

Declaration of Dr. Robert Wanat Under 37 C.F.R. § 1.68 in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 8,640,683

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Splat-R-Ball, LLC, Daisy Manufacturing Company,
and S-Beam Precision Products Ltd.
Petitioners

v.

Spin Master, Inc.
Patent Owner

U.S. PATENT NO. 8,640,683

Case IPR2023-TBD

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U.S. PATENT NO. 8,640,683**

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I, Dr. Robert Wanat, do hereby declare as follows:

I. INTRODUCTION

1. I have been retained as an expert witness on behalf of Splat-R-Ball, LLC, Daisy Manufacturing Company, and S-Beam Precision Products Ltd. for the above-captioned Petition for *Inter Partes* Review (“IPR”) of U.S. Patent No. 8,640,683 (the “’683 Patent”). I am being compensated for my time in connection with this IPR at my standard consulting rate of \$525 per hour. My compensation is not affected by the outcome of this matter.
2. I have been asked to provide opinions relating to certain Challenged Claims involving super absorbent polymer (SAP) ammunition for projectile launchers. I understand the Challenged Claims are 1-14.
3. The ’683 Patent issued on February 4, 2014, from U.S. Patent Appl. No. 13/761,082 (the “’082 application”), filed on February 6, 2013. Ex. 1001 at Cover. The ’082 application that led to the ’683 Patent was a divisional application from the application that issued as U.S. Patent No. 8,271,282 (the “’282 Patent”).
4. For the purposes of my Declaration, I used the alleged invention dates asserted by Patent Owner in the ITC Investigation pending between Patent Owner and Petitioners, specifically, February 21, 2010 as the date of the alleged invention for claims 1, 3, 4, and 11, April 8, 2010 as the date of the alleged invention

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for claim 14, and the '282 Patent filing date of May 10, 2010 for claims 2, 5-10, and 12-13. In my opinion, whether the date of alleged invention is February 21, 2010, April 8, 2010, or May 10, 2010 has no impact on the analysis I offer in this Declaration.

5. I understand that Spin Master, Inc. alleges it currently owns the '683 Patent.
6. In preparing this Declaration, I have reviewed the '683 Patent, the file history of the '683 Patent, the prior art and publication references described in this Declaration, and all materials cited in this Declaration. I relied upon my education, training, knowledge, and experience in the relevant art, and have considered the viewpoint of a person having ordinary skill in the relevant art ("POSITA") as of February 21, 2010, April 8, 2010, and May 10, 2010. Whether the alleged invention date is February 21, 2010, April 8, 2010, or May 10, 2010 does not impact any of the opinions I've offered here. My opinions are based, at least in part, on ThinkGeek Spitballs, which I understand has a date of public availability of at least November 27, 2009. Ex. 1007. I also had a call with Dr. Amanda Bligh.
7. I understand from counsel that claims in an IPR are construed using the same claim construction standard that would be used to construe the claim in a civil action, including construing the claim in accordance with the ordinary and

customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

II. SUMMARY OF MY OPINIONS

8. It is my opinion that the ThinkGeek Spitballs discloses the claimed “super absorbent polymer” limitation found in all Challenged Claims of the ’683 Patent because it discloses a polymer that can absorb an extremely large amount of liquid relative to its own mass, *i.e.*, at least 100 times its mass in water. My opinion that ThinkGeek Spitballs discloses a “super absorbent polymer” applies whether Patent Owner’s proposed claim construction or Petitioner’s proposed claim construction is adopted.
9. It is my opinion that it was well-known to a POSITA prior to February 2010 how to adjust an SAP’s physical characteristics to prescribe its shape, initial size, fully hydrated size in a given solution, strength, and absorbency.
10. It is my opinion that a POSITA would understand that the material contained in disposable diapers, such as discussed on the “Spudgun” webpage and in U.S. Patent No. 8,584,589 (“Carlson”), is an SAP, and hydrating that material with water will result in a hydrated SAP.

III. BACKGROUND AND QUALIFICATIONS

11. I am the founder and president of Innov8 Chem LLC, a consulting company specializing in the analysis, development, manufacture, and applications of

polymers, plastics, materials, and adhesives. My thirty plus years of experience in the chemical industry includes research, leadership, scale-up, manufacturing, and commercialization strategy for global chemical companies involved in the development of polymer products, plastics, and adhesives.

12. I earned a Ph.D. and M.S. in Chemistry from Cornell University. As a doctoral student, I received the Tunis Wentink “Graduate Student of the Year” award and the Rohm and Haas Fellowship. I have a Certificate in Technology Management from the California Institute of Technology, and I received my B.S. in Chemistry from the University of Scranton, where I graduated *magna cum laude* in 3 years.
13. During my career, I developed numerous products including many ones used in plastics, coatings, or as additives. I prepared polymers in emulsion, solution, and bulk polymerization processes, frequently using raw materials based on the chemistry of acrylic acid and methacrylic acid which are key materials used in commercial super absorbent polymers. These developments form part of the basis for my understanding of polymers and their behavior.
14. From 1985 to 1996, I was a Senior Research Scientist at Rohm and Haas and Elf AtoChem and helped develop the materials for use in coatings and in plastics applications.

15. From 1996 to 1998, I was a Technical Marketing Specialist at Elf AtoChem in the AtoGlas Division where I helped develop the Solarkote® product line. Solarkote® is a thermoplastic made of an acrylic resin that is resistant to deterioration caused by UV rays. It is typically applied as a polymer melt which fuses to a substrate polymer melt to provide long term adhesion, durability, and aesthetics to the product.
16. From 1999 to 2006, I was the R&D Manager at Altuglas International—a subsidiary of Arkema group and a world leader in engineered plastics. As the R&D Manager, I led research and development of high performing polymers for a variety of applications and managed and presented failure analysis studies of plastic and composite materials based on weathering, thermal degradation, chemical reaction, and fracture.
17. From 2006 to 2016, I was the Global Director of Research at Altuglas International. In this position, I led a team of up to 60 researchers in the United States, France, and Korea on the identification of new product opportunities and the development of appropriate product formulations. I also worked with directors for other Arkema businesses including those overseeing the development of chemicals, water-based and solvent-based coatings, as well as other plastic materials on development programs and on other technology leadership issues.

