material) and which includes a passive hydraulic link.” *Id.* at 1:18–21.

Figure 1 of the '138 patent, reproduced below, is a cross-section view of a directly actuated fuel injection valve according to a preferred embodiment. *Id.* at 8:36–38, 61–63.

¹ Patent Owner’s Mandatory Notices (Paper 5) do not include page numbers. We consider the title page as page 1 and proceed from there in numerical order.

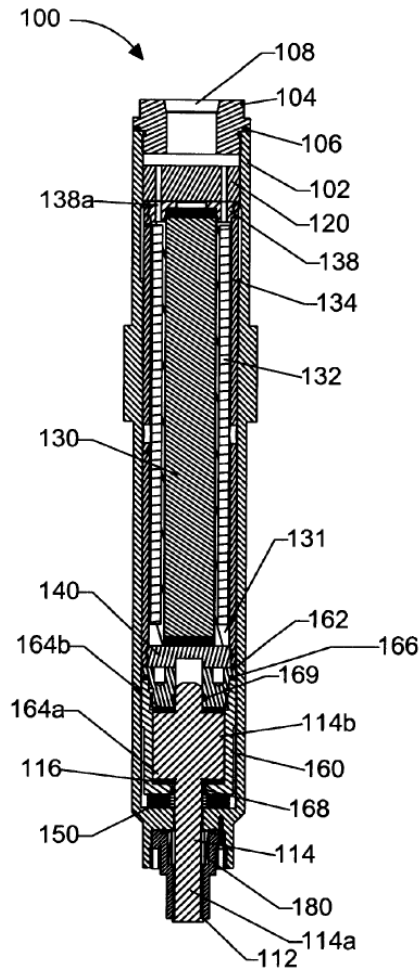


FIG. 1

Figure 1 of the '138 patent depicts injection valve 100 including elongated valve housing 102 and valve cap 104, which includes inlet port 108 through which fuel enters. *Id.* at 9:4–6, 8–9. Valve member 114 extends through an opening in the tip of valve housing 102 and cooperates with valve seat 112 to provide a fluid tight seal. *Id.* at 9:23–27, 59–61. Valve member 114 includes valve stem 114*a* and valve piston 114*b*. *Id.* at 9:64–10:1, 10:7–9. A spring assembly comprising at least one valve spring 116 biases valve member 114 in a closed position. *Id.* at 10:13–16. To open the valve, an actuator assembly provides an opening force that overcomes the closing force provided by the spring assembly. *Id.* at 9:32–34. In the embodiment

shown in Figure 1, the actuator assembly is a magnetostrictive actuator comprising solid magnetostrictive member 130, bobbin 131, electric coil 132, and flux tube 134 disposed between magnetostrictive member 130 and valve housing 102. *Id.* at 10:41–46. Actuating the actuator assembly causes magnetostrictive member 130 to grow in length and push sliding pole 140 towards valve member 114 to provide an opening force to open injection valve 100. *Id.* at 10:59–62.

Figure 2 of the '138 patent, reproduced below, is an enlarged cross-sectional view of a lower portion of a fuel injection valve in an open position and having the fuel inlet port in an alternate location from that shown in Figure 1. *Id.* at 8:40–43.

