
BEFORE THE PATENT TRIAL AND APPEAL BOARD

NXTGEN TOYS, LLC
Petitioner

v.

ZIPSTRING, LLC,
Patent Owner

Patent No. 11,674,774
Inter Partes Review No. 2024-01213

DECLARATION OF JASON JANET

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DECLARATION OF JASON A. JANÉT

I, Jason Janét, declare as follows:

I. BACKGROUND AND QUALIFICATIONS

A. Background

1. My name is Jason Janét. I have been retained as an expert witness to provide my independent opinion in regard to the matters at issue in inter partes review of U.S. Patent No. 11,674,774 (“the ’774 patent”) in IPR2024-01213. I have been retained by ZipString, LLC, the Patent Owner in this proceeding. Petitioner is NxtGen Toys, LLC. (“Petitioner” or “NextGen”).

2. I am being compensated \$500 per hour for my time spent working in connection with this case. My compensation is in no way related to the outcome of this litigation. If called as a witness, I would testify as to the statements and opinions contained in this report.

3. I am not a legal expert and offer no opinions on the law. However, I have been informed by Counsel of the various legal standards that apply, and I have applied those standards in arriving at my conclusions.

B. Qualifications

4. My credentials are set forth in full detail in my Curriculum Vitae which is attached as Exhibit A, incorporated here by reference, and summarized as follows: I am currently CTO for Applied Research Associates (ARA). I also hold the rank of

Adjunct Associate Professor at Duke University and at North Carolina State University.

5. I received a Bachelor of Science in Mechanical Engineering from the University of Virginia in 1990; a Master of Integrated Manufacturing Systems from the Integrated Manufacturing Systems Engineering Institute at North Carolina State University in 1994; and a Ph.D. in Electrical and Computer Engineering from North Carolina State University in 1998.

6. Since 1991, I have been active in the robotics, sensors, artificial intelligence, pattern analysis, and automation fields. My MS thesis, entitled *Global Motion Planning and Self-Referencing for Autonomous Mobile Robots*, leveraged graph theory and time-of-flight and/or Doppler sensors to optimize mobile robot movement through, and perception of, environments. My PhD dissertation, entitled *Pattern Analysis, Tracking and Control for Autonomous Vehicles*, leveraged multiple UGVs, time-of-flight and/or Doppler sensors, point clouds, and neural networks to enhance simultaneous localization and mapping (SLAM), as well as the sharing of knowledge between multiple different UGVs. I have authored numerous publications and have co-authored a textbook entitled *Computational Intelligence*.

7. I have designed, built, and marketed toys, robots, automated systems, measuring systems and components thereof, including ground mobile robots, unmanned aerial vehicles (UAV), unattended sensors, automated storage and

retrieval systems (ASRS), submersible mobile robots, proof-of-concept extra-terrestrial robots, manually-manipulated (“twiddled”) submersible foils, wall climbing mobile robots, corner-grip ballgame goals, proximity and ranging systems, point-cloud systems, pattern analysis tools, and augmented reality systems.

8. I have taught the following courses: Introduction to Robotics and Automation (Duke and NCSU); Introduction to Control Theory (Duke and NCSU); Distributed Real-Time Controls (NCSU); and myriad independent studies courses in the areas of robotics, automation, artificial intelligence, autonomy, pattern analysis, sensors, and control systems. I have also served on several MS- and PhD-level graduate student committees, designed qualifying exam problems, served on the NCSU IMSEI Board, and participated in curriculum development for undergraduate and graduate level programs.

9. I have also started, sponsored, and advised multiple champion student teams for international robot competitions including, but not limited to, the NASA/ASCE Extra-Terrestrial Robotics Competition, the DARPA Grand Challenge, the AUVSI/ONR Autonomous Underwater Vehicle Competition, and the European CLAWAR Wall-Climbing Robot competition.

10. I have initiated multiple unmanned systems projects at both academic and industry levels. Academic unmanned aerial vehicles (UAVs) include, but are not limited to, Quadcopters with Hybrid Remote and Autonomous Control, Marsupial

UAVs that Deploy and Recover Unmanned Ground Vehicles, and Wall-Climbing UAVs. Additionally, the AngelFish Cross-Domain Submersible UAV, a DARPA ASW program that I incubated and procured funding for at Teledyne, included a partnership with North Carolina State University. Unmanned underwater vehicles (UUVs) include, but are not limited to, the MicroHunter-class of very small underwater robots, the PilotFish, Gamera, Artemis and other holonomic robots, and submersible crawlers that are used in nuclear boiler water reactors, the LBC hull inspection system, and the HULLBUG hull cleaning system. Unmanned ground vehicles (UGVs) include, but are not limited to, the miniature PERRY, wall-climbers, all-terrain and subterranean crawlers.

11. I have also supported multiple toy-focused ventures with companies including, but not limited to, Marvel, Hasbro, Twidco, Spin Master, Nottingham-Spirk, IDEO, ARA, and other firms. For Marvel, multiple Spiderman toys were conceived and developed and validated, including the Spiderman Wall-Climbing Car, the Corner-Climbing Spider, and the Inflatable Wall-Climbing Spiderman. For Hasbro, a proprietary corner-gripping technology was employed to place basketball goals in corners. For Twidco, a proprietary flapping foil technology was combined with multiple fish shapes (e.g., shark and clownfish) to enable users to create fish-like motion by “twiddling” a connecting cable from above. For Spin Master and multiple design firms, multiple wall-climbing toys were developed for small wall-

climbing robot concepts including simple radio control vehicles and the “Hangtime 540” Tony Hawk aerial skateboard toy. For ARA, augmented reality systems for indoor and outdoor games.

12. In 1999, while I was employed by Nekton Research (“Nekton”), I captured and managed multiple programs sponsored by the Department of Defense (DoD) and private-sector companies that focused primarily on autonomous underwater vehicles (AUV), remotely operated vehicles (ROV), TwiddleFish toys, and indirect-fire projectiles. During my tenure, Nekton entered into a joint venture agreement with the founders of what eventually became known as Parata Systems – a pharmacy automation solutions company, which I supported launching.

13. After leaving Nekton in March 2002, I joined a then New Jersey-based company called Avionic Instruments, Inc (“Avionic”). While at Avionic, I continued developing and marketing robots and supported engineering related to various design, manufacturing, quality and assembly issues on the core aerospace product lines. Avionic product lines include, but are not limited to, ducted fans, transformer-rectifier units (TRU), regulated TRU (RTRU), auxiliary power unit (APU) control systems, power distribution systems (PDU), frequency converters, corner clamps, and VRAM attractors/thrusters. Customers included DoD, NASA, Boeing, Sikorsky, Augusta-Westland, Dassault, and Lockheed-Martin.

14. At Avionic, I was also tasked with ruggedizing, optimizing, and

commercializing two emerging proprietary technologies: the “CFG” and “VRAM”. The CFG, short for Corner Friction Grip, was a proprietary technology based on non-marring and non-adhesive materials that provided optimal grip patterns on inside and outside corners. CFG formed the basis of a company called “Shelf Works Technologies,” which was spun out of Avionic instruments in 2004, and whose products were sold in Home Depot, Bed Bath and Beyond, etc. CFG also formed the basis of multiple toys including a miniature basketball goal for Hasbro, and a corner climbing Spiderman toy for Marvel.

15. The VRAM, short for Vortex Regenerative Air/Aqueous Movement is a patented method for producing attraction forces between an object and a surface. VRAM is euphemistically referred to as a “tornado in a cup” and generally comprises both cylindrical and toroidal flow patterns that result in vacuum-like regions. The VRAM had several applications, including but not limited to: holding breaching charges and sensors against vertical or inverted surfaces; acting as an attractor for wall and ceiling climbing robots; acting as an attractor for submersible hull-crawling robots; filter-less vacuuming (conceptually similar to the Dyson vacuum); and robotic pick-and-place end-effector (conceptually similar to a gripper) to move articles from one location (e.g., a conveyor) to another (e.g., a collator). The VRAM also formed the basis for multiple toys including: a wall-climbing car for Spin Master, IDEO and Nottingham-Spirk; a Spiderman car for Marvel; an

inflatable wall-climbing Spiderman for Marvel; and the Tony Hawk Hangtime 540 aerial skateboard for IDEO.

16. My work with the filter-less vacuum VRAM prompted me to explore a concept related to pharmacy automation, which ultimately led to a Ferris-wheel concept for rapidly dispensing pills. In mid-2003, my team conceived of two prescription pill counting mechanisms that actually benefitted from centrifugal forces and optimally exploited gravity and vacuum: an inner ring with vacuum-based apertures and an inner-bowl with vacuum-based apertures. The inner-bowl with vacuum-based apertures was deemed most viable, was awarded two US patents, and to this day forms the basis of the RxMedic ADS™ pharmacy robot. The VRAM formed the basis of Vortex HC technologies, many of which have been licensed out to entities including, but not limited to Teledyne SeaBotix, SeaRobotics, and HDT. Both RxMedic and Vortex HC were officially spun out of Avionic in July 2004, at the date Avionic was acquired by Transdigm.

17. In late 2004, soon after Avionic was acquired, I, along with others from Avionic, secured funding to develop an alpha-level multi-dispenser pharmacy robotic system and develop the RxMedic business plan and raise multiple rounds of venture capital. In late 2006, RxMedic (called “APDS” until November 2006) was launched as a stand-alone, sole-focus venture. After the operational launch of RxMedic, I served as General Manager and eventually Chief Technical Officer.

Through my roles at RxMedic, I oversaw the development of the RxMedic ADS robot, managed the intellectual property portfolio, coordinated sales and marketing, and provided strategic, fiscal, and operational leadership. In May 2010, J.M Smith Corporation acquired RxMedic, and to assist in the change of ownership, I served as a Director of RxMedic until May 2011.

18. Also in late 2004, after Avionic was acquired, I, along with others from Avionic, secured funding for Vortex HC through DoD contracts and robot sales, to continue developing the VRAM Mobile Robot Platform (VMRP – a wall-climbing robot), the ARTEMIS AUV (a holonomic submersible robot for counter-mine and counter-obstacle operations), the submersible crawler, the nuclear-grade boiler water reactor (BWR) inspection robot, and other robot products centered around the VRAM. Some DoD programs were/are classified, for which I maintained a SECRET clearance at both the personal and facilities level, and served as the facilities security officer (FSO). In late 2006, corresponding to the full launch of RxMedic, Vortex HC technologies were largely licensed to Teledyne SeaBotix, SeaRobotics, and HDT. However, I have continued to support Vortex HC licensees and customers to-date.

19. After the sale of RxMedic, and after fulfilling my 12-month employment obligation, I joined Teledyne Technologies in Summer 2011. I served as the Senior Manager for the RTP division of Teledyne Scientific, and supported multiple DoD-sponsored robotic-focused programs. Some of these programs

were/are classified, for which I maintained a personal SECRET clearance. Among these programs, were cargo unmanned ground vehicles (CUGV); squad-level autonomous unmanned ground vehicles (UGV); autonomous underwater vehicles (AUV); unmanned underwater vehicles (UUV); a cross-domain autonomous vehicle capable of transitioning between air-, surface- and underwater-domains; the EXACTO program for optically tracking and steering bullets to targets; and LIDAR systems for UGVs, as well as the mapping of urban and subterranean environments (along with sister-company Optech). Cross-domain vehicles that were evaluated, designed and prototyped included, but were not limited to, the AngelFish (later called “EagleRay”) cross-domain submersible UAV for anti-submarine warfare, as well as a ball-shaped robot for beach-, ground- and surf-zone countermine operations. Sensor design, refinement and signal processing was a major component of each program. Sensors employed include, but are not limited to: proximity sensors; ranging sensors; electro-optical imaging; LIDAR. long-, short- and mid-wave infrared (IR); inertial measurement units (IMU); optical flow; and radio-frequency (RF). Additionally, control systems were designed, refined and integrated into the aforementioned systems. Most control systems were closed-loop, in that they utilized sensor-based feedback; others were open-loop, where states were estimated with little or no feedback.

20. In late 2013, Avionic, a Transdigm business unit at that point, requested

that I return to turn around both a supply-chain issue, and the Sikorsky S97 Raider/JMR helicopter programs. The S97 Raider was designed to be the fastest, most maneuverable helicopter, due to its coaxial, counter-rotating variable-pitch wings, and an aft-based push-propeller. Avionic also controlled two business units named Acme Aerospace (Acme) and Aerospace Cooling Solutions (ACS). Avionic, Acme and ACS supported the S97 program, which ultimately met milestones and continues to produce multiple successful demonstrations. In 2013, Transdigm expanded my role to include directorship of the Avionic, Acme and ACS revenue and engineering teams, and to report operational and financial status at six-week intervals. Transdigm required that I move my family to New Jersey in late 2014, which influenced my decision to resign and assume the CEO role offered to me by Delta Five Systems in Raleigh, NC.