18. During my time as Global Director of Research, my work and that of my team were recognized by industry leaders. Notable awards include a 2012 R&D 100 Award for the development of Plexiglas® Rnew biopolymer alloys, the 2012 Prix Pierre Potier Award for development of ShieldUp sheet, and the 2010 Arkema Arena Award for Solarkote® capstocks.
19. From 2009 to 2011, I also had the role of Director of Manufacturing for Altuglas International, where I oversaw more than 300 employees and the operations at four manufacturing facilities in North America producing over 100 million pounds of plastic per year. This experience provides insight into the manufacture, processing, quality assurance, and packaging of materials in the chemical industry.
20. From 2016 to 2018, I was the Chief Technology Officer and the Global R&D Director for Bostik, an adhesive company. In this role, I oversaw a team of over 200 people dedicated to adhesives research in the United States, France, the United Kingdom, China, India, and other countries. Members of this team developed hot-melt, solvent-based, water-based, thermoplastic, and reactive adhesives. In many applications, such as automotive interiors, hygiene, and industrial assembly, the existing and developmental adhesives were designed to be applied by processes including spraying, coating, roll-coating, brush, extrusion, hot melt, heat seal, hot lamination, and other techniques.

21. From 2018 to the present, I have been the president of Innov8 Chem LLC, a consulting company I founded that specializes in the analysis, development, manufacture, and applications of polymers, plastics, materials, and adhesives.
22. I am a named inventor on ten U.S. patents and have overseen research leading to over twenty-five other U.S. Patents granted to members of my R&D team. Most of the patents and a vast majority of my experience in the plastics industry was on the development, manufacture, and application of plastic materials. This provides me with extensive experience in the development, applications, production, quality control, packaging, and customer handling of polymers, plastics, and adhesives.
23. I have authored or co-authored several publications on chemicals, reactivity, and plastics and have supervised the work leading to numerous publications and presentations on the development of plastics, composites, and multilayer structures that require control of individual material properties and of adhesion between the layers. These publications and presentations were prepared for both industry and government organizations, as well as for conferences on plastics, thermoforming, bioplastics, lighting, automotive, and chemicals.
24. My experience in chemicals, plastics, and adhesives has presented opportunities for me to encounter technical challenges in the development,

formulation, and manufacture of these products. I am aware of the limitations facing the ordinary producer of these products (*i.e.*, a producer who typically develops and manufactures products that must comply with a wide variety of customer and regulatory requirements while maintaining certain performance criteria at the same time).

25. I am a member or have been a member of several professional organizations, including the Society of Automotive Engineers, the Society of Plastics Engineers, the American Chemical Society, the Adhesive and Sealants Council, the Industrial Research Institute, and the Institute for the Study of Business Markets. I served on the Board of Directors for the Adhesive and Sealant Council, and was chosen to serve as a Judge for its 2019, 2020, and 2021 Innovation Awards.
26. I have worked for/with many companies in the polymers, plastics, and adhesives industries, and that experience has provided me with a deep and broad base of knowledge on the research, manufacturing, and material handling behaviors in the polymers and plastics
27. I have carefully reviewed the documents provided to me for this case. I am familiar with the technical field of polymers, plastics, and adhesives and with the research, development, manufacture, handling, packaging, and regulatory

issues of these materials. I have personally worked on or have supervised others working on each of these topics.

28. Further explanation of my professional experiences and scientific accomplishments is in my curriculum vitae. Ex. 1006.
29. A list of cases on which I have served as an expert witness is appended to the end of my curriculum vitae. Ex. 1006.

IV. UNDERSTANDING OF PATENT LAW

30. I am not a legal expert and have relied upon counsel in connection with the applicable law. Below I provide my understanding of the law, and I applied this understanding when rendering my opinions in this Declaration.
31. I understand that prior art to the '683 Patent includes: (1) patents and printed publications in the relevant art that were published before the February 21, 2010 alleged invention date of claims 1, 3, 4, and 11; (2) patents and printed publications in the relevant art that were published before the April 8, 2010 alleged invention date of claim 14, and (3) patents and printed publications in the relevant art that were published before the May 10, 2010 alleged invention date of claims 2, 5-10, and 12-13.
32. I understand that a claim is invalid if it is anticipated or obvious. I understand that anticipation requires that every claim element be disclosed expressly or

inherently in a single prior art reference, arranged in the prior art reference as arranged in the claim.

33. I understand that obviousness of a claim requires that the claim be obvious from the perspective of a POSITA at the time the alleged invention was made. I understand that a claim may be obvious in view of a single reference or may be obvious from a combination of two or more prior art references.
34. I understand that an obviousness analysis requires an understanding of the scope and content of the prior art, any differences between the alleged invention and the prior art, and the level of ordinary skill in evaluating the pertinent art.
35. I further understand that certain factors may support or rebut the obviousness of a claim and must be considered as part of the obviousness analysis when present. I understand that such factors include, among other things, commercial success of the alleged invention, skepticism of those having ordinary skill in the art at the time of the alleged invention, unexpected results of the alleged invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field. I also

understand that contemporaneous and independent invention by others is a secondary consideration tending to show obviousness.

36. I understand that there must be a nexus—that is, a connection—between any such factors (sometimes called “secondary considerations”) and the alleged invention. I understand that if there is not a nexus between the secondary considerations evidence and the claimed invention, that is not indicative of nonobviousness.
37. I further understand that a claim is obvious if it unites old elements with no change to their respective functions or alters prior art by mere substitution of one element for another known in the field, and that combination yields predictable results. While it may be helpful to identify a reason for this combination, common sense should guide and no rigid requirement of finding a teaching, suggestion, or motivation to combine is required. When a product is available, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person having ordinary skill in the relevant art can implement a predictable variation, obviousness likely bars its patentability. For the same reason, if a technique has been used to improve one device and a person having ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious. I understand that a claim may be obvious if common

sense directs one to combine multiple prior art references or add missing features to reproduce the alleged invention recited in the claims.

