

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SCEPTER CANADA, INC.,
Petitioner,

v.

NO SPILL INC.,
Patent Owner.

IPR2020-00360
Patent 10,029,132 B2

Before SCOTT C. MOORE, FREDERICK C. LANEY, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

MOORE, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Scepter Canada, Inc. (“Petitioner”) filed a petition requesting *inter partes* review of claims 1–18 of U.S. Patent No. 10,029,132 B2 (Ex. 1001, “the ’132 Patent”). Paper 2 (“Pet.”). No Spill Inc. (“Patent Owner”) filed a Preliminary Response. Paper 6. We instituted an *inter partes* review as to all claims and grounds set forth in the Petition. Paper 7.

After institution, Patent Owner filed a response to the Petition (Paper 11, “Response” or “Resp.”), Petitioner filed a reply to the Response (Paper 14, “Reply”), and Patent Owner filed a sur-reply (Paper 19, “Sur-Reply”). Oral arguments took place on April 8, 2021.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has not shown by a preponderance of the evidence that any of the challenged claims is unpatentable.

A. Related Matters

Petitioner also challenged U.S. Patent No. 9,174,075, which is the parent application of the ’132 Patent, in IPR2020-00361. We declined to institute an *inter partes* review of that patent. IPR2020-00361, Paper 7.

According to the parties, the ’132 Patent is involved in *No Spill Inc. v. Scepter Corporation n/k/a 1216037 Ontario Inc., et al.*, Case No. 2:18-cv-02681-JAR-KGG (D. Kan.). Pet. 2; Paper 5, 2–3 (Patent Owner’s Mandatory Notice).

B. Real Parties In Interest

Petitioner asserts that Scepter Canada, Inc. and Myers Industries, Inc. are the real parties in interest. Pet. 2. Patent Owner asserts that No Spill Inc. is the real party in interest. Paper 5, 2.

C. Technology Background

This case involves safety features on portable fuel containers, specifically those safety features to prevent explosions of the container. According to the '132 Patent, most modern fuel containers work well under normal circumstances, but “explosions within fuel containers have been induced by researchers in highly-controlled, extreme laboratory environments.” Ex. 1001, 1:54–61.

Combustion requires a combination of oxygen and fuel in the presence of an ignition source. Ex. 1001, 1:47–50. The ratio of air to fuel is important because combustion cannot occur when there is too little fuel and too much air (a “lean mixture”), or when there is too much fuel and too little air (a “rich mixture”). *Id.* at 2:43–55. But “when fuel and air are present and their mixture is within a given combustible range, combustion will occur if the mixture is ignited.” *Id.* at 2:43–46.

Typically, the high volatility of fuel (e.g., gasoline) produces sufficient vapors inside the container to make the air-fuel mixture too rich to support combustion. Ex. 1010, 4 (Brian Elias, *Hazard Assessment of Portable Gasoline Container Flammability*, Worcester Polytechnic Institute (2011) (“Elias”)). However, in certain conditions, “such as small liquid volumes, low temperatures, or certain pour angles, a flammable region can develop in this space.” *Id.* This type of scenario is illustrated in Figure 1 of Elias, which is reproduced below.

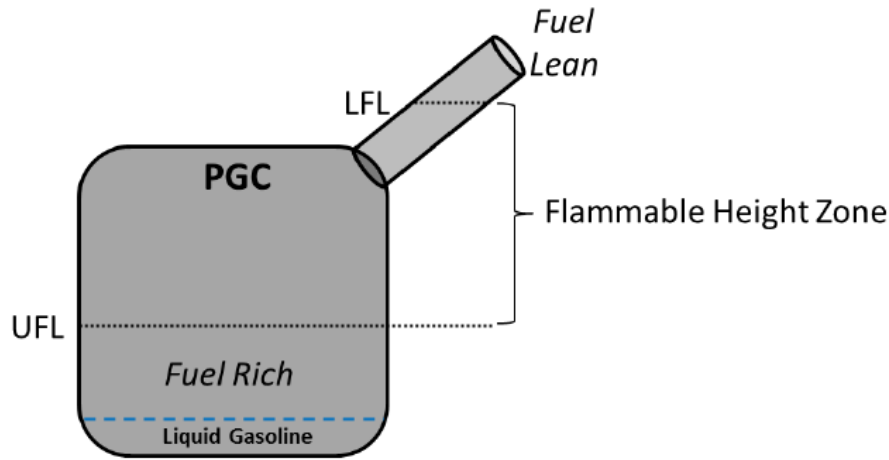


Figure 1. Flammable height zone within a PGC.

Figure 1 of Elias depicts a portable gasoline container (“PGC”) having a relatively low fuel level, “where a flammable vapor zone exists in the area between the liquid gasoline and the pour spout tip.” Ex. 1010, 4–5. “The lower area close to the liquid surface is above the upper flammable limit, while the area farthest from the liquid is below the lower flammable limit.” *Id.* at 4.