21. As CEO of Delta Five, I led a private-equity backed, hospitality-focused venture, coordinating the company's launch and strategic path including an early-stage pivot. Initially focused on back-end robotics and automation, Delta Five shifted its focus to address the rampant bed bug problem—a top priority for hoteliers—with a novel unattended sensor and trap, called the Telemetered Pest Monitoring System (TPMS), which is based on computer vision and internet of things (IoT), and has proven capable of scaling to other pests. In addition to the TPMS, Delta Five developed a novel means to mass produce a natural, unscented

aggregation pheromone that, in concert with placement and heat, lured invertebrates to the TPMS. After leading Delta Five and serving on its Board for four years, I resigned to join ARA but continue serving Delta Five as a share-holder and transition agent.

22. In 2018, I joined ARA as CTO. My primary responsibilities include leading the commercialization and technology transition efforts, which require technical, business and corporate development, as well as the procurement of capital and managing matrixed rosters.

23. I have served as an expert witness on multiple cases including cases involving IPR, ITC, contract disputes, and civil litigation in District and Federal Courts. My resume lists these cases.

II. MATERIALS REVIEWED

24. In formulating my opinions and conclusions provided in this declaration, I have relied upon my training, knowledge, and experience in mechanical engineering, avionics and toys. I have also read and considered the following.

Materials Reviewed
U.S. Patent No. 11,674,774 (“the ’774 patent”)
Prosecution history of the ’774 patent
B. Yeany, String shooter-String launcher – physics of toys – Homemade Science with Bruce Yeany, YouTube video, June 11, 2014 (available at https://www.youtube.com/watch?v=rffAjZPmkuU) (“Yeany”)
Abello, Margaux, <i>et al.</i> , String Shooter’s Overall Shape in Ambient Air, Volume 4, <i>Emergent Scientist</i> , 1-8, January 14, 2020 (“Abello”)
Daerr, Adrian, et al., The Charmed String: Self-Supporting Loops Through Air Drag, Volume 877, <i>Journal of Fluid Mechanics</i> , 1-12, August 20, 2019 (“Daerr”)
Scorch Works, String Shooter, YouTube video, July 4, 2018 (available at https://www.youtube.com/watch?v=IGIDy-IJxmo) (“Scorch”)
U.S. Patent No. 6,537,126 to Wagner (“Wagner”)
C.C.L. Gregory, Theory of a loop revolving in air, with observations on the skin-friction, <i>Q. J. Mech. Appl. Math.</i> 2 (1949) (“Gregory”)
Anderson, <i>Fundamentals of Aerodynamics</i> , Sixth Edition, published by McGraw-Hill Education, 2017 (“Anderson”)
Sunita Sharma, et. al., Yarn Hairiness Determination Using Image Processing, <i>IOSR Journal of Electronics and Communication Engineering</i> , Volume 11, Issue 5, Ver. II (Sep.-Oct. 2016), pages 48-52 (“Sharma”)
G. K. Tyagi, Yarn structure and properties from different spinning techniques, Chapter 5 of <i>Advances in Yarn Spinning Technology</i> , pages 119-154, published by Woodhead Publishing Limited, 2010 (“Tyagi”)
d’Art of Science, How to make a String Shooter? DIY String Shooter dArtofScience, YouTube video, June 29, 2018 (available at https://www.youtube.com/watch?v=bsZ93j_nUVc&t=283s) (“d’Art of Science”)
Yeany YouTube video (https://www.youtube.com/watch?v=rffAjZPmkuU)
Scorch YouTube video (https://www.youtube.com/watch?v=IGIDy-IJxmo)

III. LEGAL STANDARDS

A. Claim Construction

25. I understand that the purpose of claim construction is to determine what a person of ordinary skill in the art would have understood the claim terms to mean at the time of the patent filing. Claim terms are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question as of the effective filing date.

26. I understand that the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification. I understand that the patent specification, under the legal principles, has been described as the single best guide to the meaning of a claim term, and is thus highly relevant to the interpretation of claim terms. And I understand for terms that do not have a customary meaning within the art, the specification usually supplies the best context of understanding the meaning of those terms.

27. I further understand that other claims of the patent in question, both asserted and unasserted, can be valuable sources of information as to the meaning of a claim term. Because the claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in

understanding the meaning of particular claim terms.

28. I understand that the prosecution history can further inform the meaning of the claim language by demonstrating how the inventors understood the invention and whether the inventors limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be. Extrinsic evidence, such as dictionaries, may also be consulted in construing the claim terms.

29. I understand that, in *Inter Partes* Review (IPR) proceedings, a claim of a patent shall be construed using the same claim construction standard that would be used to construe the claim in a civil action filed in a U.S. district court (which I understand is called the “*Phillips*” claim construction standard), 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 at the time the patent was filed and the prosecution history pertaining to the patent.

30. I have been instructed by Counsel to apply the “*Phillips*” claim construction standard for purposes of interpreting the claims in this proceeding, to the extent they require an explicit construction. The description of the legal principles set forth above thus provides my understanding of the “*Phillips*” standard as provided to me by Counsel.

31. I understand that certain terms appearing in the challenged claims have been the subject of dispute in the district court litigation. For purposes of my analysis

here, I do not believe express claim constructions are necessary because the claims can readily be given their ordinary and customary meaning in the context of the patent at the time it was filed .

32. I understand that the parties have proposed claim constructions for various terms of the challenged claims. I also understand that no claim construction has taken place in this proceeding.

33. Where claim construction issues arise, I have noted them in my analysis below.

B. Anticipation

34. I am informed and understand that to anticipate a patent claim under 35 U.S.C. § 102, a single asserted prior-art reference must disclose each and every element of the claimed invention, either explicitly or inherently, to a person of ordinary skill in the art. There must be no difference between the claimed invention and the disclosure of the alleged prior-art reference as viewed from the perspective of the person of ordinary skill in the art.

35. I understand that for a reference to be an anticipating reference, it must describe the claimed subject matter with sufficient clarity to establish that the subject matter existed and that its existence was recognized by persons of ordinary skill in the field of the invention.

36. In addition, I am informed and understand that to establish that an

element of a claim is “inherent” in the disclosure of an asserted prior-art reference, the extrinsic evidence (or the evidence outside the four corners of the asserted prior-art reference) must make clear that the missing element is the inevitable outcome of the process and/or thing that is explicitly described in the asserted prior-art reference, and that it would be recognized as necessarily present by persons of ordinary skill in the relevant field. To be “inherent,” I understand that the missing element must necessarily be present in the reference. An element is not “inherent” if the missing element is only probably present or if there is merely a possibility it is present.

C. Obviousness

37. I am also informed and understand that even though a prior-art reference does not fully anticipate a claim of a patent, a claim may nonetheless be rendered obvious to a person of ordinary skill in the art if the differences between the subject matter set forth in the patent claim and the prior art are such that the subject matter as a whole of the claim would have been obvious at the time the claimed invention was made.

38. I am informed and understand that obviousness is a determination of law based on various underlying determinations of fact. In particular, these underlying factual determinations include (1) the scope and content of the prior art; (2) the level of ordinary skill in the art at the time the claimed invention was made; (3) the differences between the claimed invention and the prior art; and (4) the extent

of any proffered objective *indicia* of nonobviousness. I understand that the objective *indicia* which may be considered in such an analysis include commercial success of the patented invention (including evidence of industry recognition or awards), whether the invention fills a long-felt but unsolved need in the field, the failure of others to arrive at the invention, industry acquiescence and recognition, initial skepticism of others in the field, whether the inventors proceeded in a direction contrary to the accepted wisdom of those of ordinary skill in the art, and the taking of licenses under the patent by others, among other factors.

39. I am informed and understand that to ascertain the scope and content of the prior art, it is necessary to first examine the field of the inventor's endeavor and the particular problem for which the invention was made. The relevant prior art includes prior art in the field of the invention, and also prior art from other fields that a person of ordinary skill in the art would look to when attempting to solve the problem.

40. I am informed and understand that a determination of obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention. Instead, it is my understanding that to render a patent claim invalid as being obvious from a combination of references, there must be some evidence within the prior art as a whole to suggest the desirability, and thus the obviousness, of making the

combination in a way that would produce the patented invention.

41. I am further informed and understand that in an obviousness analysis, neither the motivation nor the purpose of the patentee dictates. What is important is whether there existed at the time of the invention a known problem for which there was an obvious solution encompassed by the patent's claims.

42. In addition, it is my understanding that to find a patent claim invalid for obviousness, there must be a finding that each element in each limitation of the patent claim is disclosed, taught, or suggested by the asserted combination of prior-art references or elsewhere in the relevant prior art. I understand, however, that a patent claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. But multiple prior-art references or elements may, in some circumstances, be combined to render a patent claim obvious. I understand that I should consider whether there is an "apparent reason" or motivation to combine the prior-art references or elements in the way the patent claims. To determine whether such an "apparent reason" or motivation exists to combine the prior-art references or elements in the way a patent claims, it will often be necessary to look to the interrelated teaching of multiple prior-art references, to the effects of demands known to the design community or present in the marketplace, and to the background knowledge possessed by a person of ordinary skill in the art.

43. I also understand that when the prior art “teaches away” from combining prior-art references or certain known elements, discovery of a successful means of combining them is more likely to be nonobvious. A prior-art reference may be said to “teach away” from a patent when a person of ordinary skill in the art, upon reading the reference, would be discouraged from following the path set out in the patent or would be led in a direction divergent from the path that was taken by the patent. Additionally, a prior-art reference may “teach away” from a claimed invention when substituting an element within that prior-art reference for a claim element would render the claimed invention inoperable.

44. I am informed and understand that a patent for a combination which only recites old elements with no change in their respective functions withdraws what is already known into the field of its monopoly and diminishes the resources available to person of ordinary skill in the field. When a patent claims a structure already known in the prior art that is altered by mere substitution of one element for another known in the field, the combination must do more than yield a predictable result. I am informed and understand that the corollary to this principle is that when the prior art teaches away from combining known elements, discovery of a successful means of combining them is more likely to be nonobvious. Thus, the question to be answered is whether someone reading the prior art would be discouraged from following the path taken by the inventor.

45. I am further informed and understand that when an element is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill in the art can implement a predictable variation of that available element, Section 103 likely renders the invention obvious. For the same reason, I am informed and understand that if a technique has been used to improve one device or process, and a person of ordinary skill in the art would recognize that such technique would improve similar devices or processes in the same way, using the technique is obvious unless its actual application is beyond his or her skill. Following these principles often requires one to look to interrelated teachings of multiple patents; the effects of demands known to the design community present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art to determine whether there was an apparent reason to combine the known element in the manner claimed by the patent at issue. I am further informed and understand that the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, because one can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

46. I am further informed and understand that although the use of the “teaching, suggestion or motivation” test for combining references has not been completely rejected, the obviousness analysis cannot be confined by a formalistic

conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents. Under the correct analysis, any need or problem known in the field of endeavor at the time of the invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

D. Priority Date

47. I understand that the “priority date” of an invention is the date that determines whether a reference qualifies as prior art to the alleged invention. I understand that the priority date is the date the patent application is filed, and that a patent application may claim priority to an earlier-filed application or applications. In order to successfully claim priority to an earlier-filed application, the earlier-filed application must provide (i) sufficient written description support and (ii) an enabling disclosure for the full scope of the later-claimed invention. If the earlier-filed application fails to provide sufficient written description or lacks an enabling disclosure for the full scope of the later-claimed invention, the patent is not entitled to the priority date of the earlier-filed application.

IV. ASSIGNMENT AND MATERIALS REVIEWED

48. As noted above, I have been asked to provide my opinions regards validity of the ‘774 Patent in connection with the *inter partes* review Petition filed by NxtGen. My opinions are based on my years of education, research, and

experience, as well as my investigations and study of relevant materials. In forming my opinions, I have considered the materials I identify in this report and those listed in the attached Exhibit B.

49. This declaration represents only those opinions I have formed to date, but they may not be exhaustive of my opinions on the patentability of the claims-at-issue. The fact that I do not address a particular point should not be understood to indicate any agreement on my part that any claim otherwise does not comply with patentability requirements.

50. My analysis of materials in this investigation is ongoing and I will continue to review any new material as it is provided. I reserve the right to revise, supplement or amend my opinions, or any combination thereof, based on new information and on my continuing analysis of the materials already provided.

V. PERSON OF ORDINARY SKILL IN THE ART

51. I am informed and understand that the claims of a patent are judged from the perspective of a hypothetical construct involving a “person of ordinary skill in the art” (POSITA). The “art” is the field of technology to which the patent is related. I understand that the purpose of using the viewpoint of a person of ordinary skill in the art is for objectivity. I understand that a person of ordinary skill in the art is presumed to know and be familiar with of the relevant art in the field at the time of invention and is also presumed to possess an average level of creativity.

52. I understand that factors that may be considered in determining the level of ordinary skill include: (1) the type of problems encountered in the art at or prior to the relevant time period; (2) pre-existing solutions (i.e., prior art) to those problems; (3) the pace at which solutions innovations were developed at the relevant time period; (4) the sophistication of technology at the relevant time period; and (5) the education level of people working in the relevant field(s) at the relevant time period.

