IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

TMC FUEL INJECTION SYSTEM, LLC	:	**CIVIL ACTION**
v.	:	**No. 12-4971**
FORD MOTOR COMPANY	:	

Norma L. Shapiro, J. **January 13, 2014**

MEMORANDUM AND ORDER

Plaintiff, TMC Fuel Injection System, LLC ("TMC"), filed an action for patent infringement against defendant, Ford Motor Company ("Ford"). TMC alleges that Ford is infringing claim numbers 38 and 40 of its U.S. Patent No. 7,318,414 ("the '414 patent"), which was issued by the United States Patent and Trade Office ("PTO") on January 15, 2008.

Before the court are the claim construction briefs of both TMC and Ford. The parties dispute the construction of several terms contained in the claims at issue. The court held a *Markman* hearing on October 15, 2013, at which both parties were heard. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967 (Fed. Cir. 1995) (en banc), *aff'd* 517 U.S. 370 (1996).

I. LEGAL STANDARD

In a patent infringement action, the court must first determine the scope and meaning of the patent claim, if disputed, then the trier of fact compares the judicially-defined claim with the alleged infringing device. *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998) (en banc). Construction of a patent is a matter of law and interpreting the terms within a patent's claim is "exclusively within the province of the court." *Markman*, 517 U.S. at 372. A court gives the terms in a claim "their ordinary and customary meaning." *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). "[T]he ordinary and customary

meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

"[T]he court should look first to the intrinsic evidence of record, *i.e.*, the patent itself, including the claims, the specification and, if in evidence, the prosecution history. Such intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language." *Vitronics*, 90 F.3d at 1582. The court should initially consider the words of the claim itself to understand and define the scope of the invention. *Id.*; *see also Phillips*, 415 F.3d at 1314 ("Because claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims."). Next, the court must look to the specification of the patent. *Vitronics*, 90 F.3d at 1582. The specification contains a clear and complete written description of the invention, so that an ordinary person skilled in the art may make and use the invention. 35 U.S.C. § 112(a). "[T]he specification is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Vitronics*, 90 F.3d at 1582. Finally, if needed, the court may look to the prosecution history of the patent, which is "the complete record of all the proceedings before the Patent and Trademark Office." *Id.* However, the prosecution history may be less useful for claim construction purposes because it represents an "ongoing negotiation" between the inventor and the PTO that can contain ambiguity itself. *See Phillips*, 415 F.3d at 1317. "In most situations, an analysis of the intrinsic evidence alone will resolve any ambiguity in a disputed claim term. In such circumstances, it is improper to rely on extrinsic evidence." *Vitronics*, 90 F.3d at 1583.

If the intrinsic evidence is insufficient to understand the legally operative meaning of the terms of a claim, the court may also look to extrinsic evidence, including the testimony of experts or inventors, dictionaries, and treatises. *Phillips*, 415 F.3d at 1317. However, extrinsic evidence is "less significant than the intrinsic record in determining the legally operative meaning of claim language." *Id.* (quotation marks and citations omitted). Where a term is unambiguous, the most important consideration is the ordinary meaning of the words in the patent.

II. DISCUSSION

A. The Invention

The '414 patent describes a fuel injection system used to supply fuel from an automobile tank to its engine. In most fuel injection systems, fuel is pumped from the fuel tank through a metal pipe called a fuel rail. From the fuel rail, fuel is distributed to fuel injectors that inject fuel into the engine. There are two ways of increasing the amount of fuel that is injected into the engine: (1) increasing the pressure of the fuel being pumped through the fuel rail; and (2) increasing the amount of time each fuel injector remains open and increasing the size of the space allowing fuel to flow into the engine.

It is not always easy to provide the exact amount of fuel needed by the engine at a given time. Much more fuel is needed to accelerate to 60 miles per hour when entering a highway than maintaining a speed of 25 miles per hour on a flat rural road. It takes more fuel to power a heavier vehicle at a given speed than a lighter vehicle at that same speed. When there is excess fuel in an engine, it is generally pumped back into the fuel tank through a pipe known as a fuel return line, but the engine will heat the fuel before it returns to the tank through the return line. It is undesirable to have heated fuel in the tank.

Two methods are commonly used to regulate the amount of fuel going into the engine to prevent heated fuel from returning to the tank. These two methods comprise the prior art. Both of these methods regulate the fuel injected into the engine by increasing or decreasing the pressure of the fuel being pumped into the engine. The first varies the speed of the fuel pump. The faster the speed of the fuel pump, the more pressure is on the fuel to flow to the engine. A lag between a change in the fuel demand and the speed of the pump may lead to excess fuel being pumped to the engine or not enough fuel reaching the engine to meet demand. Another problem is that the frequent acceleration and deceleration of the pump can shorten the product life and reliability of the pump.