The ’132 Patent indicates that it was known in the prior art to use flame arrestors¹ to minimize the risk of portable fuel can explosions. Ex. 1001, 1:66–2:2. “A flame arrestor is a metal screen that is fitted inside the neck of the tank and attempts to keep an ignition source such as a flame or spark from entering the tank of the portable fuel container.” *Id.* at 2:2–5. A flame arrestor “absorbs and dissipates the heat generated by [a] flame” and

¹ Some of the cited references use the spelling “arrestor” rather than “arrestor.” Except when quoting materials that use a different spelling, we use the spelling “arrestor” herein in order to be consistent with the terminology of the challenged ’132 Patent.

thereby “insures that the vapors on the protected side of the [flame] arrester barrier do not reach their ignition temperature.” Ex. 1008, 2; *see also* Pet. 4 (explaining that flame arrestors include “screens with . . . apertures [that] allow heat to transfer from the flame to the length of the aperture”); Resp. 12 (“A metal flame arrester . . . is designed to contain enough metal to absorb the anticipated heat load so that it does not overheat and allow the flame to pass through it.”)

But flame arrestors also have limitations, particularly when used in plastic fuel containers. “[P]umping gasoline through a metal screen may cause a static spark Metal safety cans offer a grounding tab to prevent this static electricity discharge, but this is not possible nor practical in a synthetic resin (plastic) tank” Ex. 1001, 2:13–17.

D. The '132 Patent

The '132 Patent discloses a way of preventing explosions that “run[s] contrary to conventional thinking.” Ex. 1001, 2:37–38. “Rather than cutting off a source of liquid fuel or ignition sources” such as by way of a prior art flame arrester, the '132 Patent teaches that “an overly rich fuel-to-air ratio is provided within the portable fuel container, thus preventing the possibility of combustion.” *Id.* at 2:38–42. For example, an overly rich condition may “be maintained in close proximity to the opening [of the gas container] such that combustion may not proceed into the interior of the container but rather any explosive event will be suppressed by the retention of fuel immediately proximate to the opening.” *Id.* at 3:16–20.

The '132 Patent further discloses that one way of maintaining an overly rich mixture near the opening of a portable gas can is to use a “flash suppressor.” A flash suppressor can be a cylindrical structure having

perforations to allow the fuel to pass through, which nevertheless “retain[s] a sufficient quantity of fuel within the container, and in particular in the narrowed neck area such that the fuel-air mixture is too rich to support combustion entering” the portable fuel tank. *Id.* at 3:41–55.

One type of flash suppressor is depicted in Figure 7 of the '132 Patent:

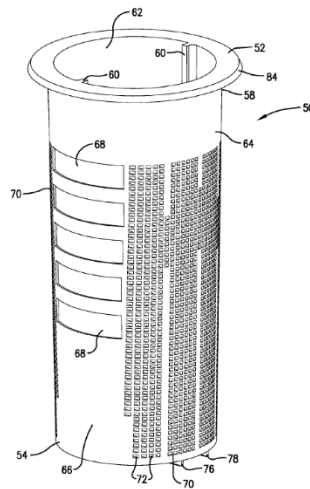


Fig. 7.

Figure 7, reproduced above, depicts an open-topped cylindrical structure 50 (flash suppressor) having many perforations 72. *Id.* at 6:63–7:42. This structure is attached to, and resides within, the opening of a portable fuel container. *See, e.g., id.* at Fig. 15. In this type of flash suppressor, fuel-retaining wall 64 at the top of the structure has no perforations, which prevents all of the fuel from draining from the fuel container, thus maintaining the fuel-rich environment near the pour spout. *Id.* at 7:28–31.

A second type of flash suppressor is depicted in Figure 16 of the '132 Patent:

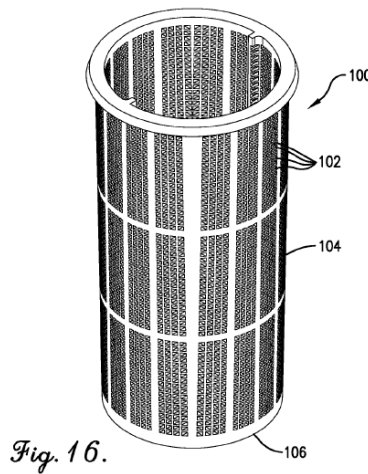


Figure 16, reproduced above, depicts flash suppressor 100 having perforations 102. *Id.* at 8:37–40. This embodiment has no fuel retaining wall 64, and instead relies on perforations 102 to retain the fuel at or near the opening of a portable fuel container. *Id.* at 8:46–51. “[T]he perforations are configured in a manner such that after the liquid fuel has been dispensed from the container and the fuel retention structure is no longer submerged in the liquid fuel, a quantity of the liquid fuel is retained in the perforations due to intermolecular forces.” *Id.* at 8:62–67. This retained fuel creates an environment near the opening that is too rich to support combustion. *Id.* at 8:43–46.