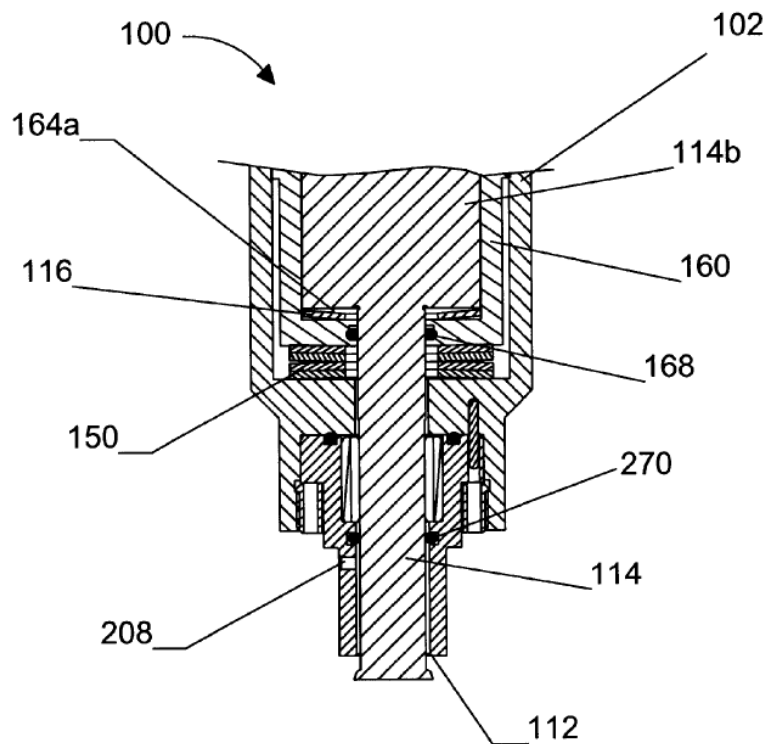


FIG. 2

Figure 2 of the '138 patent depicts valve member 114 extending through an opening in the tip of valve housing 102 to an open position in which the sealing surface of valve member 114 is not in contact valve seat 112. *Id.* at 9:59–64. The opening force that extends the valve member 114 is transmitted through a hydraulic link assembly, which comprises hydraulic cylinder 160, cylinder cap 162, seals 166, 168, 169, and viscous hydraulic fluid 164*b*. *Id.* at 11:65–12:3, 12:7–11, 14:16–22. Hydraulic cylinder 160 is in a close-fitting relationship around piston 114*b*. *Id.* at 11:67–12:3.

Viscous hydraulic fluid 164*b* is disposed in a space between cylinder cap 162 and a planar surface of piston 114*b*. *Id.* at 14:16–22. The '138 patent explains that “the hydraulic fluid preferably has a sufficiently high viscosity and bulk modulus so that it acts as an incompressible solid when actuation of the actuator assembly causes a valve opening force to be quickly transmitted through the hydraulic fluid between the bottom of cylinder 160 and hydraulic piston 114*b*.” *Id.* at 12:26–32. According to the '138 patent,

because valve actuation occurs suddenly (on the order of 200 μ s), hydraulic fluid 164*b* does not have time to flow through the narrow clearance gap between piston 114*b* and hydraulic cylinder 160. Instead, hydraulic fluid 164*b* acts as a solid and transfers the movement of magnetostrictive member 130 to valve member 114 via piston 114*b*, causing valve member 114 to lift away from valve seat 112.

Id. at 14:26–33.

D. The Challenged Claims

Petitioner challenges claims 1–3, 6, 13, 14, 17–21, 26–28, and 41 of the '138 patent. Pet. 1. Of the challenged claims, claims 1 and 41 are independent. Claim 1 is illustrative and reproduced below:

1. [1-p] An injection valve for injecting fuel into a combustion chamber of an internal combustion engine, said injection valve comprising:

[1(a)] (a) a valve housing comprising:

[1(a)-1] a fuel inlet port;

[1(a)-2] an interior chamber fluidly connected to said fuel inlet port; and

[1(a)-3] a valve seat for cooperating with a valve member to seal said interior chamber from said combustion chamber when said injection valve is closed;

[1(b)] (b) said valve member having one end disposed within said valve housing and an opposite end extendable from said valve seat toward said combustion chamber, wherein said valve member comprises a sealing surface that fluidly seals against said valve seat when said injection valve is closed and that is liftable away from said valve seat when said injection valve is open;

[1(c)] (c) a biasing mechanism associated with said valve member, said biasing mechanism applying a closing force to said valve member when said valve member is in said closed position;

[1(d)] (d) an actuator assembly associated with said valve member, wherein said actuator assembly may be actuated to apply an opening force to said valve member stronger than said closing force, for moving said valve member to said open position; and

[1(e)] (e) a hydraulic link assembly comprising a passive hydraulic link having a hydraulic fluid thickness through which said opening and closing forces are transmitted, whereby said hydraulic fluid acts substantially as a solid with said thickness being substantially constant while said actuator assembly is actuated and wherein said thickness of said hydraulic link is adjustable while said actuator assembly is not actuated in response to changes in the dimensional relationship between components of said injection valve to maintain a desired valve lift upon actuation of said actuator assembly.

Ex. 1001, 17:17–53 (bracketed designations added by Petitioner (*see* Pet. 24–31)).

E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §²	Reference(s)/Basis
1–3, 6, 13, 14, 17–21, 26, 27, 41	103(a)	Wirbeleit, ³ Klügl ⁴
28	103(a)	Wirbeleit, Klügl, Newcomb ⁵
1–3, 6, 13, 14, 17–21, 26, 27, 41	103(a)	Klügl, Hayes ⁶
28	103(a)	Klügl, Hayes, Newcomb

Pet. 8. In addition to the references listed above, Petitioner relies on the Declaration of J. Matt Quinlan, Ph.D. Ex. 1003. Patent Owner relies on the Declaration of Christopher Atkinson, Ph.D. Ex. 2004.

III. ANALYSIS

A. Principles of Law

Petitioner bears the burden of demonstrating a reasonable likelihood that it would prevail with respect to at least one challenged claim for a petition to be granted. 35 U.S.C. § 314(a). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof

² The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. We apply the pre-AIA version of § 103 here because the application which became the ’138 patent was filed before the effective date of the AIA. *See* Ex. 1001, code (22).

³ US 5,479,902, issued Jan. 2, 1996 (Ex. 1004, “Wirbeleit”).

⁴ Certified translation of DE 19708304 A1, published Feb. 28, 1997 (Ex. 1006, “Klügl”) and original German language version (Ex. 1005).