A second method for regulating the amount of fuel is by using a pressure regulator. A pressure regulator allows fuel to pass through to the engine until a certain pressure is reached; the excess fuel is returned from the regulator to the tank through a fuel return line. Preventing the pressure from increasing beyond the desired point allows the speed of the fuel pump to remain constant. A pressure regulator is mechanically complex, and difficult and costly to manufacture and repair.

The claimed invention seeks to improve on the prior art by using fixed flow constraint to regulate the fuel reaching the engine, while still allowing the fuel pump to function at a substantially constant speed. The invention also is claimed to maintain stable fuel pressure without relying on a pressure regulator through the use of one or more by-pass lines. Fuel is recirculated to the tank through lines, bypassing the fuel rail and heating by the engine. By restricting or expanding the space through which the fuel must flow, the claimed invention can also provide an accurate amount of fuel to the engine as demanded by driving conditions without the lag associated with changing fuel pump speed or adjusting a pressure regulator. The claimed

invention primarily seeks to utilize the second method for regulating the amount of fuel sent to the engine, *i.e.*, regulating the size of the space through which the fuel passes.[1]

B. Claims 38 and 40

TMC alleges that Ford infringes on claim numbers 38 and 40 in the '414 patent. The parties dispute certain terms contained in both of the claims. The claims are copied below, with the disputed terms underlined.

Claim 38:

> A fuel injection system for delivering pressurized fuel from a fuel supply to fuel injectors of an engine which uses a fuel recirculation loop to minimize or eliminate the need of a hot fuel return line and a low pressure regulator comprising:
>
> [1] a fuel supply,
>
> [2] a fuel rail in fluid communication with at least one fuel injector,
>
> [3] a fuel pump having an outlet and an inlet, the inlet being connected to the fuel supply and driven at a substantially constant speed,

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[1]The prosecution history of the '414 patent is long and complex. Over the course of nearly six years, the '657 application was rejected by the PTO no fewer than four times. After the "final" rejection, the inventor, Dr. Hou, appealed the rejection. This appeal focused on distinguishing the prior art and persuaded the examiner to grant the application and issue the patent. The patent history is described at greater length in the parties' briefs. *See* TMC Brief at 7-8 (paper no. 40); Ford Brief at 12-18 (paper no. 39). The important dates are summarized below:

- May 10, 2002: The '657 application is filed with the PTO.
- July 30, 2003: The '657 application is rejected by the examiner for indefiniteness.
- November 3, 2003, and December 11, 2003: The '657 application is amended in response to the examiner's comments.
- March 3, 2004: The examiner rejects the '657 application for a second time.
- June 28, 2004: The examiner holds an interview with the inventor and counsel.
- August 6, 2004: The '657 application is again amended. Claim 38 (numbered claim 42 throughout the prosecution) is added at this time.
- November 19, 2004: The '657 application is rejected for a third time.
- February 4, 2005: The examiner holds a second interview with the inventor and counsel.
- February 22, 2005: The '657 application is amended.
- July 25, 2005: The examiner holds a third interview with the inventor and counsel.
- February 1, 2006: The '657 application is rejected for a fourth time in a final rejection.
- April 24, 2006: The '657 application is amended. Claim 40 (numbered claim 49 throughout the prosecution) is submitted to the PTO at this time.
- October 2, 2006: An appeal brief is filed with the PTO to contest the final rejection.
- Nov. 14, 2006: A second appeal brief is filed to comply with formatting requirements.
- April 5, 2007: The examiner determines that the claims of the '657 application were allowable.
- January 15, 2008: The '414 patent is issued.

[4] a main fuel supply line connected from the outlet of the fuel pump to the fuel rail in fluid communication with the at least one fuel injector,

[5] a fuel return path with flow constraint, connected from some location in the main fuel supply line, including the outlet of the fuel pump, avoiding the fuel rail to some location in the fuel supply including the inlet of the fuel pump, allowing fuel recirculation to stabilize the pump operation, and creating stable fuel pressure.

Claim 40:

A fuel injection system for delivering fuel from a fuel supply to fuel injectors of an engine which uses a fuel recirculation loop to minimize the need of a hot fuel return line and a low pressure regulator, comprising:

[1] a fuel supply,

[2] a fuel rail in fluid communication with at least one fuel injector,

[3] a fuel pump having an outlet and an inlet, the inlet being connected to the fuel supply and driven at a substantially constant speed,

[4] a main fuel supply line connected from the outlet of the fuel pump to the fuel rail in fluid communication with the at least one fuel injector,

[5] a fuel return path with flow constraint, provided by an orifice of predetermined diameter in the return path connected from some location in the main fuel supplu line, including the outlet of the fuel pump avoiding fuel rail, to some location in the fuel supply including the inlet of the fuel pump, allowing fuel recirculation to stabilize the pump operation creating stable fuel pressure.