E. Challenged Claims

Claims 1–18 are challenged, which are all of the claims of the '132 patent. Claim 1 is the sole independent claim, and is reproduced below:

1. A fuel container comprising:
a hollow tank body defining a fuel-receiving chamber and a main container opening for permitting flow of a liquid fuel into and out of the fuel-receiving chamber;

a fuel dispensing assembly coupled to the tank body proximate the main container opening and configured to dispense the liquid fuel from the container; and
a flash suppressor located proximate the main container opening and extending at least 2 inches downwardly into the fuel-receiving chamber,
wherein the flash suppressor comprises a plurality of perforations through which the liquid fuel is required to flow in order to dispense the liquid fuel from the container,
wherein the flash suppressor is formed of a synthetic resin material,
wherein the flash suppressor has an internal volume of at least 2 cubic inches,
wherein the flash suppressor is at least 10 percent open,
wherein the average open area of the perforations is at least 0.001 and not more than 0.05 square inches and wherein the flash suppressor is not more than 80 percent open; and wherein the total number of perforations is at least 100 and not more than 10,000 and wherein the average length of the perforations is at least 0.02 inches.

F. Prior Art and Asserted Grounds

Petitioner asserts the following grounds:

Claims Challenged	35 U.S.C. §	References/Basis
1–15	103	Stevick I, ² Stevick II ³
16–18	103	Stevick I, Stevick II, Frost ⁴

² Glen Stevick, David Rondinone, Allan Sagle, and Joseph Zicherman, *Portable Plastic Gasoline Container Explosions and Their Prevention*, Society of Forensic Engineers and Scientists (2010) (Ex. 1005).

³ Glen Stevick, Joseph Zicherman, David Rondinone, and Allan Sagle, “Failure Analysis and Prevention of Fires and Explosions with Plastic Gasoline Containers” *Journal of Failure Analysis and Prevention*, Volume 11, Issue 5, pp. 455–465 (October 2011) (Ex. 1006).

⁴ U.S. Patent No. 2,850,083, iss. Sept. 2, 1958 (Ex. 1028).

Petitioner relies on testimony from Mr. Samim Safaei, who has a master's degree in fire prevention and work experience in that field. Ex. 1003 ¶¶ 3–4. Patent Owner relies on testimony from Richard J. Roby, who has work experience in the field of fire safety, an undergraduate degree in chemical engineering, and a Ph.D. in mechanical engineering. Ex. 2014 ¶ 3.

II. PATENTABILITY ANALYSIS

A. Claim Construction

“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). We find that it is not necessary to adopt explicit constructions of any claim terms in order to resolve the issues in dispute.

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art would have had “at least a bachelor’s degree in engineering or material science, and at least two years’ industry experience working in the field of explosion prevention or fuel containers.” Pet. 17 (citing Ex. 1003 ¶¶ 23–26). Petitioner further asserts, as an alternative, that a person of ordinary skill could “substitute directly relevant work experience with a higher level of education, e.g., an advanced degree such as a master’s [of] mechanical engineering.” *Id.*

Patent Owner asserts that one of ordinary skill in the art “would have at least a bachelor’s degree in chemical, mechanical, or fire protection engineering with some coursework related to fundamentals of combustion

including an understanding of flammability limits and the structure of premixed flames.” Resp. 30. Such a person would have “a fundamental understanding of ignition and extinction of premixed flames” and “at least two years of industry experience working in the field of combustion design, fire safety, explosion prevention, or fuel container design.” *Id.* Patent Owner agrees that “[a] higher level of education could substitute for work experience and vice versa.” *Id.*

The parties’ proposed formulations are similar. For example, both formulations require at least a bachelor’s degree in a relevant technology and two years of relevant industry experience, and the parties agree that a higher level of education could substitute for work experience and vice versa. We also discern no issues in dispute that turn on differences in the parties’ proposed formulations.

For purposes of this Decision, we apply Petitioner’s formulation of the level of ordinary skill, but our analysis would have been the same had we applied Patent Owner’s similar formulation.

*C. Analysis of the Stevick I-Stevick II Obviousness Ground
(Claims 1–15)*

1. Stevick I

Stevick I is a report on work “undertaken to determine probable causes of portable plastic gasoline container explosions and to consider and demonstrate preventive technologies for such explosions.” Ex. 1005, 1. The report “provides preliminary results” that “clearly show that when gasoline aging occurs . . . [,] ambient temperature and volume of aged gasoline in the container are primary variables controlling when such explosions can occur.” *Id.* According to Stevick I, aging of gasoline “is a precondition for

a gasoline container explosion” because “[i]f there is no aging, the hydrocarbon concentration in the vapor space will be above the upper explosive limit” (i.e., too rich) “and neither ignition nor explosion can occur.” *Id.* at 5.