⁵ US 4,284,263, issued Aug. 18, 1981 (Ex. 1014, “Newcomb”).

⁶ US 5,779,149, issued July 14, 1998 (Ex. 1024, “Hayes”).

in *inter partes* review).

A patent claim is unpatentable for obviousness if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). In *Graham v. John Deere Co.*, 383 U.S. 1 (1966), the Supreme Court set out a framework for assessing obviousness that requires consideration of four factors: (1) the “level of ordinary skill in the pertinent art,” (2) the “scope and content of the prior art,” (3) the “differences between the prior art and the claims at issue,” and (4) “secondary considerations” of nonobviousness such as “commercial success, long felt but unsolved needs, failure of others, etc.” *Id.* at 17–18; *KSR*, 550 U.S. at 407.

“Whether an ordinarily skilled artisan would have been motivated to modify the teachings of a reference is a question of fact.” *WBIP, LLC v. Kohler Co.*, 138 F.3d 1317, 1327 (Fed. Cir. 2016) (citations omitted). “[W]here a party argues a skilled artisan would have been motivated to combine references, it must show the artisan ‘would have had a reasonable expectation of success from doing so.’” *Arctic Cat Inc. v. Bombardier Recreational Prods. Inc.*, 876 F.3d 1350, 1360–61 (Fed. Cir. 2017) (quoting *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1068–69 (Fed. Cir. 2012)).

B. Level of Ordinary Skill in the Art

In determining the level of skill in the art, we consider the type of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the

technology, and the educational level of active workers in the field. *Custom Accessories, Inc. v. Jeffrey-Allan Indus. Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986); *Orthopedic Equip. Co. v. United States*, 702 F.2d 1005, 1011 (Fed. Cir. 1983).

Petitioner contends:

A POSITA in the technology field of the '138 patent would have had a degree in mechanical engineering or a similar discipline, along with 2 years of professional experience working with the design and development of fuel injection systems for internal combustion engines or an equivalent level of skill, knowledge, and experience. (*See* Ex. 1003, ¶¶ 37–39, 41.) This POSITA would be aware of and generally knowledgeable about how fuel injector valves are structured and operate, and how they are used to deliver fuel to an engine's combustion chambers. (*Id.*, ¶ 40.)

Pet. 23. Patent Owner does not dispute Petitioner's proposed definition. *See* Prelim. Resp. 18. Instead, Patent Owner similarly argues "that a POSITA in the timeframe of the invention would have had a degree in mechanical engineering or a similar discipline along with two (2) years of professional experience working with fuel injectors or fuel injection systems for internal combustion engines." *Id.* (citing Ex. 2004 ¶ 14). For purposes of this Decision, we adopt the definition of the level of ordinary skill in the art proposed by Petitioner as reasonable and consistent with the prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art may reflect an appropriate level of skill in the art).

C. Claim Construction

In an *inter partes* review proceeding, the Board interprets claim language using the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b), as described in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b).

Petitioner contends “that the terms of the ’138 patent’s claims do not require further construction and can be afforded their plain and ordinary meaning.” Pet. 15 (citing Ex. 1003 ¶¶ 82–85). Patent Owner asserts that, “[f]or the purposes of this preliminary response, Patent Owner does not seek construction of any term.” Prelim. Resp. 19.

On this record, we determine that no claim term requires an express construction for the purpose of determining whether to institute *inter partes* review. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Overview of the Prior Art

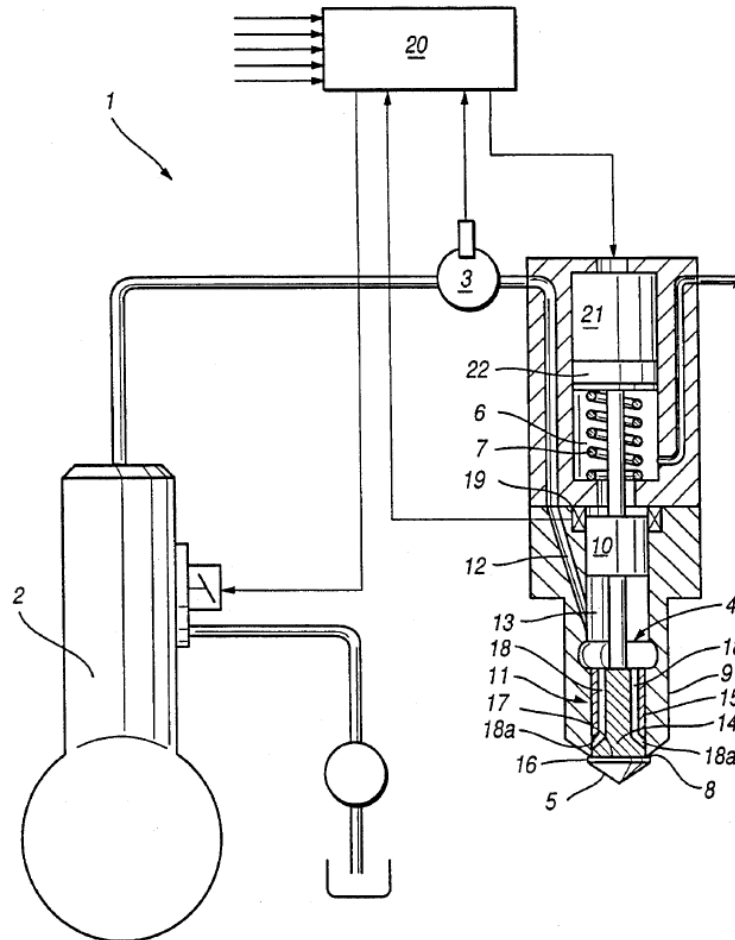
1. Summary of Wirbeleit (Ex. 1004)