C. Disputed Terms

1. Fuel Recirculation Loop and Fuel Recirculation

Phrase	Plaintiff's Construction	Defendant's Construction
Fuel recirculation loop	Continuous flow fuel return path	No construction needed
Fuel recirculation	Continuous flow fuel return	No construction needed

TMC argues that the terms "fuel recirculation loop" and "fuel recirculation" should be construed as "continuous flow fuel return path" and "continuous fuel return," respectively. TMC Brief at 13-14. Ford contends that both terms require no construction. Ford Reply at 4-5 (paper no. 41).

The patent specification explains that an:

objective of this invention is to constantly circulate fuel through the fuel-return line to maintain a constant pressure and to avoid excess fuel and pressure built-up at the fuel-rail. Thus, hot fuel from the fuel rail does not need to return to the fuel tank and the temperature in the tank will remain unchanged regardless of how

long the vehicle is in operation.

Specification at 5:16-19; *see also* TMC Brief at 14. Fuel recirculation is the primary means by which the invention maintains a stable fuel pressure without relying on a pressure regulator.

The court finds that the terms "fuel recirculation loop" and "fuel recirculation" refer to this constant circulation as described in the specification. The terms are unambiguous on their face and do not require further construction.

2. Minimize or Eliminate the Need of a Low Pressure Regulator

Phrase	Plaintiff's Construction	Defendant's Construction
Minimize [or eliminate] the need of . . . a low pressure regulator	None given	The fuel system does not use a pressure regulator

Ford argues that both claims 38 and 40 exclude the possibility that the fuel system uses a pressure regulator. Ford Brief at 25-29. TMC argues that "[d]iminishing or eliminating the need of a component, does not mean that the component must be absent from the system — it merely means that the component is not needed to practice the claimed elements. For example, the component may be included as a backup to the claimed invention, even though unnecessary for the system to perform as desired." TMC Reply at 10 (paper no. 42).

The language of the claim 38 supports the position that a pressure regulator may be present. Claim 38 describes a "a fuel recirculation loop to minimize *or eliminate* the need of . . . a low pressure regulator" (emphasis added). Claim 40 only uses the phrase "to minimize" when describing the invention's effect on the use of a pressure regulator. If "to minimize" means that a pressure regulator could not be physically present, then the disjunctive phrase "to eliminate" would be rendered superfluous in claim 38. *See, e.g.*, *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1119 (Fed. Cir. 2004) ("While not an absolute rule, all claim terms are presumed to have meaning in a claim.").

"To minimize" means to make less, not to eliminate. The specification does not state that a pressure regulator may not be present, but emphasizes that the system does not require one. *See, e.g.*, Specification at 8:55-61 ("The structure also reduces the critical dependence to a fuel regulator, which contains numerous high-precision mechanical parts."). The operative term of this phrase as used in claims 38 and 40 is "need." To minimize or eliminate the need for a component is not equivalent to the elimination of that component altogether.

The court finds that the phrase "minimize [or eliminate] the need of . . . a low pressure regulator" is unambiguous and does not require further construction.

3. Driven at a Substantially Constant Speed

Phrase	Plaintiff's Construction	Defendant's Construction
Driven at a substantially constant speed	Operated at a substantially constant speed for a range of driving conditions	Operate[d] at a single predetermined speed
A fuel pump . . . driven at a substantially constant speed	None given	A constant speed pump, i.e. a pump adapted to operate at a single predetermined speed

TMC and Ford disagree whether the fuel pump in the invention must remain at a "single predetermined speed" throughout the operation of the system or whether it may fluctuate slightly such that the pump operates at a "substantially constant speed for a range of driving conditions."

Both claims 38 and 40 use the word "substantially" to modify "constant" when describing the speed of the fuel pump. It follows that substantially should not be read out of the claim. *Innova/Pure Water*, 381 F.3d at 1119. Ford's construction would render "substantially" meaningless for either claim.

Ford argues that its use of the phrase "single predetermined speed" does not "require[] exactly constant speed." Ford Reply at 16 (emphasis in original). Ford insists that its construction describes a pump that is "adapted to operate" at a single speed, but in practice the

pumps may vary in the speed at which they actually run. *Id.* This interpretation of Ford's construction is confusing and Ford does not offer support for this contention.[2]

The court disagrees with Ford that "substantially constant" should be interpreted as a "single predetermined speed." Substantially, in its ordinary meaning, means most of the time; it does not mean absolutely always.

The court finds the disputed terms are self-evident and no construction is necessary.