53. I understand that Petitioner is a Defendant in the U.S. District Court Case number 1:24-cv-00136-TCB, in the Northern District of Georgia Atlanta Division, wherein Patent Owner asserts that Defendant/Petitioner infringes multiple patents including the ‘774 Patent. I also understand that, Defendant/Petitioner asserts in 1:24-cv-00136-TCB that a POSITA as of the priority date of the ‘774 Patent “would have a bachelor’s degree in mechanical engineering, aerospace engineering, physics or other science or engineering based degree, be familiar with general principles of mechanics and aerodynamics, and have at least two years of experience in product design and development in the field of toys or other amusement-type devices. Other combinations of education with relevant practical experience may also qualify one as a POSITA, as the case may be.” [NxtGen Opening Claim Construction Brief, pp 7-8]

54. Patent Owner, which is the Plaintiff in 1:24-cv-00136-TCB put forth

that a POSITA as of the priority date of the ‘774 Patent “would have had at least a B.S. degree in Mechanical Engineering, Electrical Engineering, Aerospace Engineering, Industrial Design, Product Design, or similar field, with at least two years industry experience in one of these fields, and such POSITA would have been familiar with general principles of mechanics, fluid mechanics and aerodynamics.”

[*ZipString Opening Claim Construction Brief*, p 11]

55. It is noticed that Petitioner did not explicitly include Bachelor’s degrees in Electrical Engineering, Industrial Design, or Product Design. I believe that Electrical Engineering should be included because a B.S. in Electrical Engineering would leverage coursework in physics, electronics, actuators and controls. I assume that Petitioner would agree and that Electrical Engineering would fit under the “or other science or engineering based degree”. I also believe that Industrial Design and Product Design should be included because their degree curricula typically includes a combination of: 1) academic courses in product design, user experience, materials, manufacturing, human factors and design research; 2) studio work for practical experience in prototyping, design development, and final presentations; and, 3) hands-on experience with real-world projects through internships and/or capstone design projects. I note that Petitioners also provide for “at least two years of experience in product design and development in the field of toys or other amusement-type devices” and “other combinations of education with relevant

practical experience”, which may include the Industrial Design and Product Design degrees.

56. The two POSITA definitions do not differ significantly. I have applied these definitions to my analysis in this case. Based on my education and experience, I consider myself to have at least the necessary qualifications of a POSITA under both definitions, and have prepared all opinions set forth herein on the basis of that understanding. Furthermore, I frequently interact with, work with, supervise, and mentor persons with these qualifications.

VI. BACKGROUND OF THE TECHNOLOGY AND OVERVIEW OF THE ‘774 PATENT

A. Historical Gadgets with Appeal of Visual Paradoxes

57. Kinetic gadgets like the string shooter disclosed in the ‘774 Patent appear to defy the laws of physics—by exhibiting unexpected motion, stability, or energy transformations—and often captivate people by exploiting principles of classical mechanics, fluid dynamics, or magnetism in ways that seem paradoxical at first glance.

58. Historical examples include:

	Kinetic Gadget	Appeal of Visual Paradoxes
1	Tippe Top (1890s–1950s)	• Intriguing behavior: Flips upside down while spinning • Invented: Patented by Helene Sperl in 1891 (Germany); popularized in the 1950s • Why it seems to defy physics: When spun

	Kinetic Gadget	Appeal of Visual Paradoxes
		rapidly, the top flips over and continues spinning on its stem. • Physics explained: The toy exploits the conservation of angular momentum and friction between the tip and surface, which causes the center of mass to rise, flipping the top.
2	Rattleback / Celtic Stone (Ancient origin, popularized 1970s)	• Intriguing behavior: Spins in one direction only; reverses if spun the other way • Rediscovered: In scientific literature in the 1890s; toy versions popularized in the 20th century • Why it seems to defy physics: When spun in one (non-preferred) direction, it slows, rocks violently, then spins in the opposite (preferred) direction. • Physics explained: Asymmetry in mass distribution and curvature creates coupling between rotational and vibrational motion.
3	Euler's Disk (1990s)	• Intriguing behavior: Spins for a very long time and then abruptly stops • Invented: Patented by Joseph Bendik in 1990 • Why it seems to defy physics: It seems to spin forever, with increasing wobble and noise until it suddenly stops. • Physics explained: It converts rotational energy into sound and heat through friction and air resistance. The increasing frequency of oscillation before stopping is due to energy dissipation rates increasing as the disk approaches flatness
4	Drinking Bird (1940s)	• Intriguing behavior: Appears to perpetually bob up and down • Invented: Invented independently in the 1940s (notably by Miles V. Sullivan in 1945) • Why it seems to defy physics: It seems like a perpetual motion machine. • Physics explained: Evaporative cooling at the head condenses vapor, creating a pressure

	Kinetic Gadget	Appeal of Visual Paradoxes
		difference that moves liquid through the neck, shifting the center of gravity. Not perpetual—requires an ambient water source for evaporation
5	Magnetic Levitating Gadgets (1950s–present)	• Intriguing behavior: Objects appear to float in air • Why it seems to defy physics: Magnets holding stationary positions against gravity • Physics explained: Usually involves a combination of magnetic repulsion and mechanical constraints or active stabilization (e.g., diamagnetic materials, feedback-controlled electromagnets). Passive magnetic levitation is typically unstable by Earnshaw's theorem unless constrained
6	Gyroscopic (1910s–present)	• Examples: Gyroscopes, Perpetual Motion Tops, Space Wheels • Why it seems to defy physics: Gyroscopes resist changes in orientation and can balance on narrow edges or strings. • Physics explained: Angular momentum and gyroscopic precession; direction of rotation resists external torques
7	Slinky (1945–present)	• Intriguing behavior: Appears to “walk” downstairs or hang suspended in motion • Invented: Richard James, 1943 • Why it seems to defy physics: A suspended Slinky dropped from both ends appears to float briefly midair. • Physics explained: The bottom of the Slinky doesn’t move until the compression wave from the top reaches it, demonstrating tension and wave propagation in spring dynamics
8	Levitron (1990s)	• Intriguing behavior: A spinning magnetic top floats above a magnetic base

	Kinetic Gadget	Appeal of Visual Paradoxes
		• Invented: Roy Harrigan, patented in 1983, commercialized in the 1990s • Why it seems to defy physics: The top levitates mid-air while spinning. • Physics explained: Spin stabilizes orientation (gyroscopic effect), overcoming Earnshaw's theorem temporarily via dynamic stabilization
9	Balancing Bird (1970s–present)	• Intriguing behavior: Appears to balance impossibly on a tiny point (like a beak) • Why it seems to defy physics: Large wingspan but balances stably on a small point • Physics explained: The center of mass is low, often due to hidden weights in the wings, producing a stable equilibrium
10	Newton's Cradle (1960s)	• Intriguing behavior: Swinging one ball causes another to swing out on the opposite side • Why it seems to defy physics: Energy and momentum seem perfectly transferred • Physics explained: Demonstrates conservation of momentum and energy in elastic collisions, with practical losses due to sound and heat
11	Crookes Radiometer (1870s)	• Spins when exposed to light; works due to thermal transpiration, not radiation pressure as once thought.
12	Jacob's Ladder Toy	• Appears to flip downward indefinitely; uses momentum and visual illusion.
13	Magic Sand (Hydrophobic Sand)	• Behaves unexpectedly underwater; repels water due to hydrophobic coating.
14	Floating Globe (Electromagnetic Levitation)	• Uses feedback-controlled magnetic fields.
15	Floating Ribbon	• Used in rhythmic gymnastics and dance, ribbons

	Kinetic Gadget	Appeal of Visual Paradoxes
	Dancers/Kinetic Ribbons (1970s)	stay aloft due to inertial and aerodynamic forces from the handle's motion.
16	TwiddleFish (1990s)	The fish appears to move on its own or to “wiggle” with realistic locomotion when a user oscillates (or “twiddles”) a flexible handle connected to the fish's head.

59. Petitioner's expert witness, Dr. Kudrowitz, cites in his Declaration to multiple string shooter devices wherein “a loop becomes air-borne”. [Kudrowitz p18] Dr. Kudrowitz includes a reference to a patent “filed in 2001 by Clifford Wagner describing an ‘amusement device comprising an endless flexible loop and an inline traction drive unit to rotate the loop.’” However, Dr. Kudrowitz does not acknowledge the fundamental differences between the ‘774 Patent and these cited references, which are discussed in detail below, nor the fact that Wagner was cited by the Examiner of the ‘774 Patent. [‘774 File History pdf pg 19]

B. The ‘774 Patent

60. Embodiments described in the ‘774 Patent—which use unexpected mechanical or physical principles to create a mesmerizing motion—belong to a lineage of kinetic and “physics-defying” devices that captivate audiences by revealing subtle dynamics of (and balances between) tension, inertia, gyroscopic motion, and wave behavior. The string shooter of the ‘774 Patent has utility as a toy, STEM device, and industrial applications.

61. The ‘774 Patent refers to its disclosed embodiments generally as “string shooting devices”. The string shooting device of the ‘774 Patent is more specifically defined as “a string shooting device having a string capable of generating lift when propelled from the string shooting device” [‘774 Abstract] The mechanism for the string shooter of the ‘774 Patent is a thin loop of string that is rapidly propelled by and between two rotating wheels driven by one or more battery-powered internal motors. During operation, a user holds the body of the string shooting device in their hand, inserts the string through the loading slot in the housing and between the wheels and turns on the device to activate the rotation of the wheels. As the string is propelled in and out of the housing the string appears to hover, zip and curve in midair without collapsing. The string’s shape is maintained by centrifugal force, tension and air drag. The embodiments disclosed in the ‘774 Patent appear to defy physics because the string behaves like a levitating beam, curving and hovering. The string moves rapidly without visible support, bending around obstacles and suspending midair.

62. Previous kinetic gadgets, including string shooters, were limited in human factors such as ease of loop installation, ease of loop removal, and ease of use in general. Previous string shooters also did not employ housings that at least partly covered the wheels that “shoot” the string, and enable the looped string loading and removal without taking apart the string shooting device. To overcome

these and other deficiencies, the ‘774 Patent teaches a novel, simplified housing design that also comprises a unique loading slot, guide slot for between-wheel emplacement/removal, curing previous, overly complex and error-prone approaches.

C. File History of the ‘774 Patent

63. The ‘774 Patent is a utility patent with a non-provisional application filing date of November 17, 2022. The Patent Owner for the ‘774 Patent is ZipString, LLC, which is based in Georgia. The application for the ‘774 Patent is number 18/056,567, and was granted Track One status for prioritized examination. Application 18/056,567 received an initial review and non-final rejection on February 15, 2023. The February 2023 non-final rejection cited US Patent Number 5,205,266 (Kilby, Jr.) and US Pat. No. 5,471,967 (Matsuzaki) and anticipatory prior art for certain, but not all, claims. The Examiner stated that Claims 2-4 and 26-17 were potentially allowable subject matter in that “the specific limitations of the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis to generate a turbulent air boundary layer around the string are not anticipated by or found obvious by the cited prior art. [‘774 File History, pdf pg 76]

64. In March of 2023 Patent Owner amended dependent Claim 2 into independent Claim 1, amended dependent Claim 16 into independent Claim 15, and

similarly amended independent Claim 11. Patent Owner added new Claims 21 and 22, “directed to the housing at least partially covering the pair of wheels and the configuration of the loading slot defined by the housing.” and cited support for new Claims 21 and 22 “at least in paragraphs [0047] and [0057], and illustrated at least in Figures 6-14” of application 18/056,567. [‘774 File History, pdf pg 59] After these amendments, Examiner allowed Claims 1, 3-15, and 17-22 on April 4, 2023. [‘774 File History, pdf pg 10]

65. From my perspective as a POSITA, and based on the ‘774 Patent File History, including the prior art searches and citations, the Examiner applied the necessary rigor in reviewing and ultimately allowing the ‘774 Patent.

D. Impact of the ‘774 Patent

66. I have been informed that the claimed invention of the ‘774 Patent quickly made an impact in the market after an embodiment, the ZipString, entered a toy space, otherwise crowded with fidget toys, STEM kits and novelty gadgets. Based on the disclosure in the ‘774 Patent (application), ZipString launched on Kickstarter in 2021 and rapidly exceeded funding goals, reflecting strong public interest and viral traction, largely because it created its own category of a physics-driven device that is not exclusively educational, with an emphasis on tactile control and mesmerizing motion.

67. ZipString’s videos on social media, including TikTok and Instagram,

showed the visual paradox of a string that levitates, curves through the air and avoids obstacles. These were mesmerizing and became viral, drawing millions of views with comments expressing disbelief and awe. Science and education fields were also drawn to the ZipString as evidenced by science communicators’ and creators’ video demonstrations, as well as the adoption as a physics demonstration tool and a STEM gateway toy, reaching 1,800 underrepresented eighth-grade students across 12 schools.^{1 2} ZipString was also widely adopted in the digital art and motion graphics communities. Furthermore, robotics and rigging communities see the ‘774 Patent as a potential solution in soft robotics and actuation.