Stevick I teaches that flame arrestors “work[] by removing heat from a flame and keeping the temperature of the fuel on the other side of the arrester below its ignition point.” Ex. 1005, 13. In particular, “[t]he flame arrester mesh breaks the flame into many flamelets, and the heat of these flamelets is transferred to the walls of the mesh.” *Id.*

Stevick I also discloses tests that were performed on flame arrestors, and indicates that “[n]ot once did an explosion occur.” Ex. 1005, 14. Three flame arrester designs are described in the Table 1 of Stevick, which is reproduced below.

Table1: Flame Arrester Comparisons

Can Material	Name	d - mesh hole size cm	Critical diameter (cm)	y - wire thickness cm	V (m/s)	Fundamental flame speed for gasoline (m/s)
Metal	JUSTRITE	0.0584	0.3	0.025	1.374	0.4
Plastic	EAGLE TYPE1	0.143	0.3	0.048	0.503	0.4
Metal	Blitz Commercial	0.03	0.3	0.020	3.04	0.4

Table 1, above, describes measurements (e.g., mesh hole size and wire thickness) of the JUSTRITE, EAGLE TYPE 1, and Blitz Commercial flame arrestors. *Id.*

2. Stevick II

Stevick II reports additional findings from the work described in Stevick I. Pet. 26; *see also* Resp. 26 (“Stevick II reports the same 15 tests . . . in Stevick I.”) Like Stevick I, Stevick II teaches that flame arrestors

“work[] by removing heat from a flame,” and that “[t]he flame arrester mesh breaks the flame into many flamelets, and the heat of these flamelets is transferred to the walls of the mesh.” Ex. 1006, 8.

Table I of Stevick II, reproduced below, describes six different flame arrestors. Ex. 1006, 9.

Table 1 A comparison of flame arrester geometry and dimensions for cans from six different manufacturers

Manufacturer	Can material	d , mesh hole size, mm	Critical diameter, mm Equation 1	y , wire thickness, mm	Flame speed, m/s Equation 2	Fundamental burning velocity for gasoline, m/s
A: Commercial Cylindrical flame arrester	Metal	0.584	3	0.25	1.374	0.4
B: Commercial Cylindrical flame arrester	Plastic	1.43	3	0.48	0.503	0.4
C: Commercial Screen disk flame arrester	Metal	0.3	3	0.20	3.04	0.4
D: Consumer (with plastic flame arrester)	Plastic	1.2	3	0.75 (plastic)	0.74	0.4
E: Consumer Cylindrical flame arrester by authors	Plastic	1	3	0.4	0.84	0.4
F: Consumer Screen disk flame arrester	Plastic	1	3	0.3	0.72	0.4

One consumer manufacturer (F) utilizes a screen that acts as a flame arrester. Authors developed and installed the flame arrester in can (E)

Table 1, above, lists measurements (e.g., mesh hole size and wire thickness) for these six flame arrestors. *Id.* Although the manufacturers are not identified, the first three flame arrestors have exactly the same dimensions as the three flame arrestors described in Table I of Stevick I.⁵ Compare Ex. 1006, 9, with Ex. 1005, 14. Thus, it is apparent that the first three flame arrestors described in Table I of Stevick II (i.e., Manufacturers A, B, and C) are, the JUSTRITE, EAGLE TYPE 1, and Blitz Commercial flame arrestors, respectively. *Id.*

⁵ Stevick II reports measurements for mesh hole size, critical diameter, and wire thickness in millimeters, rather than the centimeters used in Stevick I. Thus, even though the reported dimensions of these measurements differ by a factor of 10, the actual dimensions of these components are identical.

3. *Claim 1*

Independent claim 1 recites a fuel container with a “hollow tank body,” a “main container opening,” a “fuel dispensing assembly,” and a “flash suppressor” that “comprises a plurality of perforations” and “is formed of a synthetic resin material.” Ex. 1001, 11:27–43. The recited flash suppressor extends “at least 2 inches downwardly” into the container and has an “internal volume of at least 2 cubic inches.” *Id.* at 11:35–37, 43–44. Claim 1 also recites certain additional limitations pertaining to the flash suppressor and the perforations. *Id.* at 11:46–53.