V. LEVEL OF ORDINARY SKILL IN THE ART

38. I understand that a patent must be read from the perspective of a person of ordinary skill in the art. I understand that such a hypothetical person is one who is trained in the relevant technical field of a patent without possessing extraordinary or otherwise exceptional skill, but rather they possess ordinary skill. I further understand that the level of skill in the art is determined by factors such as the education level of those working in the field, the sophistication of the technology, the types of problems encountered in the art, prior art solutions to those problems, and the speed at which innovations are made.
39. I understand that Petitioner proposed, in a related proceeding before the International Trade Commission (ITC), that a POSITA at the time of the alleged invention of the '683 Patent would be someone who (i) had a Bachelor's degree in Industrial Design or Mechanical Engineering or (ii) a toy designer with at least five years' experience designing toys (including launchers), with both of (i) and (ii) having access to a chemist knowledgeable regarding super absorbent polymers.

40. I understand that Patent Owner proposed, in a related proceeding before the International Trade Commission (ITC), that a POSITA at the time of the alleged invention of the '683 Patent would (1) have had a Bachelor's degree in mechanical engineering, industrial design, or an equivalent, with at least one year of relevant experience designing projectile launching systems and (2) be a member of a team, which would include a person with a Bachelor's in materials science, chemistry, or equivalent, or has at least one year experience working with materials for use in consumer products.
41. The focus of my declaration involves super absorbent polymers. As I described above, I have a background in chemistry. I offer my perspective as someone that a mechanical engineer, industrial designer, and/or toy designer developing a launcher would have access to and/or as a team member. Regardless of which definition applies, I understand that the POSITA will have access to the information I have described in this report. My opinions set forth in this Declaration do not change based on which level of ordinary skill in the art is applied.

VI. TECHNOLOGY BACKGROUND

A. Superabsorbent Polymers

42. Polymers are large, long chain molecules. The word "polymer" comes from the combination of two Greek words: *poly* meaning "many" and *mer* meaning

“unit.” Thus, *polymer* means “many units.” As an example, acrylic acid is a liquid monomer, and when many units of acrylic acid are polymerized (linked together into a chain), they become the solid polymer, poly(acrylic acid). *See* Ex. 1054 at Chapter 2 (for discussion of acrylic acid polymerization) and at 10 (discussing how crosslinks are introduced to the polymer when preparing an SAP).

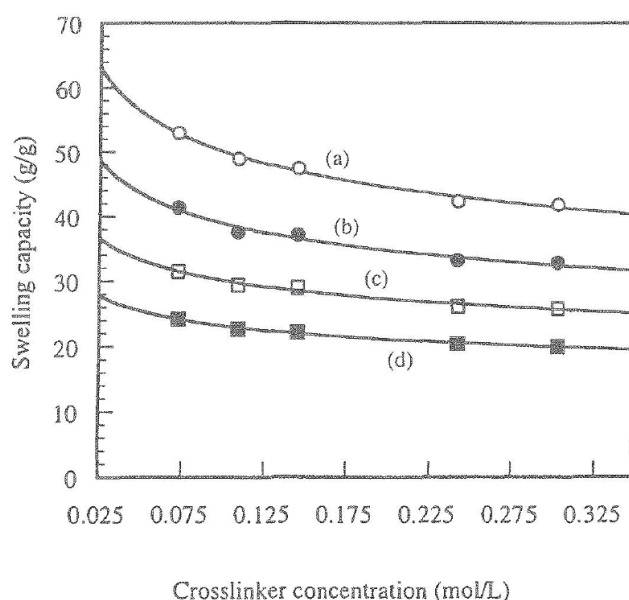
43. Superabsorbent polymers (SAPs) are a large class of cross-linked polymer chains that have the ability to absorb and hold liquid. Cross-linking refers to a process whereby the polymer chains are joined together, which has a significant effect on how the polymer behaves when exposed to water. *See* Ex. 1054 (Buchholz) at 6-9. While SAPs do not have a defined technical specification and commercial usage of the term can vary, as I discuss below, they generally are capable of absorbing and holding a large amount of liquid relative to the polymer’s own mass (with the definition of “large” varying by source). *Compare* Ex. 1058 at 1 (an SAP “can absorb ***hundreds*** to thousands of times its weight”) and Ex. 1018 at 2 (SAPs are “capable of absorbing water around ***100 times*** of their own weight”) *with* Ex. 1059 at 452 (describing SAPs as “ultrahigh absorbing materials [that] can imbibe deionized water as high as 1,000-100,000% (10-1000 g/g) whereas the absorption capacity of common hydrogels is not more than 100% (1 g/g)”), Ex. 1060 at 7 (an SAP is “capable

of absorbing water in an amount which is *at least ten times* of the weight of the substance in its dry form”), and Ex. 1061 at 1 (an SAP “has 10g/g or more water absorption capacity”). For this reason, SAPs are referred to as being very hydrophilic (“hydro” is Greek for “water” and “philic” is Greek for “love,” *i.e.*, water-loving).