68. Commercially, ZipString experienced strong sales through its own website as well as channels including Amazon, TikTok Shop, etc. It benefited from frequent top toy listing during holiday seasons, as well. Following an appearance on Shark Tank Season 14, ZipString was offered a \$100,000 investment for 20% equity from “Sharks” Kevin O’Leary and Robert Herjavec. The excitement over ZipString led to immediate sales and a significant surge in demand.^{3 4 5} By the end of 2024,

¹ [Zip to STEM: Integrating Engineering Design in MS Science | STEM Teacher Leadership Network](#)

² [Zippping Towards STEM: Integrating Engineering Design into the Middle School Physical Science Curriculum | STELAR - STEM Learning and Research Center](#)

³ [Shark Tank ZipString Update 2025 | Season 14](#)

⁴ [ZipString Net Worth 2025: A Fun Toy That’s Flying High After Shark Tank - Spot Herld](#)

⁵ [ZipString Update After Shark Tank: Exciting Growth and New Developments \(2025\)](#)

ZipString is thought to have surpassed 1 million units sold.⁶

E. Challenged Claims

69. I understand that Petitioner is challenging claims 1-4, 12, and 15-17 of the '774 Patent, reproduced below.

Claim 1	
1.0	A string shooting device comprising:
1.1	a body;
1.2	a housing attached to the body;
1.3	a pair of wheels, wherein at least one of the pair of wheels is a driven wheel;
1.4	a string, wherein the string comprises a surface texture configured to increase air friction in response to the string being propelled through air by the pair of wheels, wherein the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis.
Claim 2	
2	The string shooting device of claim 1, wherein the plurality of fibers extending away from the axis generate a turbulent air boundary layer around the string in response to the string being propelled through the air by the pair of wheels.
Claim 3	
3	The string shooting device of claim 2, wherein the string is a looped string, wherein the looped string, at a distal portion furthest from the body, generates lift from the turbulent air boundary layer.

⁶ [ZipString ties up 1m unit salesToy World Magazine | The business magazine with a passion for toys](#)

Claim 4	
4	The string shooting device of claim 1, wherein the housing covers, at least partially, the pair of wheels, and wherein the housing defines a loading slot through which the string is loaded or removed from between the pair of wheels.
Claim 12	
12.0	A method of propelling a looped string through air comprising:
12.1	receiving a looped string into a housing between a pair of wheels, wherein at least one of the pair of wheels is a driven wheel,
12.2	wherein the looped string defines an axis along which the string extends, and wherein the looped string comprises a plurality of fibers extending away from the axis;
12.3	driving the at least one driven wheel;
12.4	propelling the looped string from the at least one driven wheel; and
12.5	generating, from the looped string propelled by the at least one driven wheel, lift at an end of the looped string distal from the housing based on a surface texture of string configured to increase air friction in response to the looped string being propelled.
Claim 15	
15	The method of claim 12, wherein propelling the looped string from the at least one driven wheel comprises: receiving the looped string through an intake aperture of the housing; guiding the looped string between the pair of wheels; and propelling the looped string through an exit aperture of the housing.
Claim 16	
16.0	A string shooting device comprising:
16.1	a housing attached to the body and defining a loading slot;
16.2	a pair of wheels, wherein at least one of the pair of wheels is a driven wheel, wherein the loading slot is disposed at least partially over at least one of the pair of wheels; and

16.3	a looped string, wherein the looped string comprises a surface texture configured to increase air friction in response to the looped string being propelled through air by the pair of wheels.
Claim 17	
17	The string shooting device of claim 16, wherein the surface texture comprises a plurality of fibers extending away from an axis along which the looped string extends to generate a turbulent air boundary layer around the looped string in response to the looped string being propelled through the air by the pair of wheels.

VII. PETITIONERS ASSERTED PRIOR ART

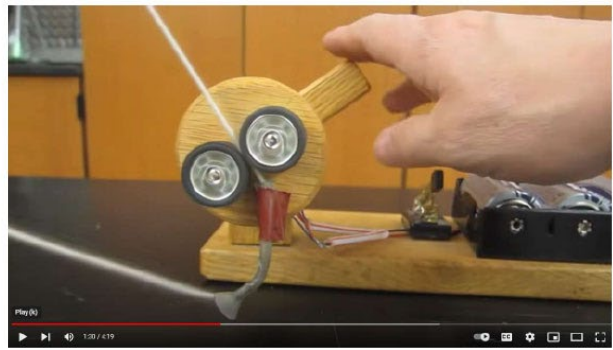
70. Below are summaries of the prior art Petitioner is asserting that forms the basis of Dr. Kudrowitz’s analysis in this IPR that I discuss at length in this declaration.

A. Yeany

71. Dr. Kudrowitz states that “the Yeany video YouTube webpage indicates it was published on June 12, 2014 (available at <https://www.youtube.com/watch?v=rffAjZPmkuU>). ” and that YouTube’s support webpage states, “[w]hen you publish a video, the video is made available for anyone to watch,” and the ‘Publish date’ is the [sic] shown ‘beneath your live video,’ ” [Kudrowitz, pg 25]

72. According to Dr. Kudrowitz, “Yeany is a YouTube video featuring Professor Bruce Yeany as he discusses a string shooter device he created. As shown in Yeany, the device is constructed from a length of string, two driven wheels, a

housing tube, motors, batteries, an on/off switch, some wires, and the body of the device comprised of wooden blocks. When the device is turned on, the motors drive the wheels to propel the string as a continuous loop that appears to float in air as seen in” the Yeany video. [Kudrowitz, pg 27] Dr. Kudrowitz also notes that “the string used by Yeany has a surface texture configured to increase air friction, as seen by the visible fibers extending from the string’s surface”. [Kudrowitz, pg 28] Dr. Kudrowitz includes the following still images:



Yeany at 1:05 and 1:30



Yeany at 1:16

73. Immediately noticeable from the Yeany video is that it is a table top device that includes a large wooden base on which another round wooden piece is

mounted that supports two rotatable wheels. This contrasts with the device of the ‘774 Patent that is shown and described as being configured to be held by a user. [‘774 Col. 6 lines 14-17].

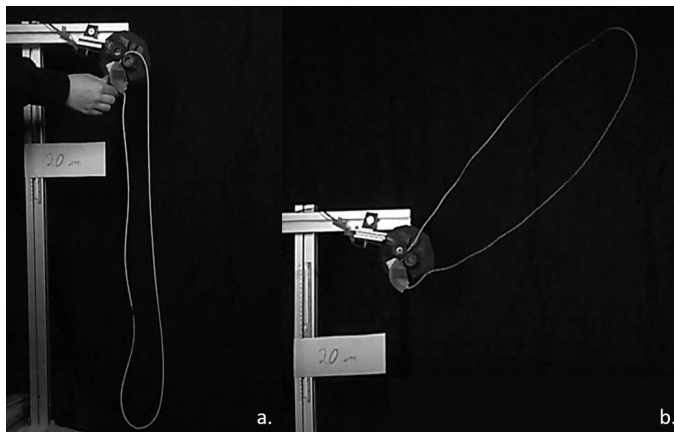
74. Another immediately distinguishable element from the Yeany video is the inability to “readily attach and detach the string from the string shooting device”. [‘774, Abstract] Rather, Professor Yeany requires that the string be threaded through a “little plastic tube” [Yeany 1:30] that has a funnel-shaped end(s), which cannot be achieved with a *looped* string. Instead, this design limitation requires a user to start with a non-looped string, thread one end through the tube and between the wheels that were inspired by a “baseball pitching machine” [Yeany 1:10], and then to connect the two ends to form a loop after it is threaded. The sound of string where the two ends are adhered to each other can be heard in the Yeany video as the fusion point passes through the wheel pair, giving a cyclic clicking sound. It should also be noted that Yeany does not disclose a housing that covers in any way the pair of wheels. Additionally, Yeany does not disclose a housing that defines a loading slot through which the looped string is loaded or removed from between the pair of wheels, as claimed in the ‘774 Patent. [‘774 Claim 4, Col. 12 lines 37-41].

75. It should again be noted that Yeany’s device is not a string-shooting device that is configured to be held by a user. As such, there are significant difference between the device disclosed in the ‘774 Patent and the device shown in

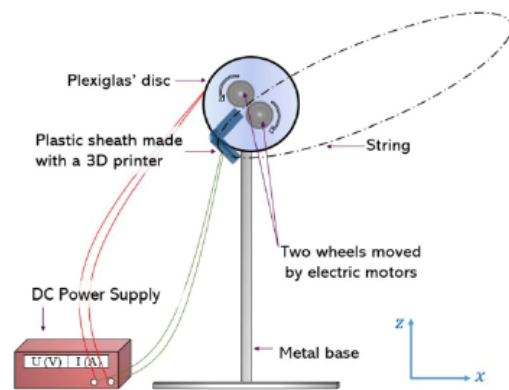
Yeany's video. First, the "little plastic tube" is an inelegant design that requires a complicated string installation and removal process. Second, the exposed wheels teach a hazardous mechanism wherein hair, fingers, clothing, etc. may become entangled if used as a hand-held device. Third, Professor Yeany's launching of popsicle sticks as projectiles that may be launched highlight that it is not designed as a string shooting device as disclosed in the '774 Patent, but as a device that launches projectiles, which is not taught in the '774 Patent.

B. Abello

76. Dr. Kudrowitz states that "Abello relates to 'an experimental setup wherein a closed string loop is propelled through the air using two motorized wheels spinning in opposite directions.'" [Kudrowitz, pg 29] Dr. Kudrowitz also explains that "Figure 2 of Abello illustrates the experimental setup." [Kudrowitz, pg 29]



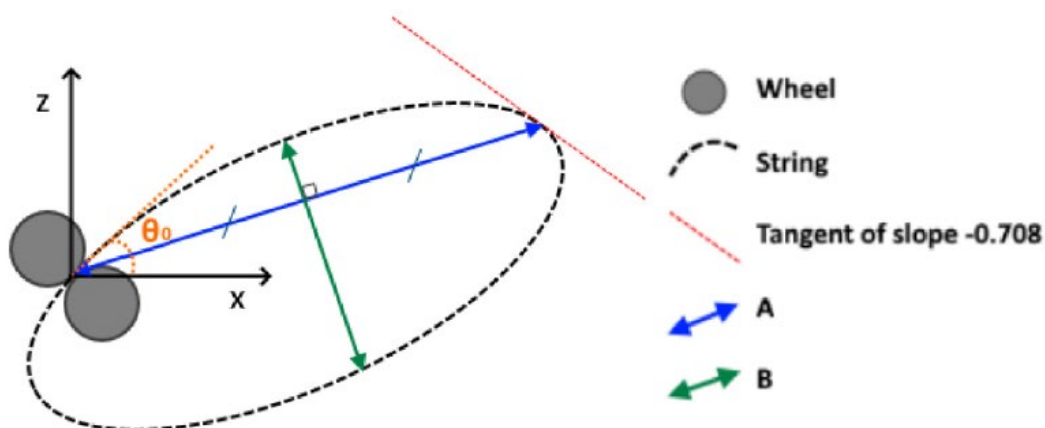
Abello Figure 1.



Abello Figure 2.

77. Abello's efforts focused mostly on characterizing the string shooter "SSh" on the basis of atmospheric pressure, string materials, takeoff speed, linear

mass of the string, length of the string loop, and the angle of ejection of the string. [Abello pg 2] Abello “noticed that the most dense strings as well as the smoothest strings were the ones to have the highest takeoff speeds,” and “[a]lthough these results are counterintuitive, it was found that for a given string, [take-off speed] depend [sic] neither on the length L of the SSh (see Tab. 3) nor the angle”. [Abello pp 4-5]. The fact that Abello specifically notes that the “smoothest” string has the highest takeoff speeds indicates a desirability for the string to be smooth, which teaches away from the device as claimed in the ‘774 Patent.

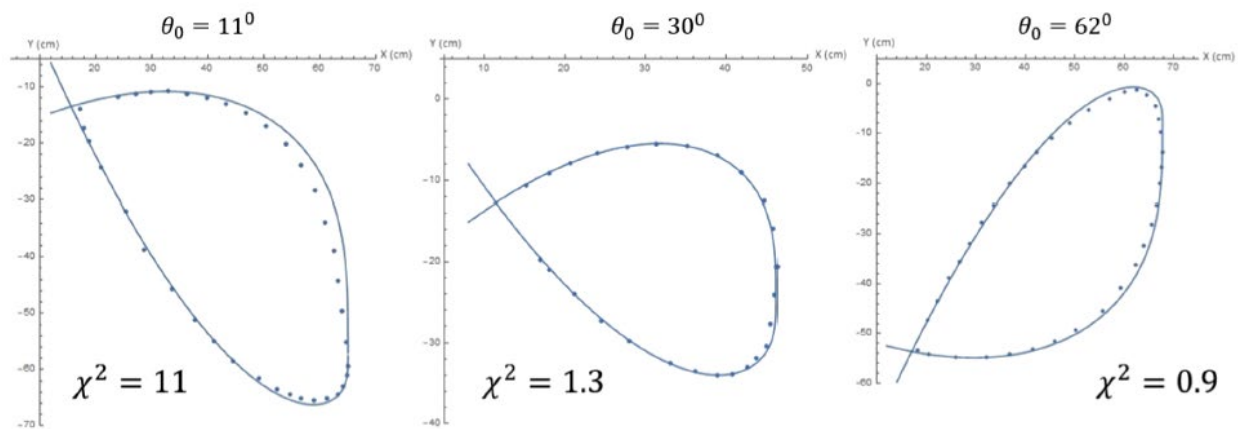


Abello Figure 4.