Petitioner contends that independent claim 1 would have been obvious over Stevick I and Stevick II. Pet. 23–40. In particular, Petitioner contends that one of ordinary skill in the art would have been motivated to take the metal EAGLE flame arrestor (one of three arrestors described in Stevick I’s Table 1), replace the metal with plastic, and then increase the thickness of the wire to match the wire thickness of a plastic flame arrestor described in Stevick II’s Table 1. *Id.* at 28–31. According to Petitioner, one of ordinary skill in the art would have preferred to design a plastic fuel container to reduce manufacturing costs, and would have started the design process with the dimensions of a flame arrestor that was known to work with plastic gasoline containers. *Id.* at 28–29 (citing Ex. 1003 ¶ 86). Such a person allegedly would have focused on the EAGLE flame arrestor because it “was the only flame arrestor disclosed in Stevick I implemented in a plastic gasoline container,” and because it had the largest perforation diameter, which advantageously would have increased flow rate. *Id.* (citing Ex. 1003 ¶¶ 86–87). Because Stevick I and II are related, such a person allegedly would have looked to the teachings of both references, realized from Stevick

II that a plastic flame arrestor could be created, and would have been motivated to replace the metal of the EAGLE flame arrestor with plastic in order to reduce the likelihood of electrostatic buildup. *Id.* at 29–30 (citing Ex. 1003 ¶ 88–89). According to Petitioner, a plastic flame arrestor would have been the most practical and low-risk option, and would have been easier and cheaper to manufacture. *Id.* at 31 (citing Ex. 1003 ¶¶ 92–93). Finally, Petitioner contends that such a person would have further modified the plastic version of the EAGLE flame arrestor by increasing the wire thickness to match that of the Stevick II plastic flame arrestor, because a “plastic flame arrestor simply would be too fragile if it was made as thin as its metal counterpart.” *Id.* at 31 (citing Ex. 1003 ¶ 94).

Patent Owner argues that there are several problems with Petitioner’s proposed combination and several weaknesses with Petitioner’s rationale for combining the teachings of Stevick I and II. For example, Patent Owner argues that the allegedly obvious modified EAGLE flame arrestor would not extend “at least 2 inches downwardly into the fuel-receiving chamber” as recited in claim 1. Resp. 43–47. Patent Owner points out that Petitioner relies on measurements of the JUSTRITE flame arrestor of Stevick I to show that this limitation is satisfied, even though Petitioner’s obviousness argument is based on modifying a different embodiment (the EAGLE flame arrestor). *Id.* at 43–44. According to Patent Owner, the EAGLE arrestor is only 1.8 inches long, and thus would not satisfy this limitation. *Id.* at 45–47. Having reviewed the evidence and arguments submitted by the parties, we find Patent Owner’s argument persuasive.

The evidence of record establishes that the EAGLE flame arrestor of Stevick I and Stevick II is only 1.8 inches in length. We agree with Patent

Owner’s assertion that the EAGLE flame arrestor described in Table I of Stevick I (*see* Ex. 1005, 14) is the same as the Manufacturer B flame arrestor described in Table I and Figure 10 of Stevick II (*see* Ex. 1006, 9). *See* Resp. 45–46; Ex. 2014 ¶¶ 147–148. This argument, and the supporting testimony from the Roby Declaration, are persuasive at least because both parties admit that Stevick I and Stevick II describe the same experimental work (*see* Pet. 26; Resp. 26), and because the dimensions of the Manufacturer B arrestor of Stevick II’s Table 1 are identical to the dimensions of the EAGLE flame arrestor of Stevick I’s Table 1. *Compare* Ex. 1006, 9, *with* Ex. 1005, 14; *see* n.5, *supra*. The legend of Stevick II’s Figure 10 states that the Manufacturer B arrestor (i.e., the EAGLE) is “roughly 45 mm deep,” which translates to 1.8 inches. *See* Ex. 1006, 9; Ex. 2014 ¶ 147. Moreover, we agree with Dr. Roby that it is apparent from Stevick II’s Figure 10 that a portion of this 1.8 inches of depth is positioned in the metal rim, above the neck of the gasoline container opening. *See* Ex. 1006, Fig. 10; Ex. 2014 ¶ 148. Thus, the length of the EAGLE arrestor that would extend downwardly into the fuel receiving chamber must be less than 1.8 inches.⁶ *See* Ex. 2014 ¶ 148.

Petitioner argues in its Reply that Stevick I teaches that the EAGLE is “similar in size” to the “3-inch JUSTRITE flame arrestor,” and further teaches that depths of “1.8 or 3 inches in length were both effective options.”

⁶ Petitioner’s reply argument that there are “many types of EAGLE flame arrestors” that have different dimensions (*see* Reply 5) is not persuasive because Petitioner relies on a particular EAGLE flame arrestor—the EAGLE arrestor described in Stevick I and II—as the basis of its obviousness argument. The dimensions of other types of EAGLE flame arrestors are irrelevant because those other arrestors are never relied upon in the Petition.

Reply 5; Ex. 1035 ¶¶ 59–63. But even assuming, *arguendo*, that the statement “similar in size to the JUSTRITE device” in Stevick I refers to the EAGLE arrestor, this generalized description would not overcome the compelling evidence that the EAGLE arrestor does not extend at least 2 inches downwardly into the fuel receiving chamber (i.e., the actual dimensions of the EAGLE arrestor set forth in Stevick II). The Petition also never asserts, much less persuasively demonstrates, that any of the proposed modifications to the EAGLE arrestor would increase the length of the arrestor so that it satisfies this limitation (*see* Pet. 23–40).