44. SAPs are reported to have been first prepared by the USDA during the 1960’s—and officially “[b]orn in 1973”—using polymers based on grafting polyacrylonitrile onto starch molecules. Ex. 1055 (One Team, One Product—Many Uses) at 11; *see also* Ex. 1056 (Super Slurper). Its scientific names include saponified starch-graft polyacrylonitrile copolymers or hydrolyzed starch-g-poly(acrylonitrile) (HSPAN), but it was commonly referred to as “Super Slurper” because after hydrolysis, these materials could absorb in excess of 1,400 times their dry weight of water. Ex. 1055 (One Team, One Product—Many Uses) at 11; Ex. 1056 (Super Slurper) at 7. After years of development, SAPs achieved commercial success in the 1970’s and 1980’s, and by 2010, “[t]he use of superabsorbent fibers in bandages, training pants, sanitary napkins, diapers, and incontinence garments [was] well known.” Ex. 1054 (Buchholz) at 225.
45. Rather than dissolving in water, SAPs absorb the water and grow forming a soft gel that generally maintains the same shape it started as (*e.g.*, if the dry

SAP is a sphere, it will maintain its general spherical shape as it absorbs water and grows). Ex. 1054 (Buchholz) at 7 (noting the crosslinking of the polymer chains prevents the polymer from being dissolved in water), Fig. 13 (showing “dry granule” compared to “swollen gel particle”). Hydrated SAPs are elastic (meaning they can be deformed under moderate pressure and return to their original shape when the pressure is released), having the ability to retain the absorbed liquid even under moderate pressure. Ex. 1054 (Buchholz) at 182 (SAPs can “retain the liquid in a solid phase even under the action of moderate pressure”).

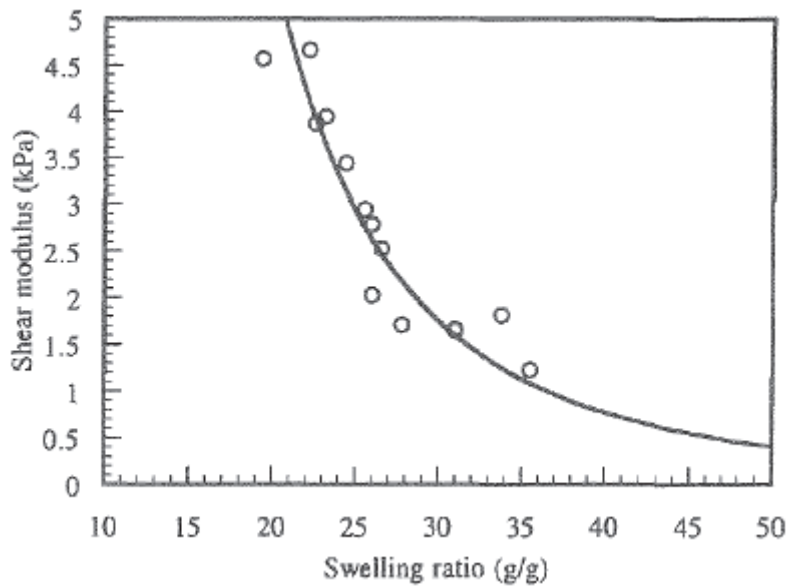
46. As an SAP absorbs more water, it grows/swells until it runs out of water to absorb, or until it reaches its absorption limit based on how large the crosslinks and the polymer composition will allow it to grow. Ex. 1054 (Buchholz) at 171 (discussing equations that “provide the fundamental relationships between swelling capacity, modulus, and the crosslink density for polymer networks”). The amount of water absorbed will depend upon, for example, the amount of crosslinking, the type of hydrophilic polymer used, and the salinity of the water. *See, e.g.*, Ex. 1054 (Buchholz) at 171, 176-183, Fig. 5.7 (discussing effect crosslinker concentration, monomer concentration, and salinity on swelling capacity):



47. Thus, it was well-known known prior to February 2010 that the type and amount of crosslinking will have an effect on the ability of an SAP to absorb water. As shown in the above figure, generally, the higher the level of crosslinking, the less water a crosslinked hydrophilic polymer will be capable of absorbing, and vice-versa (*i.e.*, a polymer network that is less crosslinked will swell more than a polymer network that is more crosslinked). As such, prior to February 2010, a POSITA would have known that they could easily make adjustments to the final size of an SAP (*i.e.*, after it has reached its absorption limit) by adjusting the crosslinking concentration of the SAP.
48. It was likewise well known to POSITAs prior to February 2010 that the size of the dry polymer (*i.e.*, before it absorbs water and swells) will impact the final size of the gel when the polymer reaches its absorption limit. Ex. 1054

(Buchholz) at 150. That is, starting with a smaller bead (in the case of a spherical hydrophilic polymer) will result in a smaller gel ball when the polymer has fully absorbed the water, and starting with a larger bead will result in a larger gel ball when the polymer has fully absorbed water.

49. Similarly, the amount of crosslinking will have an effect on the gel strength of the SAP after it has absorbed water. It was well known prior to 2010 that the higher the level of crosslinking, the stronger the SAP will be, resulting in less deformation when compressive forces are applied to a fully hydrated hydrophilic polymer. Conversely, a lower crosslinking concentration will result in a higher free swelling capacity (i.e., the hydrophilic polymer will absorb more water when not under pressure). *See, e.g.*, Ex. 1054 (Buchholz) at 158-159 (noting “The magnitude of the deformation [of a SAP] depends on the modules, which in turn depends on the initial crosslink density and extent of swelling”) and 174 (discuss the “Shear modulus [of a SAP] as a function of the amount of crosslinker used per mole of acrylic acid, for two structurally different crosslinkers”). The relationship between Shear Modulus and Swelling Ratio is described for example in the below figure from Buchholz (Ex. 1054 (Buchholz) at 9, Fig. 1.4):



50. Because of the known relationship between crosslinking concentration and gel strength, prior to February 2010 a POSITA would have known that they could easily make adjustments to the strength and resistance to deformation of an SAP by adjusting the crosslinking concentration (*e.g.*, increasing the concentration to make the gel firmer and more resistant to fracturing under pressure).