Wirbeleit is titled “Fuel Injection System for a Diesel Engine.” Ex. 1004, code (54). Wirbeleit “relates to a fuel injection system for a Diesel engine which includes a high pressure fuel pump supplying fuel under pressure to a common-rail fuel supply conduit which is in communication with valve-controlled injectors for the injection of fuel under the control of an electronic control unit.” *Id.* at 1:7–12. In particular, Wirbeleit describes

fuel injectors having fuel injection control needles engaged by springs so as to be normally seated on a valve seat and a control needle actuator for lifting the control needle off the valve seat under the control of an electronic control unit, the needle includes a cylindrical needle body movable within a cylinder and has slot-shaped orifices formed in its outer surface which are fully covered when the control needle is seated but which are exposed to a degree controllable by the needle actuator for adjustment of the orifice sizes depending on engine operating parameters.

Id. at 1:45–58.

Wirbeleit's sole figure (unnumbered) is reproduced below.



The figure of Wirbeleit depicts a fuel injection system including a fuel injector shown in a cross-sectional view. *Id.* at 2:21–22. The injector includes injector orifice control needle 5 forced onto valve seat 8 of injector body 9 via return spring 7 in spring chamber 6, but injector orifice control needle 5 is outwardly-movable to open slot orifice 4. *Id.* at 2:31–35. Orifice control needle 5 includes pressure compensation piston 10 that, along with needle tip 11, delimits pressure chamber 13, which is in communication with common supply conduit 3 via fuel admission passage 12. *Id.* at 2:35–39. Magnetostrictive actuator 21, under control of control unit 20, operates

orifice control needle 5 via hydraulic transmission element 22 at the end of the control needle opposite tip 11. *Id.* at 2:60–64.

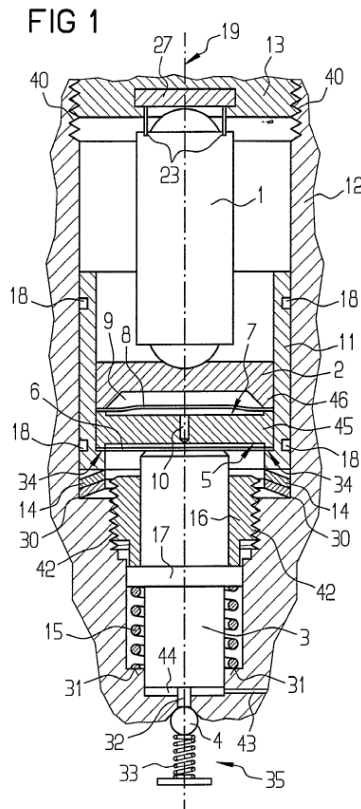
2. *Summary of Klügl (Exs. 1005 and 1006)*

Klügl is titled “Device for transmitting a motion and an injector with a device for transmitting a motion.” Ex. 1006, code (54). Klügl discloses

A power transmission device . . . used, for example, in automotive engineering to transmit the movement of a piezoelectric actuator in an injection valve to a control element, the control element opening a servo valve, for example, which in turn controls the opening and closing of an injection valve.

Id. at 1:7–12.⁷

Figure 1 of Klügl is reproduced below.



⁷ In citations to Klügl, we (like the parties) refer to the native pagination (i.e., column and line numbers).

Figure 1 of Klügl depicts an injection valve including housing 12 and piezoelectric actuator 1, which is arranged between upper stop 13 and transmission module 2. *Id.* at 1:47–51. Transmission module 2 is essentially cylindrical and includes pressure chamber 5, which is at least partially filled with hydraulic fluid and is delimited by first membrane 6. *Id.* at 1:60–62; 1:68–2:2. Connecting bore 10, which has a throttling effect, connects pressure chamber 5 to compensation chamber 7. *Id.* at 1:62–66. Drive piston 3 is biased against lower stop 16 and merges into control needle 32, which extends through relief chamber 34 to valve seat 35. *Id.* at 2:35–36, 50–52. Ball (or closing element) 4 presses against valve seat 35 by valve spring 33. *Id.* at 2:54–55. Actuating piezoelectric actuator 1 presses transmission module 2 against the spring force of the disk spring 14 and exerts pressure on drive piston 3 via first membrane 6, which exercises the hydraulic fluid in pressure chamber 5. *Id.* at 3:23–29. The hydraulic fluid moves drive piston 3 against the force of tension spring 15, and control needle 32 lifts ball 4 off valve seat 35. *Id.* at 3:30–33.