4. Flow Constraint

Phrase	Plaintiff's Construction	Defendant's Construction
Flow constraint	Fixed flow resistance	Calculated fixed flow resistance in a designed system to create pressure levels

Both parties agree that "flow constraint" is defined in the prosecution history as "fixed flow resistance."[3] *See* TMC Brief at 16-17; Ford Reply at 7-8. The court will construe "flow constraint" as "fixed flow resistance."

[2]The court does not find that there is a meaningful difference between the proposed qualification of "single predetermined speed" offered by Ford and the ordinary meaning of "substantial."

[3]Ford argues that TMC arbitrarily omits part of the explanation used in the patent prosecution in an attempt to enlarge the scope of the patent. Ford Reply at 7 & n.3. Ford relies on a statement made by TMC in the Nov. 14, 2006, appeal brief before the PTO:

> When Appellant calls for flow constraint, he means *calculated fixed flow resistance in a designed system to create pressure levels* . . . . Such fixed resistance or constraint is what 'flow constraint' means everywhere it is used in the claims of this application and in this Brief.

Joint Appendix (paper no. 38) at DOC 501 (Nov. 14, 2006, Appeal Brief) (emphasis added). However, elsewhere in the same brief, the construction offered by TMC was used:

> The design of each system is largely in the by-pass lines. Each fuel by-pass line employs flow constraint or restraint. Both terms have been used interchangeably and refer to *fixed resistance to fuel flow* designed by an engineer for each application and each line may use one binary (on-off) fuel control valve respectively, but no [pump] regulator of any kind is used by the Appellant in the system nor needs to be used at anytime.

Joint Appendix at DOC 451 (Nov. 14, 2006, Appeal Brief) (emphasis added).

5. Stable Fuel Pressure

Phrase	Plaintiff's Construction	Defendant's Construction
Stable fuel pressure	Fuel pressure that stays largely constant for a given pump speed	Constant fuel pressure
Fuel recirculation . . . creating stable fuel pressure	None given	Fuel recirculation, as opposed to a pressure regulator or varying the pump speed, creates a constant fuel pressure

The court must determine the meaning of "stable." The parties dispute whether the fuel pressure remains "constant" (Ford) or "largely constant" (TMC) while the system is operating. The plain meaning of stable indicates that there is some variation in the fuel pressure. This seems closest to "largely constant." "Constant" would imply no variation at all. TMC identifies similar language used in the specification and patent prosecution. *See* Specification at 8:52-54 ("If the flow of the fuel-return is larger than the flow for fuel injection, the structure will regulate the pressure of the fuel system to be *almost constant*.") (emphasis added); *see also* Joint Appendix at DOC 491-92 (Nov. 14, 2006, Appeal Brief) ("With fuel supply of pressurized fuel to the fuel injectors, pressure at fuel rail will remain *relatively stable* under full range of pulse width during fuel injection no matter which pressure level is selected.") (emphasis added).

Ford argues (Ford Reply at 19) that the patent requires the fuel pressure to remain stable at any speed, rather than "at a given pump speed" or voltage. The specification and prosecution history support the position that the fuel pressure varies when different voltage is applied to the pump. Specification at 7:66-8:1 ("The voltage applied to the fuel pump can also be changed to create different sets of pressure P.") *see also* Joint Appendix at DOC 234 (Oct. 31, 2005, Amendment) ("By eliminating variables introduced by variable pump speeds . . . the applications system maintains constant fluid pressure at any selected pressure level without complicated regulatory systems of the prior art.").

TMC does not dispute Ford's contention that fuel recirculation—rather than a pressure regulator or variation in the pump speed—creates stable pressure in the system. This is supported by the specification and patent prosecution. *See, e.g.*, Specification at 5:16-19; Joint Appendix at DOC 464 (Nov. 14, 2006, Appeal Brief). However, the phrase Ford proposes to construe ("fuel recirculation . . . creating stable fuel pressure") unambiguously says exactly that, and so requires no construction.

The court will construe "stable fuel pressure" as "fuel pressure that stays largely constant for a given pump speed." The court finds that "fuel recirculation . . . creating stable fuel pressure" is unambiguous and requires no construction.

III. CONCLUSION

This is the court's construction of the disputed terms:

Phrase	Court's Construction
Fuel recirculation loop	No construction needed
Fuel recirculation	No construction needed
Minimize [or eliminate] the need of . . . a low pressure regulator	No construction needed
Driven at a substantially constant speed	No construction needed
Flow constraint	Fixed flow resistance
Stable fuel pressure	Fuel pressure that stays largely constant for a given pump speed
Fuel recirculation . . . creating stable fuel pressure	No construction needed

/s/ Norma L. Shapiro

J.