B. '683 Patent And Prosecution History

51. Claim 1 of the '683 Patent, as well as every other claim by virtue of their dependency on claim 1, requires a “soft projectile being formed from hydrated super absorbent polymer.” Ex. 1001 ('683 Patent), Cl. 1.
52. The '683 Patent uses the terms “super absorbent polymer” and “SAP” more than 70 times but provides surprisingly little information regarding what these

materials are. This limited information includes that “Super absorbent polymers (SAPs) were first invented by the United States Department of Agriculture (USDA) in the 1960s and are commonly used in personal disposable hygiene products such as diapers, protective underwear, and sanitary napkins SAPs are polymers that can absorb an extremely large amount of liquid relative to their own mass. SAP’s absorb aqueous solutions through hydrogen bonding with water molecules” and that “hydrated SAP particles can maintain their shape under modest pressure.” Ex. 1001 (’683 Patent) at 3:46-53, 3:62-63. Regarding the water absorbing capacity of the SAP, the specification states “[m]ore preferably soft-projectiles made from a SAP are grown in distilled water, where they may absorb 500 times their weight” Ex. 1001 (’683 Patent) at 4:67-5:2.

53. The prosecution history of the ’082 application, which issued as the ’683 Patent—provides no additional information relevant to the meaning of SAP. *See generally* Ex. 1002 (’683 Patent Prosecution History). There were no discussions of the SAP term by applicants and examiner.

VII. CLAIM CONSTRUCTION

A. Claim Construction Legal Standard

54. Again, I am not a legal expert. I set forth below my understanding of the law of claim construction as provided by counsel.

55. I understand that the meaning of claim terms is a legal question that is decided by the Judge. I understand that patent claim terms are given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art at the time of the alleged invention—which Patent Owner contends is February 21, 2010, April 8, 2010 or May 10, 2010 depending on the claims (whether February 21, April 8, or May 10 applies does not impact my analysis)—in view of the claims, patent specification, and patent prosecution history, which are referred to as the “intrinsic evidence.” I have done so in this report. Where I understand that Petitioner and Patent Owner have provided different constructions for a term, I have applied the constructions as set forth below.
56. I understand that the specification is highly relevant to how a POSITA would understand the terms of the claims. I also understand that a construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention is usually the proper construction. I further understand that “extrinsic evidence,” which includes books, other patents, articles, dictionaries, and expert testimony, can also be useful in interpreting patent claims, but that extrinsic evidence cannot alter the plain meaning of a claim term as a POSITA would have understood it in the context of the intrinsic evidence.

B. Claim Construction of “Super Absorbent Polymer”

57. The '683 Patent's specification, after discussing SAPs that were first invented by the USDA and commonly used in personal hygiene products, similar to my discussion above, notes “SAP's are polymers that can absorb an extremely large amount of liquid relative to their own mass.” Ex. 1001 ('683 Patent) at 3:46-51. I understand Patent Owner has argued a POSITA would understand an “extremely large amount” meant an SAP can absorb at least ten times its own weight in water, whereas Petitioner argued that it requires a polymer that can absorb at least 100 times its own weight in water. In other words, assuming Patent Owner takes the same position in this IPR, I understand there is a dispute between the parties as to whether “extremely large” requires a polymer that can absorb at least 10 times its own weight in water or if it requires a polymer that can absorb at least 100 times its own weight in water.
58. I reviewed each of the proposed constructions from the perspective of a POSITA in view of the '683 Patent and the relevant art at the time of its filing. Based on my analysis, and informed by my experience in working with polymers, plastics, materials, and adhesives, it is my opinion that the plain meaning of “super absorbent polymer” to a POSITA in view of the intrinsic record would have been “a polymer that can absorb at least 100 times its mass in water.”

59. As noted above in Section VI.B, the '683 Patent specification provides very limited information relating to SAPs. The only explicit discussion of water absorption capacity is the sole preferred embodiment stating “[m]ore preferably soft-projectiles made from a SAP are grown in distilled water, where they may absorb 500 times their weight.” Ex. 1001 ('683 Patent) at 4:67-5:2.
60. The '683 Patent specification, as noted above, also references the SAPs first invented by the USDA in the 1960s and SAPs commonly used in personal disposable hygiene products. *See* Ex. 1001 ('683 Patent) at 3:46-53. A POSITA would have understood that the USDA super slurpers were known to absorb hundreds of times their own mass in water. For example, the USDA filed a patent covering the SAP technology which issued as U.S. Patent No. 3,997,484. Ex. 1057 ('484 Patent). The abstract of the USDA's SAP patent notes that the “Starch-containing polymer compositions are prepared which absorb amounts of water equaling up to more than 1000 times their own weight.” Ex. 1057 ('484 Patent) at abstract. The USDA's SAP patent includes a number of tables conveying testing data on a number of variations of the invented SAPs, all of which have absorption capacities over 100 times their own weight, with the lowest being 124 times the dry weight. Ex. 1057 ('484 Patent) at Tables 3, 5-7, 9-11 (reflected in the “Water g./g.” columns).

61. A POSITA would also understand at the time of the '683 Patent's priority date that SAPs used in personal hygiene products were capable of absorbing hundreds of times their own mass in water. Specifically, a POSITA would have understood that "Superabsorbent polymers [used in personal hygiene products] absorb, and retain under a slight mechanical pressure (1–5 kPa in diapers), about 30 times their weight *in urine*." Ex. 1054 (Buchholz) at 254. It is well understood that SAPs absorb much more water than urine due to impurities contained in urine that limit the absorption capacity, and therefore, a POSITA would understand that an SAP that absorbs about 30 times its own weight in urine would absorb a far higher multiple of its own weight in water. Ex. 1054 (Buchholz) at 199-200 (discussing effect of ionic strength of swelling liquid on swelling capacity, noting a "larger maximum swelling extent [] is achievable in the solution with less salt"); *see also* Ex. 1054 (Buchholz) at 1 (explaining that "superabsorbent polymers will absorb up to 1,000 g of water per gram of polymer and up to about 100 g of dilute salt solution per gram of polymer"). The '683 Patent itself recognized this, noting: "A SAP's ability to absorb water is a factor of the ionic concentration of an aqueous solution," where liquids containing salts and other impurities, like urine, have a higher ionic concentration compared to distilled water, and thus, which hinders a SAPs ability to absorb the liquid. Ex. 1001 ('683 Patent) at

4:63-65. This correlation of an SAP's ability to absorb much more water than urine is reflected in the USDA's patent covering its invented SAP technology discussed above showing SAP materials absorbing less than 100 times their own weight in synthetic urine but absorbing hundreds or even thousands of times their own weight in water. *See, e.g.*, Ex. 1057 ('484 Patent) at Table 5 (showing sample Example "3B" absorbing 80 times its weight in synthetic urine and 1300 times its weight in water, and Example 4B absorbing 52 times its weight in synthetic urine and 960 times its weight in water). For the reasons discussed above, a POSITA would understand that SAPs used in personal hygiene products are capable of absorbing hundreds of times their own weight in water.