3. *Summary of Newcomb (Ex. 1014)*

Newcomb is titled “Temperature-Compensated Control Valve.” Ex. 1014, code (54). Newcomb “relates to a control valve such as a servovalve or fuel injection valve for controlling flow of a medium.” *Id.* at 1:5–7. Newcomb describes that the object of the invention is to provide a control valve with a construction that reduces the effects of thermal expansion. *Id.* at 1:45–49; *see also id.* at 1:31–38 (describing that piezoelectric valves have a small stroke and that it is essential to minimize thermal expansion of valve parts so that valve flow varies only slightly with ambient temperature changes). Newcomb discloses a control valve in which “part of the actuating member consists of a spacer or distance piece of a different non-

piezoelectric material having such a coefficient of thermal expansion that with temperature variations the linear expansion of the actuating element and distance piece together is equal to that of the housing.” *Id.* at 1:51–56. Newcomb explains that using a valve body material with a similar thermal expansion coefficient to the piezoelectric actuator “minimize[s] variations of valve opening with temperature.” *Id.* at 2:10–11.

4. Summary of Hayes (Ex. 1024)

Hayes is titled “Piezoelectric Controlled Common Rail Injector with Hydraulic Amplification of Piezoelectric Stroke.” Ex. 1024, code (54). Hayes relates to piezoelectric actuators for controlling a common rail injector. *Id.* at 1:8–10. Hayes discloses “a piezo actuated fuel injector comprising a[] hydraulic amplifier to increase the stroke of the piezo stack and a 2/2 poppet valve with the return spring on the top side of the valve.” *Id.* at 1:54–57.

Figure 1 of Hayes is reproduced below.

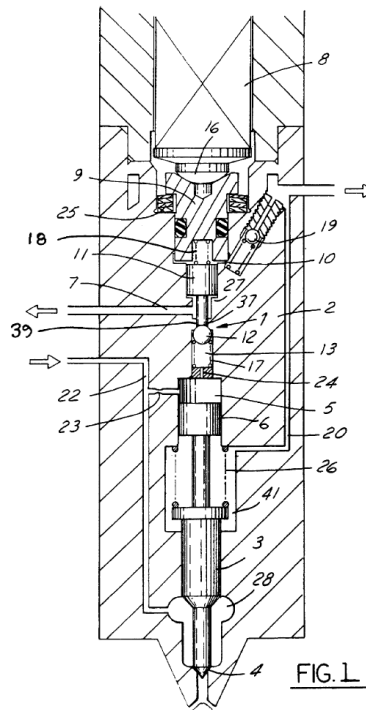


Figure 1 depicts an injector including body 2, piezoelectric actuator 8, a hydraulic stroke amplifier with pistons 9 and 11, hydraulic chamber 10 filled with low-pressure fuel, control valve 1, control chamber 5, and power piston 6 mechanically connected to injection valve needle 3. *Id.* at 2:6–15, 50–51. Feeding line 22 feeds high-pressure fuel to injection pressure chamber 28 and is connected to control chamber 5 via flow restrictor 23. *Id.* at 2:45–49. In operation, energizing piezoelectric actuator 8 opens sealing component 12 of control valve 1, which lowers the pressure in control chamber 5 against power piston 6, which causes valve needle 3 to lift away from seat 4 and open a passage for high pressure fuel to be injected into a combustion chamber. *Id.* at 3:25–63.

E. Asserted Obviousness Based on Wirbeleit and Klügl

Petitioner asserts that claims 1–3, 6, 13, 14, 17–21, 26, 27, and 41 would have been obvious under 35 U.S.C. § 103(a) based on Wirbeleit and Klügl. Pet. 24–52. Patent Owner opposes. Prelim. Resp. 19–37. Having considered the arguments and evidence before us, we conclude that Petitioner has not demonstrated a reasonable likelihood of prevailing on its assertions.

1. Independent Claim 1

Below, we analyze Petitioner’s contentions as applied to the required elements of claim 1. Pet. 24–37.