Petitioner’s new argument on reply that Stevick I teaches that “1.8 or 3 inches in length were both effective options” (*see* Reply 5) is untimely and improper. Petitioner was required to identify *in its Petition* and “*with particularity* . . . the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3) (emphasis added). It is well-established that an invention “composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Rather, Petitioner must demonstrate “both ‘that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.’” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367–68 (Fed. Cir. 2016) (citation omitted). Thus, if a person of ordinary skill in the art would have needed to further modify the length of the EAGLE arrestor of Stevick I and II in order to arrive at the invention of claim 1, Petitioner was required to set forth this

modification with particularity, and provide a supporting rationale, in the Petition itself.

Here, the Petition contends that modifying the material and wire width of the EAGLE arrestor would yield the invention of claim 1. The Petition never proposes lengthening the EAGLE arrestor, much less identifies as a rationale that one of ordinary skill would have recognized that “1.8 or 3 inches in length were both effective options.” *See* Reply 5. Petitioner may not cure these deficiencies in its Petition by proposing additional modifications or rationales in its Reply. *See* Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019),⁷ 74 (“[A] reply or sur-reply may only respond to arguments raised in the preceding brief. . . . ‘Respond’ . . . does not mean proceed in a new direction with a new approach as compared to positions taken in a prior filing. . . . [A] reply or sur-reply that raises a new issue or belatedly presents evidence may not be considered.”). Accordingly, we reject Petitioner’s attempt to argue on reply that a skilled artisan would have had reason to further modify the EAGLE arrestor by increasing its length to three inches.

On this record, and considering all of the evidence and arguments by the parties, we find Petitioner has failed to demonstrate by a preponderance of the evidence that Stevick I and Stevick II would have taught or suggested a fuel container comprising a flash suppressor that extended “at least 2 inches downwardly into the fuel-receiving chamber,” and satisfied the remaining limitations of claim 1.

⁷ The Consolidated TPG is available at <https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf>.

We also observe several significant weaknesses in Petitioner’s rationales for why one of ordinary skill in the art would have had reason to modify the EAGLE arrestor in the manner set forth in the Petition. As discussed above, Petitioner contends that an ordinarily skilled artisan would have wanted to design a portable fuel container out of plastic in order to reduce costs (Pet. 28–29 (citing Ex. 1003 ¶ 86)), and would have been motivated to employ a plastic flame arrestor to reduce the likelihood of an explosion from static build-up (*id.* at 30 (citing Ex. 1003 ¶ 89)). Petitioner contends that such a person also would have considered the teachings of Stevick I and Stevick II together (*id.* at 29–30 (citing Ex. 1003 ¶ 88–89)), and that these teachings would have motivated such a person to start with the EAGLE arrestor because it was “the only flame arrestor disclosed in Stevick I implemented in a plastic gasoline container” (*id.* at 28 (citing Ex. 1003 ¶ 86)) and the flame arrestor with the largest perforation diameter (*id.* at 28–29 (citing Ex. 1003 ¶¶ 86–87)).

Petitioner’s first rationale, that the EAGLE arrestor is the only disclosed design implemented in a plastic gasoline container, ignores the disclosure in Stevick II of three additional flame arrestor designs implemented with plastic containers, including one arrestor made of plastic. *See* Ex. 1006, 9 (Table 1). Petitioner, which asserts that one of ordinary skill would have considered the teachings of Stevick I and Stevick II together, has offered no persuasive rationale for why such a person would have ignored the arrestors disclosed in Stevick II, and focused myopically on a single arrestor in Stevick I, as the starting point for a design. *See* Pet 28–31. Indeed, given the design goals set forth by Petitioner (i.e., a plastic flame arrestor that would work with a plastic gasoline container), the most logical

and straightforward approach would have been to start with the plastic flame arrestor (which had the second largest perforation diameter) that was already known to work with a plastic fuel container—the Manufacturer D arrestor of Stevick II. *See* Ex. 1006, 9 (Table 1).

Petitioner’s argument that the EAGLE arrestor had the largest perforation diameter is not persuasive because it ignores the modifications Petitioner proposes to make. It is true that the *unmodified* EAGLE arrestor has a hole diameter of 1.43 mm, which is larger than the 1.22 mm hole diameter of the plastic arrestor of Stevick II. *See* Ex. 1006, 9 (Table 1, Manufacturers B and D). But Petitioner proposes increasing the wire thickness of the EAGLE arrestor from 0.48mm to 0.75mm, a difference of 0.27 mm. *See* Pet. 31; Ex. 1003 ¶ 170. Assuming no other changes were made (and Petitioner has proposed none), increasing the wire thickness by 0.27 mm would necessarily decrease the hole diameter of the EAGLE by 0.27 mm.⁸ Thus, Petitioner’s modified EAGLE arrestor would have a perforation diameter of 1.16 mm, which is less than the perforation diameter of Stevick II’s plastic flame arrestor. Accordingly, Petitioner’s rationale based on the desirability of a large perforation diameter also does not persuasively demonstrate that one of ordinary skill in the art would have been motivated to use the metal EAGLE arrestor as the starting point for designing a plastic flame arrestor.