62. In my opinion, a POSITA reviewing the intrinsic record would have understood "super absorbent polymer" to be "a polymer that can absorb at least 100 times its mass in water."
63. I understand that Patent Owner, and its expert in the related ITC Investigation, point to a selective number of extrinsic evidence documents to support their argument that 10 times would be considered an "extremely large amount of water." However, the extrinsic evidence discussing the absorption capacity of SAPs is conflicting, with some evidence specifying a minimum absorption of 10 times while others specify no less than 100 times. *Compare* Ex. 1058 at 1

(an SAP “can absorb ***hundreds*** to thousands of times its weight”), Ex. 1018 at 2 (SAPs are “capable of absorbing water around ***100 times*** of their own weight”) *with* Ex. 1059 at 452 (describing SAPs as “ultrahigh absorbing materials [that] can imbibe deionized water as high as 1,000-100,000% (10-10000 g/g) whereas the absorption capacity of common hydrogels is not more than 100% (1 g/g)”), Ex. 1060 at 7 (an SAP is “capable of absorbing water in an amount which is ***at least ten times*** of the weight of the substance in its dry form”), and Ex. 1061 at 1 (an SAP “has 10g/g or more water absorption capacity”)).

64. In fact, one of the pieces of extrinsic evidence that I understand Patent Owner and its expert in the related ITC investigation relied on shows why a POSITA would not understand an SAP to be a polymer that can absorb at least 10 times its own weight in water, as proposed by Patent Owner. Specifically, they relied on an article titled *Superabsorbent Polymer Materials: A Review*, which explains that both “Wood pulp fluff” and “Cotton ball” materials are polymers that can absorb more than 10 times their own weight in water. *See* Ex. 1059 at 453 (table showing wood pulp fluff absorbing 12 times its own weight and cotton ball absorbing over 18 times its own weight in water, as compared to “Superab A-200” SAP absorbing 202 times its own weight). A POSITA would understand that neither wood pulp fluff nor cotton balls are an SAP.

Yet, those two materials would meet the SAP claim term under Patent Owner's proposed 10 times lower bound absorption. This shows why a POSITA would not understand ten times to be the lower bound absorption rate for an SAP.

65. In sum, in my opinion, based on the intrinsic and extrinsic evidence, a POSITA would understand “super absorbent polymer” as claimed in the '683 Patent to mean “a polymer that can absorb at least 100 times its mass in water.”

VIII. BACKGROUND ON PRIOR ART

A. ThinkGeek Spitballs

66. Spitballs is a November 27, 2009 archive of a listing for a Spitballs product on ThinkGeek.com that contains an image of the product packaging and its description. Ex. 1007.
67. Based on my review of the packaging and product description ThinkGeek Spitballs are spherical in shape. Ex. 1007 (describing the product as “awesome spherical polymers,” and including several images of hydrated spherical Spitballs). The product description teaches the user of ThinkGeek Spitballs can “Grow em and chuck em!” Ex. 1007. Indeed, the product description explains that the Spitballs are “gobs of squishy stuff flying through the air,”

instructing users to fling “awesome spherical polymers at your friends and/or coworkers.” Ex. 1007.

68. The ThinkGeek webpage notes “*Spitballs* start off as small hard little spheres. Soak them in water for about 4 hours (or overnight for best results) and they will absorb water and grow up to 200 times their original size.” Ex. 1007.
69. Based on the pictures provided on the packaging and product description I reviewed, ThinkGeek Spitballs teaches a plurality of Spitballs. Ex. 1007 (stating that each package contains “2g of Spitballs (about 150 or so),” Ex. 1007 (displaying images showing multiple dry Spitballs and multiple hydrated (swollen) Spitballs).



B. “Spudgun” Webpage

70. I have reviewed the Internet Archive of the spudgun enthusiast webpage. Ex. 1015 at 82-104. Under the “things to shoot” portion of the webpage, there is a description of using “fluffy stuff” taken from an “un-used diaper,” adding “a lot of water” so that “the stuff soaks it up,” turning it into a “gel-like stuff” (Ex. 1015 at 85):

Wet Diaper	First find an un-used diaper and cut a hole in the middle of it. Shake out all of that fluffy stuff into a bowl, add a lot of water and the stuff soaks it up. Put this gel-like stuff in a small cup and drop it in your gun. Good to have fights with.
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71. As noted above in Section VI.A, it was well-known to POSITAs before February 2010 that personal hygiene products, including diapers, used SAPs as the absorbing material. This was also recognized in the '683 Patent itself, as discussed above in Section VI.B. *See* Ex. 1001 ('683 Patent) at 3:46-50 (noting SAPs (are commonly used in personal disposable hygiene products such as diapers, protective underwear, and sanitary napkins”).