78. A POSITA would notice that, while Abello discusses air drag, Abello does not use the term “hairiness”, nor focus specifically on the fibers on the string exterior. Rather, Abello merely notices that “modifying the string itself by independently changing each of its characteristic parameters, such as linear density, roughness, fibre material, diameter, etc.” “would be valuable and meaningful to explore.” Said differently, a POSITA may find that Abello deferred to future work

evaluating and validating the impact of external fibers and did not conclude that roughness or any particular fiber material would be beneficial to aiding in lift.

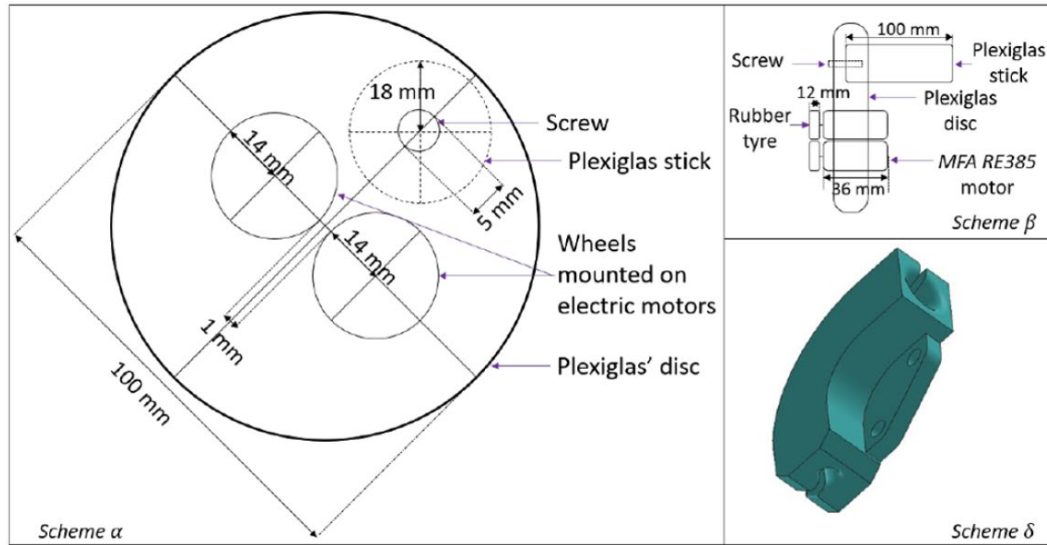
79. A POSITA would notice that the elliptical models, shown in Abello Figures 2 and 4, do not actually match the physical outcome shown, for example, in Abello Figure 1. The supposed string trajectories shown in Abello Figure 9 also do not match the actual full trajectory of the string loop in, for example, Abello Figure 1, particularly at the point where the line fit forms intersections that imply a harsh turn for the string, or a figure-8 contour. Discrepancies like this would give a POSITA pause and cause the POSITA to question the model and its assumptions.



Abello Figure 9.

80. A POSITA would also notice that Abello’s “plastic sheath”, (See Abello Figure 2) “crafted by a 3D printer, was placed under the wheels in such a way that it guides the returning string back in between the wheels. The exit of the sheath is located 1.7 cm before the ejection point, where the wheels touch.” [Abello pg 5] This “plastic sheath” defines the curvature of the returning string, not a natural

trajectory, even at the “String Shooter’s stationary state”. [id]



Abello Figure 3.

81. Abello provides no additional information about this “plastic sheath” component and seems to not factor the drag it likely imposes on the string loop into the mathematical model. Instead, Abello states “ R depends on the string’s linear mass density μ , but also its velocity v and its features (such as the perimeter of a string section or its texture), which both influence the linear drag force applied on the string.” [id pg 4] Abello does notice that the SSh shape has instabilities and “Even if the SSh’s shape had been considered stable at each measurement, it appears that in practice, the SSh’s shape sometimes takes a certain time to stabilise, particularly near $v_{takeoff}$. The irregularity of the shape could be coming from the loop’s junction point passing through the sheath.” [id pg 6] Abello also states “Higher speeds meant more mechanical stress on every component of the SSh (string, wheels, sheath).” [id pg 7], but does not include its drag in the mathematical model.

Additionally, Abello notices that the string's loop "junction" registers a sound each time it passes through the sheath [*id* pg 2] which, again, indicates an impact on the string, but is not factored into the mathematical model. A POSITA would know that anything that contacts the string can create drag and should be included in the mathematical model; without it a POSITA would be skeptical to rely on the Abello reference.

82. A POSITA would also notice that Abello does not disclose a housing that covers in any way the pair of wheels. Additionally, Abello does not disclose a housing that defines a loading slot through which the looped string is loaded or removed from between the pair of wheels.

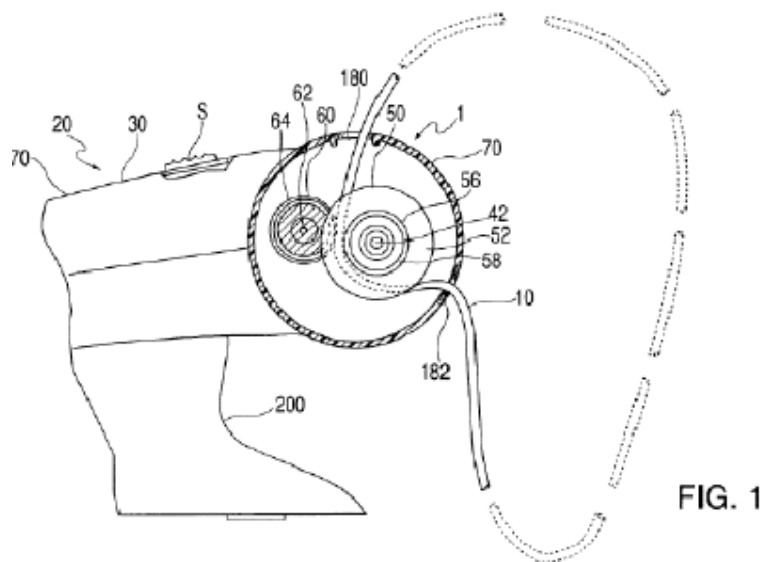
83. While Abello concludes that "there are two possible distinct states for the SSh: the *pulley state* where the loop dangles down, and the *air-lifted state*" [*id* pg 8], Abello acknowledges "[w]e spent several months studying the SSh and further investigations will be required to fully understand its behaviour." [*id* pg 6] A POSITA would also note that Abello makes no mention in the body of his report of the mechanism being used for toys or amusement.

C. Wagner

84. Cited by the examiner during prosecution of the '774 Patent ['774 File History, pdf pg 19], U.S. Patent No. 6,537,126, titled "Amusement Device," describes a handheld toy that uses a motorized mechanism to propel a flexible,

endless loop into the air, creating dynamic visual patterns. Wagner's flexible loop is an "endless loop" made of "flexible" material (such as fabric or filament) [Wagner 2:13-14; 5:46; 6:37] and is designed to move continuously through the device. Wagner's loop is driven by a pair of circumferentially opposed wheels—one powered by a motor and the other serving as a backup. This setup imparts linear velocity to the loop, causing it to extend outward from the device. [*id.* 2:36-42]

85. Wagner discloses a device with a rotatable cup and cover with ejection and take-up apertures. This design allows users to adjust the pitch orientation of the loop's motion, enabling various configurations and patterns. [*id.* 2:65-3:2] Wagner refers to the device's body as "housing" which is not the same "housing" described in the '774 Patent. Wagner's device can include a base and handle. [*id.*, 2:60-61]



Wagner Figure 1.

86. Dr. Kudrowitz states that "Wagner further discloses loading the string

in the amusement device and propelling the looped string. [Wagner at 3:57-62, 4:57-64] As shown in Figure 1 of Wagner, the looped string 10 is received between the drive wheel 50 and the backup wheel 60. [Wagner at 2:37-40, FIG. 1] The wheels 50, 60 are within the cover 150 and the rotatable cup 100 (e.g., housing). [Wagner at 4:22-38, FIG. 3] The looped string is propelled out of the cover 150 and rotatable cup 100 by the wheels 50, 60 through an ejection aperture 180 and enters into the cover 150 and the rotatable cup 100 to the wheels 50, 60 through a take-up aperture 182. [Wagner at 4:22-38]” [Kudrowitz, ¶70]

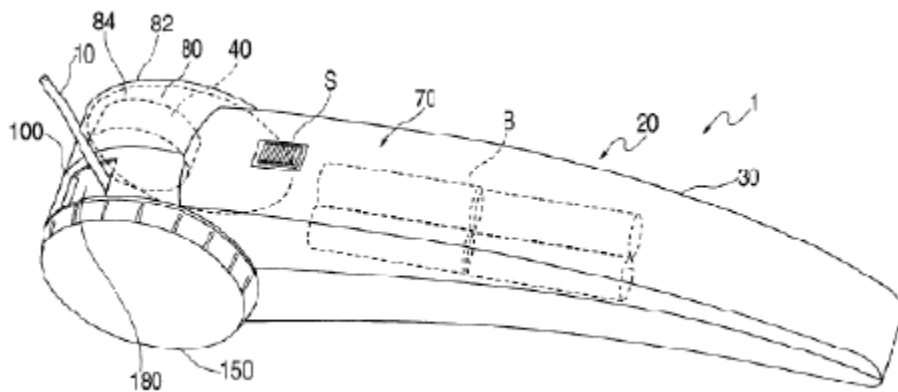


FIG. 3
Wagner Figure 3.

87. A POSITA would notice that Wagner does not have a housing, as it is defined in the ‘774 Patent, including a loading slot that allows one to insert or remove a looped string. The ‘774 Patent defines its housing that defines a loading slot through which the string is loaded or removed from between the pair of wheels [‘774, 1:63-66] Wagner’s cover 150 and rotatable cup 100 do not comprise a

channel, groove or long, narrow aperture or slit in for something to be inserted. Wagner does not have a loading slot as defined at one edge by a loading tab. [‘774, 2:50-54] Wagner does not have a “loading slot” that is oblique. [‘774, 8:45-57] Wagner does not have a loading tab that guides the string from the loading slot to the intake aperture. [‘774, 8:66-9:3] Wagner also does not have a loading slot 101 that connects with the exit aperture 103 on a front and intersects with the guiding slot 108 on a back side of the left wheel housing [‘774, 10:17-19]

88. Instead, Wagner states, “The ejection hole 158 is preferably opened to permit the loop 10 to be removed from the device 1 or reinstalled between the drive wheel 50 and the backup wheel 60 and to permit the cover 150 to be put in place **with the loop 10 installed.**” [Wagner, 3:57-62] A POSITA would understand this to mean that the string needs to be installed **before** cover 150 is installed.

89. Wagner uses terms that a POSITA would either not understand Wagner’s intended use or would know to have multiple, potentially conflicting meanings. These may include

- **Circumferential groove:** This is a term that has multiple meanings, one of which may be a simple circular channel on an end surface of a cylinder (e.g., grooves on a vinyl record) or a continuous channel that runs around the outer or inner surface of a cylindrical or round object.
- **Circumferentially spaced:** This term is often used to describe the layout of

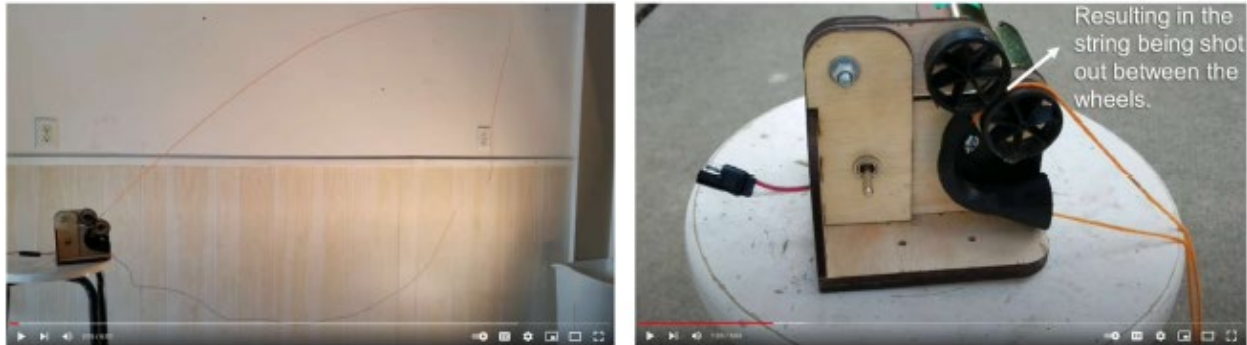
repeating features (e.g., holes, ribs, teeth) that are arranged symmetrically around a rotational axis. Wagner’s use of this term would not be understood by a POSITA, partly because Wagner is not describing repeating features, and partly because—if not repeating features—circumference is a *distance* term with distance units (e.g., mm, inch, etc.) whereas Wagner uses units of angle (e.g., “and their corresponding holes are circumferentially spaced from each other from about 105 degrees to about 110 degrees.” [Wagner, 4:35-38] Furthermore, a POSITA would not understand this term as used by Wagner because no frame of reference is defined by Wagner with which to measure the alleged angle.