⁸ Increasing the wire thickness by 0.27 mm would necessarily decrease the width of the mesh holes by half of this amount (0.135 mm) on all sides. This would decrease the total diameter of each hole (i.e., the measurement from one side to the other) by 0.27 mm.

We also are not persuaded that one of ordinary skill in the art would have reasonably expected success in developing a plastic flame arrestor by taking the dimensions of the metal EAGLE flame arrestor, changing the material to plastic, and then increasing the wire thickness to match the thickness of the plastic flame arrestor of Stevick II.

As discussed above, the '132 Patent discloses preventing explosions by creating an overly rich fuel/air mixture at the opening of a fuel container. *See, e.g.*, Ex. 1001, 3:16–20. It was known in the art that combustion could not occur in the presence of an overly rich fuel/air mixture. *See, e.g., id.* at 2:43–55; Ex. 1010, 4. But Petitioner has not persuasively shown that it was known in the prior art to have a flame arrestor that prevents combustion by creating an overly rich fuel/air mixture at the opening of a fuel container.

The evidence of record demonstrates that prior art flame arrestors were understood to operate by “absorb[ing] and dissipat[ing] the heat generated by [a] flame” and thereby “insur[ing] that the vapors on the protected side of the [flame] arrester barrier do not reach their ignition temperature.” Ex. 1008, 2; *see also* Pet. 4 (asserting that flame arrestors include “screens with . . . apertures [that] allow heat to transfer from the flame to the length of the aperture”); Resp. 11–12 (“A metal flame arrestor . . . is designed to contain enough metal to absorb the anticipated heat load so that it does not overheat and allow the flame to pass through it.”) Indeed, Stevick I and Stevick II both teach that flame arrestors operate by “removing heat from a flame,” and that the “flame arrester mesh breaks the flame into many flamelets, and the heat of these flamelets is transferred to the walls of the mesh.” Ex. 1005, 13; Ex. 1006, 8. Therefore, one of ordinary skill in the art would have understood that it was critical to construct a flame arrestor of

a material that had the ability to efficiently and effectively conduct and absorb heat.

The “thermal conductivity” of a material is the ability of that material to conduct heat. *See* Ex. 2014 ¶ 178. Patent Owner offers persuasive evidence, which Petitioner never directly disputes, that metals are typically between 37 and 1,950 times better at conducting heat than are plastics. *See id.*

The “thermal inertia” of a material is a measure of how much the surface temperature of the material will increase when the material absorbs a given amount of heat (i.e., thermal energy). Ex. 2014 ¶ 177. A material with a high thermal inertia can absorb a given quantity of thermal energy while only increasing in temperature by a small amount. *See id.* In a material with a low thermal inertia, the same quantity of absorbed heat would cause a much larger increase in the material’s temperature. *See id.* Thus, materials with high thermal inertia are able to absorb much more energy before reaching a critical temperature (e.g., the combustion temperature of a fuel/air mixture). *See id.* Patent Owner offers persuasive evidence, which Petitioner never directly disputes, that metals typically have thermal inertias three orders of magnitude greater than plastics (i.e., that a typical metal could absorb 1,000 times more energy than could a typical plastic while increasing in temperature by the same amount). *See id.*

Petitioner proposes to increase the width of the EAGLE arrestor’s wires as part of its allegedly obvious combination. *See* Pet. 31. But Petitioner proposed this change because plastics are weaker than metals. *See id.* Petitioner does not contend that this modification would result in a

plastic flame arrestor with a thermal conductivity or thermal inertia similar to those of the original, unmodified EAGLE flame arrestor. *See id.*

Petitioner argues in Reply that the “impact of a material’s thermal conductivity for quenching is nominal.” Reply 13 (citing Ex. 1035 ¶ 83). But the cited testimony from the Supplemental Safaei Declaration merely states that “thermal conductivity is a relative measurement,” that “plastic still conducts heat,” and that plastic is more thermally conductive than air or vapors. *See* Ex. 1035 ¶ 83. Petitioner, however, is not proposing to replace metal with air, or to replace air with plastic. Petitioner is proposing to replace the metal of the EAGLE flame arrestor with plastic. Thus, the relevant comparison is between the thermal conductivity and thermal inertia of metal, and those of plastic. It is undisputed that metal and plastic are drastically different in these respects.