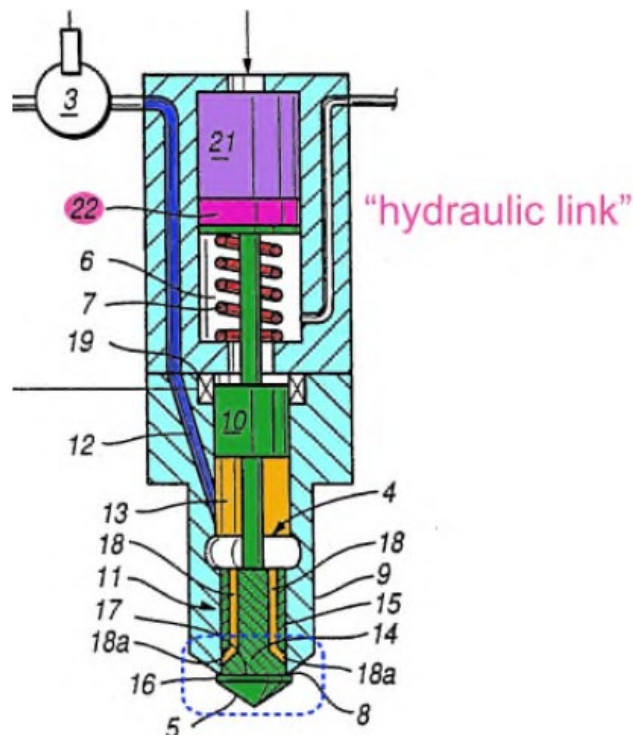
Claim 1 is generally directed to an injection valve for injecting fuel into a combustion chamber of an internal combustion engine. *See* Ex. 1001, 17:43–53. The recited injection valve includes limitation 1(e), which recites:

a hydraulic link assembly comprising a passive hydraulic link having a hydraulic fluid thickness through which said opening

and closing forces are transmitted, whereby said *hydraulic fluid acts substantially as a solid with said thickness being substantially constant while said actuator assembly is actuated* and wherein said thickness of said hydraulic link is adjustable while said actuator assembly is not actuated in response to changes in the dimensional relationship between components of said injection valve to maintain a desired valve lift upon actuation of said actuator assembly.

Id. at 17:42–53 (emphasis added).

For these limitations, Petitioner asserts that Wirbeleit’s hydraulic transmission element 22 is sealed within its housing and is not connected to a separate fluid supply. Pet. 32 (citing Ex. 1004, Fig.). Petitioner provides an annotated version of Wirbeleit’s figure, shown below, in which the hydraulic transmission element 22 is marked in pink.

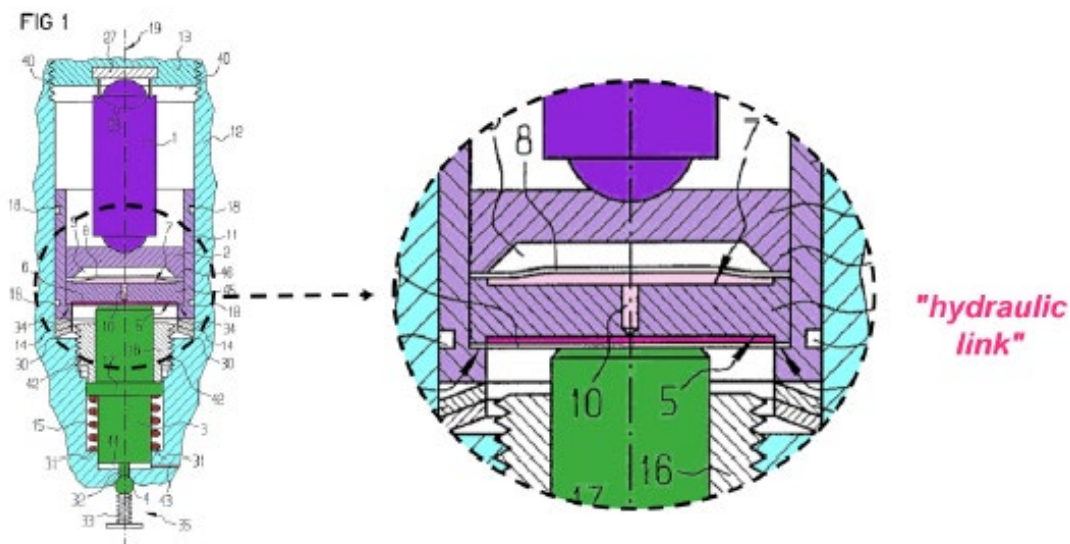


Petitioner's annotated figure provided on page 32 of the Petition marks Wirbeleit's hydraulic transmission element 22 in pink. Pet. 32.

Because Wirbeleit does not teach the specifics of element 22 in detail, Petitioner relies on Klügl for the remaining limitations recited in claim 1. *Id.* at 32; *see* Ex. 1004, 2:63–64. Petitioner contends that Klügl's transmission module 2 is located between the actuator and drive piston 3. Pet. 33 (citing Ex. 1006, 1:48–51; 2:23–41; Fig. 1). Petitioner asserts that transmission module 2 includes pressure chamber 5, compensating chamber 7, and throttle/connecting bore 10. *Id.* (citing Ex. 1006, 1:60–2:4, Fig. 1).

Petitioner further argues that pressure chamber 5 and compensating chamber 7 are filled with incompressible hydraulic fluid. *Id.* (citing Ex. 1006, 1:60–2:4).