D. Scorch

90. Dr. Kudrowitz states that “the Scorch video YouTube webpage indicates it was published on July 4, 2018 (available at <https://www.youtube.com/watch?v=IGIDy-IJxmo>). ” and repeated YouTube’s support webpage statements regarding the “Publish Date”. [Kudrowitz, ¶71]

91. According to Dr. Kudrowitz, “Scorch discloses a string shooter device that uses two wheels to shoot a loop of string.” [Kudrowitz, ¶76] and that “Scorch also teaches the housing for a string shooter can include a loading slot on the side, as shown by the slot in the black funnel that houses the string. The narrator of Scorch says that, with the housing including the loading slot, ‘you can put a new string on,

without having to disconnect the string or bond the string that's in there.' Scorch at 5:23-29." [Kudrowitz, ¶77]

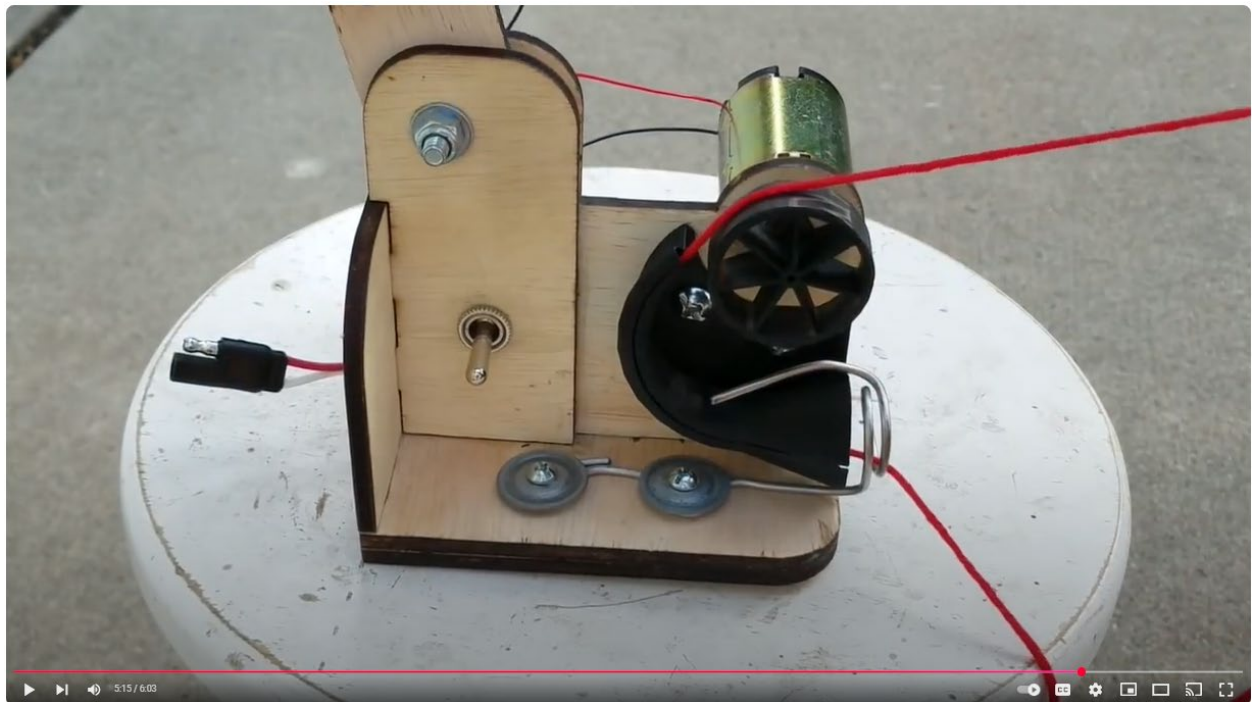


Scorch at 0:05 and 1:20 [Kudrowitz, ¶76]

92. While I agree with Dr. Kudrowitz that “Scorch discloses a string shooter device that uses two wheels to shoot a loop of string.” [Kudrowitz, ¶76], I disagree with the assertion that Scorch “teaches the housing for a string shooter” [Kudrowitz, ¶77]. Scorch’s “funnel” is not a “housing” because it does not cover the wheels of Scorch’s string shooter, in whole or in part. Second, Scorch’s slot is not a “slot through which the string is loaded or removed between the pair of wheels”. Instead, Scorch’s slot terminates at a substantial distance from where the two wheels meet; Scorch’s slot is not over the area between the pair of wheels. In fact, Scorch’s design substantially separates the wheels to load the string.

93. Additionally, Scorch states that “the string can shoot out the slot” [Scorch 4:00-4:04], meaning that Scorch’s slotted funnel does not actually *house* the looped string. To reinforce this, Scorch adds “an extra piece” fashioned from “a bent wire with a corkscrew at the end” to “prevent the string from coming out the

side”. [Scorch 4:05-4:30] A POSITA would understand that Scorch’s “separate piece” is not part of the funnel but, instead, a completely different component which does not join or otherwise become part of the funnel, and neither is nor has a slot. Petitioner and Dr. Kudrowitz do not show or mention this “separate piece”, which is in the figure below.



Scorch’s design significantly separates wheels during string load and requires external components including a (slotted) funnel and separate wireframe stabilizer. [Scorch 5:15]

VIII. PATENTABILITY OF CHALLENGED CLAIMS

94. Petitioner and Dr. Kudrowitz opine that the challenged claims are anticipated or obvious based on four grounds, which are summarized in the following table:

Ground	Prior Art	Basis	Claims Challenged
1	Yeany	§102	1-3, 12, and 15
2	Abello in view of Yeany	§103	1-3, 12, and 15-17
3	Wagner in view of Yeany	§103	1-3, 12, and 15
4	Wagner in view of Yeany and Scorch	§103	4, 16 and 17

95. Having reviewed the Petition, it is my opinion that each of claims 1-2, 4-9, 11-14, 16-17, and 19-25 of the ‘774 Patent is patentable. The Petition does not establish any of these claims is invalid. The following sections provide my detailed opinions regarding the specific invalidity grounds set forth in the Petition.

A. Ground 1 – Claims 1-3, 12 and 15 are patentable over Yeany

96. Dr. Kudrowitz asserts that claims 1-3, 12 and 15 would have been anticipated over Yeany. I disagree with Dr. Kudrowitz for the reasons provided below.

1. Claim 1

(a) [1.0] A string shooting device comprising:

97. At this time, I do not dispute that Yeany teaches this limitation.

(b) [1.1] A body;

98. A POSITA upon reading the ‘774 Patent would understand that the body is configured to be held by a user [‘774 Patent Col. 6, lines 14-17] and Yeany is not so configured.

(c) [1.2] a housing attached to the body;

99. Limitation [1.2] is not taught by Yeany. A POSITA would understand

that a housing for a kinetic device like a string shooter should be a protective, stable and structurally sound component that simultaneously shields the device's moving components and does not inadvertently expose the moving components to pose a safety risk to users or bystanders. The string shooter housing as disclosed in the '774 patent is user-friendly, enabling string loop installation and removal without the need for special tools, motions or complex assembly/disassembly steps. The string shooter housing allows visual and tactile feedback for users during operation, troubleshooting, string loop exchanges, etc. The string shooter housing of the '774 Patent uniquely provides these features. ['774 9:17-11:47] For example, the structural design of the '774 housing is sturdy, reliably integrated into the device body, minimizes exposing the wheels to ambient effects, and minimizes exposing users or bystanders to wheel entanglement (e.g., hair, apparel, appendages, etc.). The '774 Patent housing is also user friendly, enabling a minimal number of steps to install and/or remove the string loop, and providing visual and tactile feedback during the process.

100. In contrast, Yeany does not disclose a housing. A POSITA would not agree that the little plastic tube [Yeany 1:30] to which Dr. Kudrowitz improperly maps the "housing" term that does not cover the wheels, and instead teaches a hazardous unsafe mechanism in which hair, fingers, clothing, etc. may become entangled, and with which potentially hazardous projectiles are launched. [Yeany

3:30-4:00] A POSITA would also recognize that the Yeany’s little plastic tube is not actually “attached” in the way a housing on a kinetic device should be to what Dr. Kudrowitz maps the “body” term. Instead, a POSITA would notice a crudely applied piece of red tape that that adheres in a temporary manner a non-housing object to the wooden structure holding the motors.

101. Thus, Yeany does not disclose a housing attached to the body.

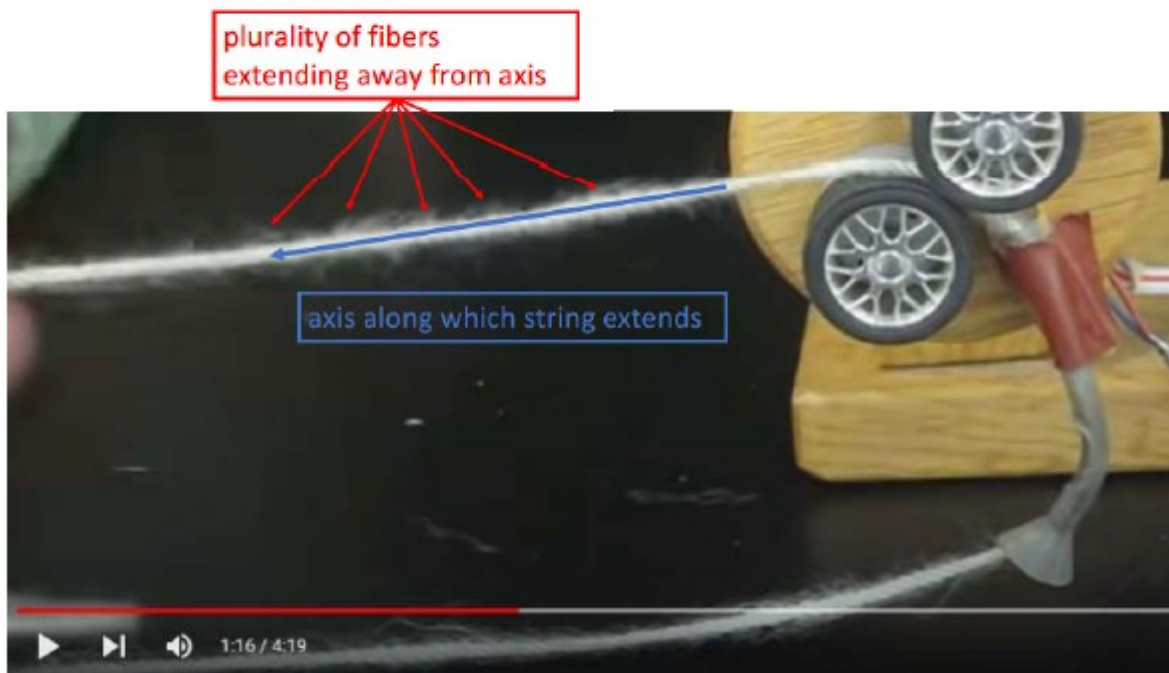
(a) ***[1.3] –pair of wheels, wherein at least one of the pair of wheels is a driven wheel,***

102. At this time, I do not dispute that Yeany teaches this limitation.

(b) ***[1.4] a string, wherein the string comprises a surface texture configured to increase air friction in response to the string being propelled through air by the pair of wheels, wherein the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis.;***

103. Limitation [1.4] is not taught by Yeany. Dr. Kudrowitz acknowledges that Professor Yeany does not say that the string’s surface texture or fibers extending away from the string’s axis are configured to increase air friction in response to the string being propelled through the air. Dr. Kudrowitz states “Although not verbally discussed in the narration, when the camera pans in on the string, it is visually shown to have fiber threads extending away from axis of the string creating a fuzzy surface texture that would increase air friction when propelled through the air. Yeany at

1:14-1:25. Examples of this surface texture and plurality of extending fibers on the string surface can be seen in the below screenshots:” [Kudrowitz, ¶83]



Yeany at 1:14 to 1:25 [Kudrowitz, ¶83]

104. Not only does Professor Yeany not discuss the texture of the string,

much less the presence or lack of fibers on the strings he uses, he also does not describe the use history of the strings in his video. A POSITA would not agree with Dr. Kudrowitz that a single close-up of a fuzzy string constitutes a teaching about any potential role of such fuzziness. A POSITA would notice that Professor Yeany does not describe how or when one of the strings became fuzzy. Instead, a POSITA would reasonably assume that the string may have begun its employment without the “plurality of fibers” that Dr. Kudrowitz suggests were present all along and intentionally exploited, and instead developed the fuzziness overtime in multiple potential ways. For example, Professor Yeany’s string shooter rig uses two motors to drive two counter-rotating wheels and the video begins with the string shooting devices already in use. A POSITA would understand that while same-model motors have similar *nominal* performance, each motor has a unique speed-torque character. Thus, even if both motors received the same power from the same source, one of the motors may spin at a slightly different speed and/or torque response than the other. This speed differential will rough up the surface of a string, even if it started out smooth. But even in the unlikely scenario where both motors spin at exactly the same speed and at exactly the same torque, the friction from the wheels would also rough up the surface of the string.