IX. ANALYSIS AND OPINIONS

A. ThinkGeek Spitballs Discloses “Super Absorbent Polymers”

72. In my opinion, under both Petitioner’s and Patent Owner’s proposed construction of “super absorbent polymer,” ThinkGeek Spitballs discloses that Spitballs are a “super absorbent polymer.”
73. The information disclosed by the Spitball’s written materials show that they meet the SAP limitation of the '683 Patent claims. For example, the Spitballs

advertising states “What if instead of real expections, you flung awesome spherical polymers.... We’re here for you: get thyself some Spitballs!” Ex. 1007 at 8. This description makes clear that Spitballs are polymers. Additionally, a POSITA would recognize that Spitballs are made from polymer even without reading this description. A POSITA would observe that the swollen Spitballs are “squishy,” transparent speres that grew from small, hard spheres. Ex. 1007 at 5, 8. The POSITA would further know from experience and as part of the general knowledge of the POSITA that small hard spheres made of glass or metal would not swell to the level shown by Spitballs. The POSITA would further understand that a soluble material, such as salt or sugar, placed in water would dissolve in the water, becoming a free-flowing solution. It would not “grow to about 0.6" in diameter.” Ex. 1007 at 8. This behavior of being able to absorb a liquid and grow to a transparent bead, much larger in size, is unique to crosslinked hydrophilic polymers. The POSITA would thus recognize that the Spitballs are made from polymers.

74. The Spitballs advertising also notes “Spitballs start off as small hard little spheres. Soak them in water for about 4 hours ... and they will absorb water and grow up to 200 times their original size.” Ex. 1007 at 8. Given that descriptions of “size” in the context of discussing polymers are commonly in reference to mass, a POSITA would understand the description that Spitballs

“grow up to 200 times their original size” (Ex. 1007 at 8) refers to the Spitballs’ mass. As such, a POSITA would understand from this description of Spitballs that it is a polymer that absorbs up to 200 times its own mass in water, and thus, meets the ’683 Patent claimed SAP limitation.

75. Even if the “200 times their original size” description refers to volume, as opposed to mass, a POSITA would understand the Spitballs meets the claimed SAP limitation based on its absorption capacity. The information provided in the Spitballs listing establishes the mass of water absorbed by Spitballs, applying the below well-known equations:

(a) $\text{mm} = \text{inch} * 25.4$

(b) $\text{Diameter} = 2r$

(c) $\text{Volume of a sphere} = (4/3) * \pi * r^3$, where r is the radius

(d) Water has a known density of: $1 \text{ g/cm}^3 = 0.001 \text{ g/mm}^3$

76. Spitballs discloses that “Spitballs grow to about 0.6" in diameter” (Ex. 1007 at), which is about 15.24 mm (using above equation (a)), which correlates to a 7.62 mm radius (using above equation (b)). Based on this, a POSITA would understand the volume of a fully hydrated Spitball is around $1,853.33 \text{ mm}^3$ (based on above equation (c)). Thus, assuming the “200 times” description refers to volume, it would be understood that dividing the $1,853.33 \text{ mm}^3$ final volume by 200 would mean the starting volume of a dry Spitball would be

9.27 mm³, with a radius of 1.303 mm (based on equation (c)) and a diameter of 2.606 mm (based on equation (b)). This means the amount of water absorbed to get from 9.27 mm³ (dry polymer volume) to 1,853.33 mm³ (polymer + absorbed water volume) would be 1,844.06 mm³ (absorbed water volume). The mass of 1,844.06 mm³ of water would be known to be 1.844 g (based on above equation (d)).

77. A POSITA would also know the starting mass of a Spitball is about 0.0133 g based on there being about 150 individual spheres per package weighing a total of 2 g. Ex. 1007 at (Spitballs discloses: “**Contains:** 2g of Spitballs (about 150 or so).”). Thus, if a Spitball grows 200 times its original volume after absorbing water, a POSITA would understand it absorbed about 138.64 times its own mass in water (using the equation 1.844 g water / 0.0133 g polymer = 138.64). A POSITA would understand this absorption amount meets the claimed SAP limitation under Petitioner’s or Patent Owner’s proposed construction of “super absorbent polymer.”
78. As I stated above, if “200 times their original size” is a reference to volume, then a POSITA would understand Spitballs have a starting, dry diameter of about 2.6 mm and are able to absorb approximately 138 times their dry mass in water. If “200 times their original size” refers to absorbing 200 times the original mass in water, then a POSITA would understand that the starting

diameter would be less than 2.6 mm, because a higher mass of water is absorbed to arrive at the final diameter disclosed by Spitballs of 0.6". Ex. 1007 at 8.

B. Adjustments of SAP Physical Characteristics Were Well Known to POSITAs Before February 2010

79. It is my opinion that a POSITA prior to February 2010 would have known how to adjust the physical characteristics of SAPs to prescribe their shape, size (both initial and once fully hydrated in a given solution), strength, and absorbency. These SAP properties are the result of scientific concepts and structure-processing-property relationships that were well-known at the time of the alleged invention in February 2010, as I describe in more detail in Section VI.A. A POSITA would be easily able to achieve different material properties and physical characteristics for SAP ammunition, including adjustments to desired size of the hydrated SAP and adjustments to the strength and durability of the SAP, before 2010. These would all be routine adjustments that would not require extensive effort and are well within the level of skill of the POSITA.
80. The use of crosslink concentration to control the properties of an SAP was well-known long before the filing of the '683 Patent. For example, "The amount of crosslinking agent is preferably within the range of from 0.05 to

2% by weight, depending on the particular crosslinking agent or dispersant employed. When the amount is less than 0.05% by weight, the fluidity and mechanical strength of the water-swollen granules become poor, and inversely when it is more than 2% by weight, the crosslinking density becomes too high, with the result of a marked decrease in water-absorbing power.” Ex. 1062 (U.S. Patent No. 5,660,935) at 4:58-65; *see also* Ex. 1054 (Buchholz) at 158-159 (noting “The magnitude of the deformation [of a SAP] depends on the modules, which in turn depends on the initial crosslink density and extent of swelling”) and 174 (discuss the “Shear modulus [of a SAP] as a function of the amount of crosslinker used per mole of acrylic acid, for two structurally different crosslinkers”). Thus, by 2010, a POSITA would have understood how to adjust an SAP’s physical characteristics, including by changing its crosslinking concentration, to adjust the final swelling capacity, size, and strength, including its ability to withstand more or less compressive forces (*e.g.*, increasing the cross-linking density will result in the SAP being capable of absorbing less water, swelling to a smaller size, and being able to withstand greater compressive forces).