Below is an annotated version of Klügl's Figure 1 provided on page 34 of the Petition.

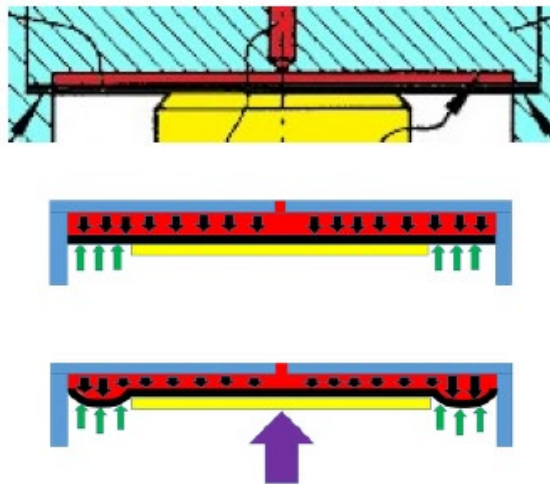


Petitioner's annotated Figure 1 from page 34 of the Petition marks the actuator assembly in dark and light purple. Pet. 34. In Petitioner's

annotated figure, pressure chamber 5 is shown in dark pink while throttle 10 and compensation chamber 7 are shown in light pink. *Id.*

Petitioner argues that in “Figure 1, the dimensions of chamber 5—including its thickness—remain constant so that the movement of the actuator results in the same amount of movement of the piston.” Pet. 34. (citing Ex. 1006, 3:23–29, Fig. 1; Ex. 1003 ¶¶ 207–215). According to Petitioner, “no stroke amplification occurs and chamber 5 does not change dimension. As a result, the hydraulic link simply transmits force rather than generating it and its ‘thickness’ is ‘substantially constant.’” *Id.* at 36 (citing Ex. 1003 ¶¶ 218–222).

In response, Patent Owner contends that Klügl does not teach a hydraulic fluid that acts substantially as a solid with a thickness being substantially constant while the actuator assembly is activated. Prelim. Resp. 29. This is because “Klügl does not include the words ‘solid’ or ‘thickness’ and teaches a system that transmits movement using a chamber of fluid maintained at a constant pressure behind a flexible membrane so that the membrane can deform to adjust for dimensional changes.” *Id.* at 29 (citing Ex. 2004 ¶¶ 50). To explain, Patent Owner provides drawings on page 31 of the Preliminary Response, shown below:



Patent Owner provides three drawings illustrating deformation of Klügl's membrane 6 (in black) during actuation. *Id.* More specifically, Patent Owner contends that Klügl's membrane 6 will deform inward where it contacts the drive piston (yellow) and bulge outward into the annular area between the drive piston and sleeve 11 (blue) when a force (purple arrow) is applied. Prelim. Resp. 31 (citing Ex. 2004 ¶¶ 48–50).

Based on our review of Klügl, we agree with Patent Owner's position. Klügl teaches that when actuated,

piezoelectric actuator 1 presses the entire transmission module 2 against the spring force of the disk spring 14 in the direction of the drive piston 3, *so that pressure is exerted on the drive piston 3 via the first membrane 6* and the transmission medium located in the pressure chamber 5 is exercised.

Ex. 1006, 3:12–29 (emphasis added). In this regard, we agree with Patent Owner that Klügl's actuator assembly teaches a system that transmits movement using a chamber of fluid maintained at a constant pressure behind a membrane. Prelim. Resp. 29; *see id.* As such, whether the fluid in Klügl's actuator assembly acts “substantially as a solid with a thickness being

substantially constant while the actuator assembly is activated” depends also on the effect of actuation on the membrane.

Petitioner acknowledges that “chamber [5] is defined and sealed by a membrane 6.” Pet. 20 (citing Ex. 1006, 3:23–33). However, Petitioner does not address membrane 6 in its discussion of claim 1(e). *See* Pet. 31–37. The Petition’s citations to Dr. Quinlan’s testimony in paragraphs 207–215 and 218–222 are not helpful in this regard. For example, Dr. Quinlan testifies that

In the embodiment shown in Klügl’s Figure 1, the movement of the actuator results in the same amount of movement of the piston without amplification. In other words, there is no change in the “stroke translation.” (*Id.*, Fig. 1; 1:41–42, 3:23–29.) *As the fluid in chamber 5 is held in place by a membrane 6 and moves through a cylindrical space of constant width and unchanging shape, the thickness of the fluid in chamber 5 will remain constant throughout actuation. (See id.).*

Ex. 1002 ¶ 208 (emphases added). But, Dr. Quinlan’s citations to Klügl do not support these conclusions. Figure 1 and lines 41–42 of column 1 do not teach that the fluid in chamber 5 moves through a cylindrical space of “constant width” and “unchanging shape,” or that the fluid maintains a constant thickness throughout actuation. Ex. 1006, Fig. 1, 1:41–42, 3:23–29. Likewise, column 3, lines 32–29 teach that “pressure is exerted on the drive piston 3 via the first membrane 6[.]” *See id.* at 3:23–29. Absent from these cited passages is any mention of constant width, unchanging shape, or fluid thickness.