105. Dr. Kudrowitz’s comparison of the aforementioned brief clip of a fuzzy string to the ‘774 Patent’s description of how “extending fibers would appear fuzzy”

might seem backwards to a POSITA. [Kudrowitz, ¶¶84-85] A POSITA would not presume that a disclosure in a patent “merely describes principals [sic] of physics that would likely apply to” an alleged prior art reference.

106. A POSITA would also be confused that Dr. Kudrowitz would advance such an assumption that contrasts with statements from at least another alleged prior art reference. For example, Abello states that “we noticed that the most dense strings as well as the smoothest strings were the ones to have the highest takeoff speeds”. [Abello, pp 4-5] Yeany’s video provides no details about the motor speeds (or torques) at which any of the videoed string shooters operated. Some may have rotated faster than others. Even if a faster motor speed is needed to shoot a smooth speed, a POSITA would know that Yeany’s strings could have been smooth, even if just at the beginning of their use.

107. Given the lack of any express discussion about the strings’ texture, and the lack of any background about the strings (which may have been smooth and still functional, as confirmed by Abello), Yeany does not teach that the string has a surface texture configured to increase air friction in response to the string being propelled through air by the pair of wheels, wherein the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis.

2. **Claim 2: The string shooting device of claim 1, wherein the plurality of fibers extending away from the axis generate a turbulent air boundary layer around the string in response to the string being propelled through the air by the pair of wheels**

108. Yeany is silent about the existence of fibers on each of the strings shown in its video, and silent about the role of any fibers when and if they materialize. Furthermore, Yeany does not teach Claim 1, from which Claim 2 depends. Thus, Yeany does not teach a string shooting device of claim 1, wherein the plurality of fibers extending away from the axis generate a turbulent air boundary layer around the string in response to the string being propelled through the air by the pair of wheels.

3. **Claim 3: The string shooting device of claim 2, wherein the string is a looped string, wherein the looped string, at a distal portion furthest from the body, generates lift from the turbulent air boundary layer.**

109. Yeany does not teach Claim 1, from which Claim 2 depends. Thus, Yeany does not teach Claim 2, from which Claim 3 depends. Therefore, Yeany does not teach the string shooting device of Claim 2, wherein the string is a looped string, wherein the looped string, at a distal portion furthest from the body, generates lift from the turbulent air boundary layer.

4. **Claim 12:**

(a) *[12.0] A method of propelling a looped string through air comprising:*

110. At this time, I do not dispute that Yeany teaches this limitation.

(b) *[12.1] receiving a looped string into a housing between a pair of wheels, wherein at least one of the pair of wheels is a driven wheel,*

111. As discussed above, Yeany does not teach a housing between a pair of wheels. Therefore, Yeany does not teach this limitation.

(c) *[12.2] wherein the looped string defines an axis along which the string extends, and wherein the looped string comprises a plurality of fibers extending away from the axis;*

112. At this time, I do not dispute that Yeany teaches this limitation.

(d) *[12.3] driving the at least one driven wheel;*

113. At this time, I do not dispute that Yeany teaches this limitation.

(e) *[12.4] propelling the looped string from the at least one driven wheel; and*

114. At this time, I do not dispute that Yeany teaches this limitation.

(f) *[12.5] generating, from the looped string propelled by the at least one driven wheel, lift at an end of the looped string distal from the housing based on a surface texture of string configured to increase air friction in response to the looped string being propelled.*

115. Discussed above, Yeany is silent about the role surface texture, including when and if the texture changes or materializes, plays on the strings shown

in the Yeany video. Thus, Yeany does not teach this limitation.

5. **Claim 15: The method of claim 12, wherein propelling the looped string from the at least one driven wheel comprises: receiving the looped string through an intake aperture of the housing; guiding the looped string between the pair of wheels; and propelling the looped string through an exit aperture of the housing.**

116. Yeany does not teach Claim 12, from which Claim 15 depends. Additionally, as previously discussed, Yeany does not teach a housing as a POSITA would define it from the '774 Patent. Furthermore, Yeany's "little plastic tube" [Yeany 1:30] does not guide the looped string between the pair of wheels. Instead, Yeany's "little plastic tube" terminates a substantial distance from where the pair of wheels meet, which a POSITA would understand enables a broad spectrum of string trajectories. Thus, Yeany does not teach Claim 15.

B. Ground 2 – Claims 1-3, 12 and 15-17 are patentable over Abello in view of Yeany

117. Dr. Kudrowitz asserts that claims 1-3, 12 and 15 would have been obvious over Abello in view of Yeany. I disagree with Dr. Kudrowitz for the reasons provided below.

1. Claim 1

(a) [1.0] A string shooting device comprising:

118. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

(b) [1.1] A body;

119. A POSITA upon reading the ‘774 Patent would understand that the body is configured to be held by a user [‘774 Patent Col. 6, lines 14-17] and neither Yeany nor Scorch are so configured.

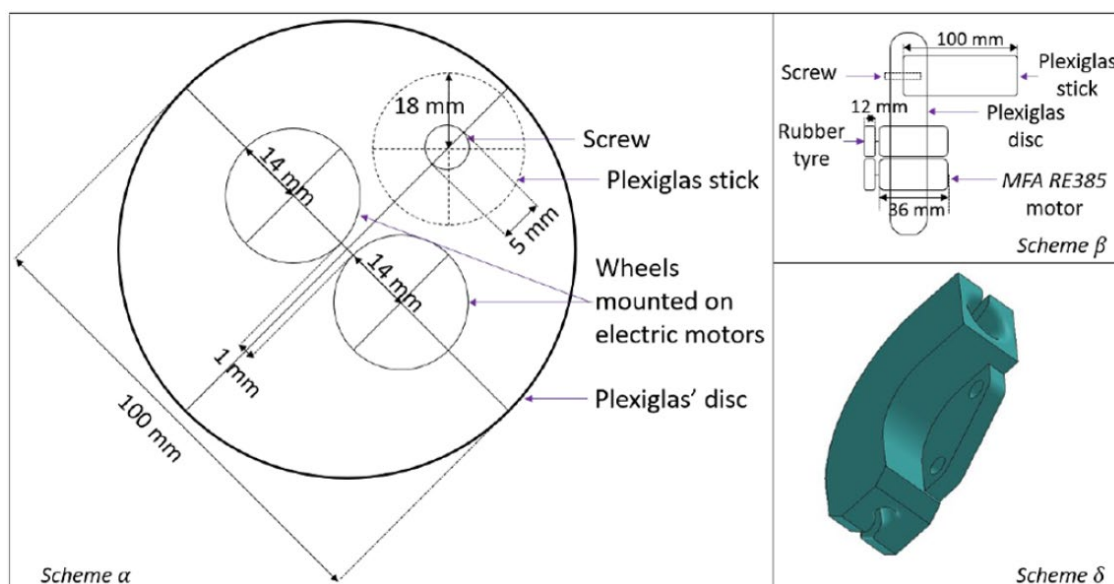
(c) [1.2] a housing attached to the body;

120. Limitation [1.2] is not taught by Abello or Yeany. A POSITA would understand that a housing for a kinetic device like a string shooter should be a protective, stable and structurally sound component that simultaneously shields the device’s moving components and does not inadvertently expose the moving components to pose a safety risk to users or bystanders. The string shooter housing should also be user-friendly, enabling string loop installation and removal without the need for special tools, motions or complex assembly/disassembly steps. The string shooter housing should also allow visual and tactile feedback for users during operation, troubleshooting, string loop exchanges, etc. The string shooter housing of the ‘774 Patent uniquely provides these features. [‘774 9:17-11:47] For example, the structural design of the ‘774 housing is sturdy, reliably integrated into the device body, minimizes exposing the wheels to ambient effects, and minimizes exposing users or bystanders to wheel entanglement (e.g., hair, apparel, appendages, etc.). The ‘774 Patent housing is also user friendly, enabling a minimal number of steps to

install and/or remove the string loop, and providing visual and tactile feedback during the process.

121. In contrast, neither Abello nor Yeany disclose a housing, as defined by the '774 Patent. A POSITA would not agree that Yeany's little plastic tube [Yeany 1:30] to which Dr. Kudrowitz improperly maps the "housing" term covers the wheels and instead teaches a hazardous unsafe mechanism in which hair, fingers, clothing, etc. may become entangled, and with which potentially hazardous projectiles are launched. [Yeany 3:30-4:00] A POSITA would also recognize that Yeany's little plastic tube is not actually "attached" in the way a housing on a kinetic device should be to what Dr. Kudrowitz maps the "body" term. Instead, a POSITA would notice a crudely applied piece of red tape that that adheres in a temporary manner a non-housing object to the wooden structure holding the motors.

122. A POSITA would notice that Abello's "plastic sheath", (See Abello Figure 2) "crafted by a 3D printer, was placed under the wheels in such a way that it guides the returning string back in between the wheels. The exit of the sheath is located 1.7 cm before the ejection point, where the wheels touch." [Abello, pg 5] This "plastic sheath" defines the curvature of the returning string, not a natural trajectory, even at the "String Shooter's stationary state". [*id*] Abello provides no additional information about this "plastic sheath" component and does not describe a loading slot.



Abello Figure 3.

123. However, Dr. Kudrowitz advances a theory that the notches shown in the only perspective of the plastic sheath's solid model design are continuous and, thus, a loading slot. This is erroneous. A POSITA would notice the notches, but without a perspective expressly showing the blind side of Abello's plastic sheath from its Figure 3, would not leap to the conclusion that they are part of a loading slot. There are several reasons for this. First, a POSITA would know that string loops ebb and flow causing slack to accumulate immediately before entering the channel preceding the wheels; this slack can cause the string to fall out of the conceptual loading slot Dr. Kudrowitz advances, thus no longer serving as a "housing". A POSITA would also notice that Abello likely knew of no other method for returning string to near the wheels, particularly given Abello's citations to Yeany, which uses a tube, and Scorch, which discloses and disparages a side slot in a funnel. Finally, a

POSITA would notice that Dr. Kudrowitz cited no express support for the conceptual loading slot attributed to Abello.

124. Additionally, a POSITA would agree that Yeany does not disclose a housing that defines a loading slot through which the looped string is loaded or removed from between the pair of wheels. The '774 Patent teaches that the string is looped for installation and removal. ['774, 10:66-11:2] But a POSITA would notice from the Yeany video its inability to “readily attach and detach the string from the string shooting device”. ['774, Abstract] Rather, Professor Yeany requires that the string be threaded through a “little plastic tube” [Yeany 1:30] that has a funnel-shape at one or more end(s), which cannot be achieved with a *looped* string. Instead, this design limitation requires a user to start with a non-looped string, thread one end through the tube and between the wheels that were inspired by a “baseball pitching machine” [Yeany 1:10], and then to connect the two ends to form a loop after it is threaded.

125. Thus, neither Abello nor Yeany disclose a housing attached to the body and defining a loading slot

(d) [1.3] pair of wheels, wherein at least one of the pair of wheels is a driven wheel;

126. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

- (e) *[1.4] a string, wherein the string comprises a surface texture configured to increase air friction in response to the string being propelled through air by the pair of wheels, wherein the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis.*

127. As discussed above, Yeany is silent about the role surface texture, including when and if the texture changes or materializes, plays on the strings shown in the Yeany video. Thus, Yeany does not teach this limitation. Not only does Professor Yeany not discuss the texture of the string, much less the presence or lack of fibers on the strings he uses, he also does not describe the use history of the strings in his video. A POSITA would not agree with Dr. Kudrowitz that a single close-up of a fuzzy string constitutes a teaching about any potential role of such fuzziness, including being “configured to increase air friction.” Dr. Kudrowitz provides no support from the Yeany video that expressly mentions air friction in response to the string be propelled through the air.