81. A POSITA would have known before 2010 that the strength and modulus, *e.g.*, softness, of the hydrated SAP particle could be tailored by the chemistry and degree of hydration, which is achieved by selecting the primary polymer

and adjusting the crosslinker and crosslinking concentration of the material to produce a soft projectile. The POSITA further would have known before 2010 that employing a gel formation technique such as suspension or reverse-phase suspension polymerization or extrusion into droplets or pellets would be expected to yield particles of the same spherical shape. Ex. 1054 at 105-113 (discussing suspension polymerization techniques, including how to adjust final particle size and shape as needed); Ex. 1063 at 40 (same).

82. Claim 1 of the '683 Patent requires that the ammunition comprise a plurality of substantially spherical soft-projectiles formed from hydrated super absorbent polymer. By 2010, a POSITA would have been familiar with hydrogel production techniques such as suspension or reverse-phase suspension or extrusion into droplets or pellets. Ex. 1054 at 105-113. A POSITA would have known before 2010 that these processes could be utilized to yield substantially spherical SAPs. Ex. 1054 at 109 (noting “[t]ypically, suspension polymerizations yield spherical particles because this shape yields the minimum single-particle surface energy”); Ex. 1063 at 40 (discussing similar techniques). And of course, ThinkGeek Spitballs teaches that SAPs can be substantially spherical. Ex. 1007 at 5, 8.
83. A POSITA would have known before 2010 that the size of the SAP can be controlled based on the processing conditions (for example, cutting and

grinding of dried gels or the pellet-making process) and/or the polymerization conditions (for example, the employed crosslink concentration of the material, as I've discussed above and in Section). In my opinion, a POSITA would have known before February 2010 that the swelling conditions of an SAP could also be controlled to achieve a desired final hydrated size of the SAP. For example, it was well-known that the final size of a hydrated SAP could be changed based on any of the following, alone or in combination: the chemical makeup of the SAP, the amount of hydrating fluid or how long the SAP is soaked in the fluid, conditions of the hydrating fluid such as the pH, salt content, or temperature, and adjustments to the size of the dried polymer bead. *See* Section ; Ex. 1054 at 147-149, 154. Therefore, it was well-known to a POSITA before 2010 that SAPs can come in a variety of sizes and that those sizes can be adjusted, and the POSITA would have known how to adjust the physical characteristic of an SAP or the hydrating process in order to end up with an SAP having a size greater than about 4 mm and less than about 9 mm when fully hydrated.

84. Claim 10 of the '683 Patent requires that SAP ammunition have a cross linking density sufficient to prevent the soft-projectiles from breaking apart when launched from the projectile launcher. As discussed above in Section VI.A, a POSITA would have known before 2010 that the gel strength of an

SAP could be adjusted either in the manufacturing or swelling process, or both, such that a POSITA would know how to adjust the SAP as need to prevent it from breaking apart due to a specific compressive force. For example, it was well-known to a POSITA before 2010 that increasing the crosslinking concentration of an SAP will result in an increase in the SAP's ability to withstand breaking apart due to compressive forces. Ex. 1054 (Buchholz) at 158-159, 174; *see also* Section VI.A. The converse was also well-known in that if a POSITA wanted the SAP to be softer, it could be achieved by decreasing the cross-linking concentration. Ex. 1054 (Buchholz) at 158-159, 174; *see also* Section VI.A. Additionally, it was well-known to POSITAs before 2010 that an SAP's ability to withstand compressive forces without breaking about decreased as the amount of water absorbed increased (which, again, can be adjusted based on the crosslinking concentration or, for example, the salinity of the water). Ex. 1054 (Buchholz) at 9, Fig. 1.4; *see also* Section VI.A.

85. In my opinion, a POSITA would have recognized that SAPs can be tailored to have increased strength, such that if they happened to break apart under application of air pressure, the SAP gel strength could be increased to be more resistant to the force of the air pressure by increasing the crosslinking concentration or decreasing its absorbency. Further, in my opinion, a

POSITA would have known that an SAP could simply be removed from surrounding liquid before it reaches its maximum absorption (*e.g.*, as expressly taught by Spitballs, Ex. 1007) and it would be able to withstand more compressive forces than if it were fully hydrated.

C. The “Spudgun” Webpage and Carlson Disclose The Use of a Hydrated SAP as Ammunition

86. As discussed above in Section VIII.B, the “Spudgun” webpage discloses the use of “gel-like stuff” formed from taking “fluffy stuff” from an “un-used diaper” and adding “a lot of water” so that “the stuff soaks it up.” Ex. 1015 at 85. Based on this description, as well as the POSITAs well-known understanding that diapers use SAPs as their absorbent material (*see* Section VI.A-VI.B), a POSITA would have understood the “Spudgun” webpage to disclose the use of a hydrated SAP as ammunition for a spudgun launcher.
87. Similarly, I have reviewed U.S. Patent No. 8,584,589 (“Carlson”), which was filed on October 6, 2010. Carlson’s “invention relates to [] toy projectiles” with a “projectile 100” that can be made of “dehydrated gels, *a hydro-polymer (similar to the absorbent polymer material used in a diaper)*, and a sponge material that is compressed and dehydrated.” Ex. 1039 at 1:13, 3:53-56 (emphasis added). Again, and as discussed above in Section VI.A, a POSITA would understand this reference to a “hydro-polymer” like the “absorbent

polymer material used in a diaper” in Carlson to refers to an SAP, just like the
“Spudgun” webpage’s reference to “gel-like stuff” taken from a diaper would
be understood to be an SAP.

Declaration of Dr. Robert Wanat Under 37 C.F.R. § 1.68 in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 8,640,683

I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I understand that willful false statements are punishable by fine or imprisonment or both. *See* 18 U.S.C. § 1001.

Date: March 23, 2023

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Robert Wanat", is written above a horizontal line.

Dr. Robert Wanat