Dr. Quinlan further testifies that “[t]he fluid is unable to leave chamber 5 during actuation (it cannot flow through throttle 10 and is held in place by a membrane 6).” Ex. 1002 ¶ 212. While that may be so, Dr.

Quinlan does not explain how membrane 6 maintains the constant dimensions of the purported cylindrical space, i.e., constant width, unchanging shape, and constant fluid thickness. *See id.* ¶¶ 208, 222. Rather, Dr. Quinlan’s conclusions are unsupported by cited passages and the reference as whole.

In contrast, Patent Owner’s expert, Dr. Christopher Atkinson, explains that “membrane [6] will tend to deform inward where it contacts the drive piston and bulge outward where unconstrained in the annular area between the edge of the drive piston and the wall of the transmission module in order to accommodate the volume of the fluid contained therein.” Ex. 2004 ¶ 52. Said another way, Dr. Atkinson’s testimony considers that only a portion of membrane 6 bears against drive piston 6. *Id.* Dr. Atkinson further explains that there is an “unconstrained” portion of membrane 6 that will experience pressure from the fluid within pressure chamber 5, but will not contact piston 3. *Id.* ¶ 51.

Dr. Atkinson’s testimony is consistent and better supported by the disclosure of Klügl while Petitioner’s expert’s testimony is incomplete and does not fully take into account how membrane 6 functions in Klügl’s actuator assembly. *See* Ex. 1002 ¶¶ 207–215, 218–222. Moreover, the Petition itself does not explicitly discuss Klügl’s membrane 6 with regard to claim 1(e). Pet. 31–37. For these reasons, we find that Petitioner’s arguments are incomplete and insufficiently developed to support its obviousness contentions for independent claim 1.

Accordingly, we determine that Petitioner has not established a reasonable likelihood of prevailing on its assertions that claim 1 would have been rendered obvious by Wirbeleit and Klügl.

2. Independent Claim 41 and Dependent Claims 2, 3, 6, 13, 14, 17–21, 26, and 27

Petitioner's obviousness contentions for independent claim 41 rely on the same deficient analysis discussed with respect to claim 1. Pet. 45–46. Thus, we determine that Petitioner has not established a reasonable likelihood that it would prevail in showing that the subject matter of claim 41 would have been obvious over the combination of Wirbeleit and Klügl.

Petitioner's analysis for dependent claims 2, 3, 6, 13, 14, 17–21, 26, and 27 also rely on the same deficient analysis. Pet. 37–52. Thus, we determine that Petitioner has not established a reasonable likelihood that it would prevail in showing that the subject matter of claims 2, 3, 6, 13, 14, 17–21, 26, and 27 would have been obvious over the combination of Wirbeleit and Klügl.

F. Asserted Obviousness Based on Wirbeleit, Klügl, and Newcomb

Petitioner asserts that claim 28 would have been obvious under 35 U.S.C. § 103(a) based on Wirbeleit, Klügl, and Newcomb. Pet. 52–55.

Claim 28 depends from claim 1. Petitioner's contentions regarding claim 28 rely on the same deficient analysis. Pet. 52–55. Thus, we determine that Petitioner has not established a reasonable likelihood that it would prevail in showing that the subject matter of claim 28 would have been obvious over the combination of Wirbeleit, Klügl, and Newcomb.

G. Asserted Obviousness Based on Klügl and Hayes

Petitioner asserts that claims 1–3, 6, 13, 14, 17–21, 26, 27, and 41 would have been obvious under 35 U.S.C. § 103(a) based on Klügl and Hayes. Pet. 55–74. Patent Owner opposes. Prelim. Resp. 37–47.

Petitioner's analysis for these claims rely on the same deficient analysis regarding Klügl. Pet. 55–74. Thus, we determine that Petitioner

has not established a reasonable likelihood that it would prevail in showing that the subject matter of claims 1–3, 6, 13, 14, 17–21, 26, 27, and 41 would have been obvious over the combination of Klügl and Hayes.

H. Asserted Obviousness Based on Klügl, Hayes, and Newcomb

Petitioner asserts that claim 28 would have been obvious under 35 U.S.C. § 103(a) based on Klügl, Hayes, and Newcomb. Pet. 74.

Petitioner’s contentions regarding claim 28 rely on the same deficient analysis discussed above. Pet. 74. Thus, we determine that Petitioner has not established a reasonable likelihood that it would prevail in showing that the subject matter of claim 28 would have been obvious over the combination of Klügl, Hayes, and Newcomb.

IV. CONCLUSION

For the foregoing reasons, we deny institution of *inter partes* review of the ’138 Patent.

V. ORDER

Upon consideration of the record before us, it is:

ORDERED that the Petition is denied as to all challenged claims, and no *inter partes* review is instituted.

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