Petitioner additionally argues in its Reply that the Gossel equations used in Stevick II do not depend on thermal conductivity or thermal inertia, and that Stevick I and Stevick II “do not discuss thermal conductivity as a consideration in the design of flame arrestors.” Reply 13–14 (citing Ex. 1035 ¶¶ 83–84). But while Stevick I and Stevick II state that a successful flame arrestor design must satisfy the two Gossel equations, Petitioner has not persuasively demonstrated that the Gossel equations are the sole requirements that must be met in order for a flame arrestor to function properly. Stevick I and Stevick II both explicitly state that a flame arrestor operates “by removing heat from a flame and keeping the temperature of the fuel on the other side of the arrester below its ignition point.” Ex. 1005, 13; Ex. 1006, 8. Accordingly, Stevick I and Stevick II make clear that the ability of a material to conduct heat away from a flame (i.e., thermal

conductivity), and to absorb heat while remaining below the ignition temperature of fuel (i.e., thermal inertia), are critical considerations in flame arrestor design, regardless of whether those considerations are part of the two disclosed Gossel equations.

In addition, Petitioner does not offer any evidence that the proposed modifications to the EAGLE arrestor would result in a design that satisfied the Gossel equations. For example, the second Gossel equation, used to calculate the critical velocity (V) of a flame arrestor, is $V = (0.38ay)/d^2$, where a is the fractional free area of the arrestor surface, y is the thickness of the arrestor elements in centimeters, and d is the diameter of the apertures in centimeters. Ex. 1005, 13–14; Ex. 1006, 8.⁹ Stevick I and Stevick II teach that a flame arrestor will not function properly unless its critical velocity is greater than 0.4 m/s. Ex. 1005, 13; Ex. 1006, 8. The critical velocity of the unmodified EAGLE arrestor is 0.503 m/s, which is only slightly greater than the minimum. See Ex. 1005, 14; Ex. 1006, 9. Increasing the thickness of the wire, as Petitioner proposes, would change the fractional free area (a), the thickness (y), and the diameter of the apertures (d), which would change the critical velocity of the arrestor. See Ex. 1005, 13–14; Ex 1006, 8. Yet Petitioner never calculates the critical velocity of the modified EAGLE flame arrestor. Thus, even if the modified EAGLE arrestor would have had sufficient thermal conductivity and thermal inertia to operate, there would still be no evidence in the record that the

⁹ The version of this equation in Exhibit 1006 uses the coefficient “38” instead of “0.38,” because y and d in Exhibit 1006 are measured in meters, rather than centimeters. These equations, however, are mathematically equivalent.

modified EAGLE arrestor would have the minimum necessary critical velocity.

On this record, we find that metals and plastics differ significantly in their abilities to conduct and absorb heat. Considering all of the evidence and arguments put forth by both parties, we are persuaded that an ordinarily skilled artisan seeking to design a flame arrestor would not have reasonably expected that taking the design of a metal flame arrestor, and substituting plastic in place of the metal, and then increasing the wire thickness, would yield a successful design.

For the foregoing reasons, Petitioner has not demonstrated by a preponderance of the evidence a sufficient rationale for why one of ordinary skill in the art would have combined the teachings of Stevick I and Stevick II in the manner that the Petition contends would have taught or suggested the limitations of claim 1. Petitioner also has not demonstrated by a preponderance of the evidence that its allegedly obvious combination of Stevick I and Stevick II would have taught or suggested a fuel container comprising a flash suppressor “extending at least 2 inches downwardly into the fuel-receiving chamber” and satisfying the remaining limitations of claim 1. Accordingly, for each of these two reasons, Petitioner has not demonstrated by a preponderance of the evidence that claim 1 is unpatentable over Stevick I and Stevick II.

4. Claims 2–15

Dependent claims 2–15 depend from claim 1, and thus incorporate the limitations of claim 1. Petitioner’s contentions regarding claims 2–15 do not cure the deficiencies discussed above in Petitioner’s contentions regarding claim 1. Accordingly, for the same reasons discussed above with respect to

claim 1, Petitioner has not demonstrated by a preponderance of the evidence that claims 2–15 are unpatentable over Stevick I and Stevick II.

*D. Analysis of the Stevick I-Stevick II-Frost Ground
(Claims 16–18)*

Claims 16–18 depend from claim 1, and thus incorporate the limitations of claim 1. Petitioner’s arguments regarding claims 16–18 solely address the additional limitations recited in these dependent claims, and do not cure the deficiencies discussed above in Petitioner’s contentions regarding claim 1. *See* Pet. 51–56. Accordingly, for the same reasons discussed above with respect to claim 1, Petitioner has not demonstrated by a preponderance of the evidence that claims 16–18 are unpatentable over Stevick I, Stevick II, and Frost.

III. CONCLUSION

For the foregoing reasons, we determine Petitioner has not shown by a preponderance of the evidence that any of the challenged claims are unpatentable.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–15	103(a)	Stevick I, Stevick II		1–15
16–18	103(a)	Stevick I, Stevick II, Frost		16–18
Overall Outcome				1–18

IV. ORDER

In view of the foregoing, it is hereby

ORDERED that claims 1–18 of U.S. Patent No. 10,029,132 B2 have not been shown to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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