128. A POSITA would notice that Professor Yeany does not describe how or when one of the strings became fuzzy. Instead, a POSITA would reasonably assume that the string may have begun its employment without the “plurality of fibers” that Dr. Kudrowitz suggests were present all along and intentionally exploited, and instead developed the fuzziness overtime in multiple potential ways. For example, Professor Yeany’s string shooter rig uses two motors to drive two

counter-rotating wheels. A POSITA would understand that while same-model motors have similar *nominal* performance, each motor has a unique speed-torque character. Thus, even if both motors received the same power from the same source, one of the motors may spin at a slightly different speed and/or torque response than the other. This speed differential will rough up the surface of a string, even if it started out smooth. But even in the unlikely scenario where both motors spin at exactly the same speed and at exactly the same torque, the friction from the wheels would also rough up the surface of the string.

129. Dr. Kudrowitz’s comparison of the aforementioned brief clip of a fuzzy string to the ‘774 Patent’s description of how “extending fibers would appear fuzzy” might seem backwards to a POSITA. [Kudrowitz, ¶¶84-85] A POSITA would not presume that a disclosure in a patent “merely describes principals [sic] of physics that would likely apply to” an alleged prior art reference.

130. A POSITA would also be confused that Dr. Kudrowitz would advance such an assumption that contrasts with statements from at least another alleged prior art reference. For example, Abello states that “we noticed that the most dense strings as well as the smoothest strings were the ones to have the highest takeoff speeds”. [Abello, pp 4-5] Yeany’s video provides no details about the motor speeds (or torques) at which any of the videoed string shooters operated. Some may have rotated faster than others. Even if a faster motor speed is needed to shoot a smooth

speed, a POSITA would know that Yeany's strings could have been smooth, even if just at the beginning of their use.

131. Given the lack of any express discussion about the strings' texture, and the lack of any background about the strings (which may have been smooth and still functional, as confirmed by Abello), Yeany does not teach that the string has a surface texture configured to increase air friction in response to the string being propelled through air by the pair of wheels, wherein the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis.

132. Regarding Abello, Dr. Kudrowitz acknowledges that "Abello does not provide explicit details on the surface texture of the string". [Kudrowitz ¶123] A POSITA would notice that, while Abello discusses air drag, Abello does not use the term "hairiness", nor focuses specifically on the fibers on the strings' exteriors. Rather, Abello merely notices that "modifying the string itself by independently changing each of its characteristic parameters, such as linear density, roughness, fibre material, diameter, etc." "would be valuable and meaningful to explore." Said differently, a POSITA may find that Abello deferred to future work evaluating and validating the impact of external fibers.

133. Thus, Abello in view of Yeany does not teach this limitation.

2. **Claim 2: The string shooting device of claim 1, wherein the plurality of fibers extending away from the axis generate a turbulent air boundary layer around the string in response to the string being propelled through the air by the pair of wheels**

134. In my discussion about Ground 1, I point out that Yeany is silent about the existence of fibers on each of the strings shown in its video, and silent about the role of any fibers when and if they materialize. Additionally, Dr. Kudrowitz acknowledges that Abello “does not expressly state the source of this turbulent boundary layer” and, thus, does not provide support. Furthermore, Yeany does not teach Claim 1, from which Claim 2 depends. Thus, Abello in view of Yeany does not teach a string shooting device of claim 1, wherein the plurality of fibers extending away from the axis generate a turbulent air boundary layer around the string in response to the string being propelled through the air by the pair of wheels.

3. **Claim 3: The string shooting device of claim 2, wherein the string is a looped string, wherein the looped string, at a distal portion furthest from the body, generates lift from the turbulent air boundary layer.**

135. Dr. Kudrowitz acknowledges that Abello “does not expressly state the source of this turbulent boundary layer” and, thus, does not provide support for its role. Therefore, Abello in view of Yeany does not teach Claim 1, from which Claim 2 depends. Thus, Abello in view of Yeany does not teach Claim 2, from which Claim 3 depends. Therefore, Yeany does not teach the string shooting device of

Claim 2, wherein the string is a looped string, wherein the looped string, at a distal portion furthest from the body, generates lift from the turbulent air boundary layer.

4. Claim 12:

(a) [12.0] A method of propelling a looped string through air comprising:

136. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

(b) [12.1] receiving a looped string into a housing between a pair of wheels, wherein at least one of the pair of wheels is a driven wheel,

137. As discussed above regarding Claim element 1.2, neither Yeany nor Abello teach a housing between a pair of wheels. Therefore, Abello in view of Yeany does not teach this limitation.

(c) [12.2] wherein the looped string defines an axis along which the string extends, and wherein the looped string comprises a plurality of fibers extending away from the axis;

138. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

(d) [12.3] driving the at least one driven wheel;

139. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

- (e) *[12.4] propelling the looped string from the at least one driven wheel; and*

140. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

- (f) *[12.5] generating, from the looped string propelled by the at least one driven wheel, lift at an end of the looped string distal from the housing based on a surface texture of string configured to increase air friction in response to the looped string being propelled.*

141. As discussed above regarding Claim element 1.2, neither Yeany nor Abello teach a housing between a pair of wheels. Therefore, Abello in view of Yeany does not teach this limitation. Also discussed above regarding Claim 1, Yeany is silent about the role surface texture, when and if the texture changed or materialized, plays on the strings shown in the Yeany video. Thus, Yeany does not teach this limitation. Also, regarding Abello, Dr. Kudrowitz acknowledges that “Abello does not provide explicit details on the surface texture of the string”. [Kudrowitz ¶123] Rather, Abello generally notices that “modifying the string itself by independently changing each of its characteristic parameters, such as linear density, roughness, fibre material, diameter, etc.” “would be valuable and meaningful to explore.” Said differently, a POSITA may find that Abello deferred to future work evaluating and validating the impact of external fibers. In contrast to Dr. Kudrowitz’s statement, neither Yeany nor Abello uses the term “fuzzy”, or its variants. [Kudrowitz, ¶137]

Therefore, Abello in view of Yeany does not teach this limitation.

5. **Claim 15: The method of claim 12, wherein propelling the looped string from the at least one driven wheel comprises: receiving the looped string through an intake aperture of the housing; guiding the looped string between the pair of wheels; and propelling the looped string through an exit aperture of the housing.**

142. Neither Abello nor Yeany teach Claim 12, from which Claim 15 depends. Additionally, as previously discussed regarding Claims 1, 12 and 15, neither Abello nor Yeany teaches a housing. Thus, Abello in view of Yeany does not teach Claim 15.

6. **Claim 16:**

(a) *[16.0] A string shooting device comprising:*

143. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

(b) *[16.1] a body,*

144. A POSITA upon reading the '774 Patent would understand that the body is configured to be held by a user ['774 Patent Col. 6, lines 14-17] and neither Yeany nor Abello are so configured.

(c) *[16.2] a housing attached to the body and defining a loading slot;*

145. As discussed above regarding Claim 1, neither Yeany nor Abello teach a housing defining a loading slot. Therefore, Abello in view of Yeany does not teach this limitation.

(d) [16.3] a pair of wheels, wherein at least one of the pair of wheels is a driven wheel,

146. At this time, I do not dispute that Abello in view of Yeany teaches this limitation.

(e) [16.4] wherein the loading slot is disposed at least partially over at least one of the pair of wheels; and

147. As discussed above regarding Claim 1, neither Yeany nor Abello teach a housing defining a loading slot. Dr. Kudrowitz seemingly broadens the definition of “over” with “Claim 16 does not provide any point of reference for a POSITA to determine if the loading slot is “over” one of the wheels and thus the claim would encompass a loading slot disposed over one of the pair of wheels from any perspective.” [Kudrowitz, ¶144] However, the ‘774 Patent clearly defines this as “FIGS. 6-9 illustrate the housing 100 that is configured to receive therein wheels for propelling a looped string. The housing 100 includes a loading slot 101 dividing a left wheel cover 106 from a right wheel cover 107, where the right wheel cover 107 extends at least partially over both wheels.” [‘774 Patent, 9:37-41] Figures 6-9 are shown below. A POSITA would understand from this that “over” means around and atop the wheels, not just to one side.

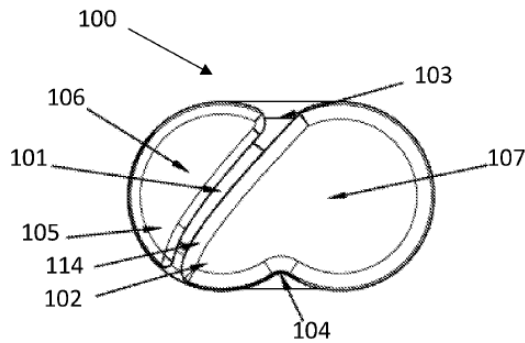


FIG. 6

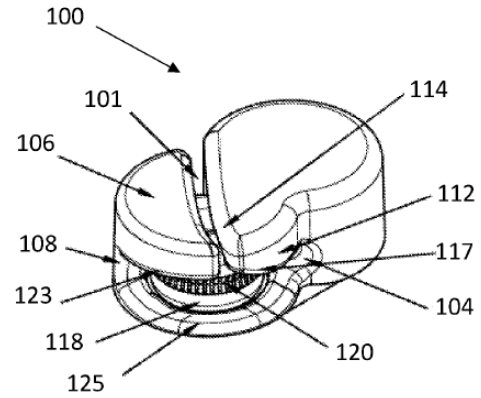


FIG. 7

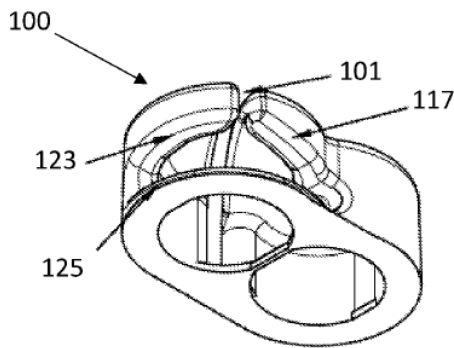


FIG. 8

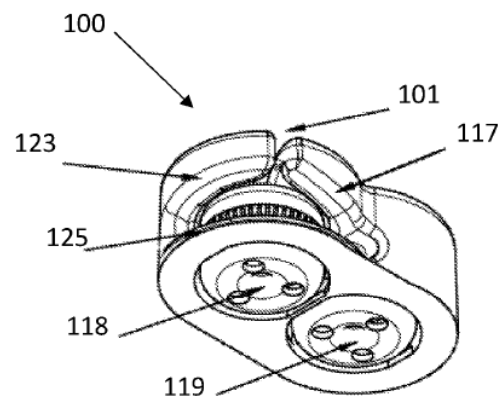


FIG. 9

‘774 Patent, Figures 6 through 9.

- (f) ***[16.5] a looped string, wherein the looped string comprises a surface texture configured to increase air friction in response to the looped string being propelled through air by the pair of wheels.***

148. As discussed above regarding Claim 1 and 12, Yeany is silent about the role surface texture, when and if the texture changed or materialized, plays on the strings shown in the Yeany video. Thus, Yeany does not teach this limitation. Also, Dr. Kudrowitz acknowledges that “Abello does not provide explicit details on the

surface texture of the string”. [Kudrowitz ¶123] Rather, Abello generally notices that “modifying the string itself by independently changing each of its characteristic parameters, such as linear density, roughness, fibre material, diameter, etc.” “would be valuable and meaningful to explore.” A POSITA would believe that Abello deferred to future work evaluating and validating the impact of surface texture. Therefore, Abello in view of Yeany does not teach this limitation.

7. **Claim 17: The string shooting device of claim 16, wherein the surface texture comprises a plurality of fibers extending away from an axis along which the looped string extends to generate a turbulent air boundary layer around the looped string in response to the looped string being propelled through the air by the pair of wheels.**

149. Dr. Kudrowitz acknowledges that Abello “does not expressly state the source of this turbulent boundary layer” and, thus, does not provide support for its role. Additionally, Abello in view of Yeany does not teach Claim 16, from which Claim 17 depends. Thus, in consideration of reasons previously provided regarding Claim 2, Abello in view of Yeany does not teach Claim 17.

C. Ground 3 – Claims 1-3, 12 and 15 are patentable over Wagner in view of Yeany

150. Dr. Kudrowitz asserts that claims 1-3, 12 and 15 would have been obvious over Wagner in view of Yeany. I disagree with Dr. Kudrowitz for the reasons provided below.

1. Claim 1

(a) [1.0] A string shooting device comprising:

151. At this time, I do not dispute that Wagner in view of Yeany teaches this limitation.

(b) [1.1] A body;

152. A POSITA upon reading the ‘774 Patent would understand that the body is configured to be held by a user [‘774 Patent Col. 6, lines 14-17] and Yeany is not so configured.

(c) [1.2] a housing attached to the body;

153. Limitation [1.2] is not taught by Wagner in view of Yeany. A POSITA would understand that a housing for a kinetic device like a string shooter should be a protective, stable and structurally sound component that simultaneously shields the device’s moving components and does not inadvertently expose the moving components to pose a safety risk to users or bystanders. The string shooter housing should also be user-friendly, enabling string loop installation and removal without the need for special tools, motions or complex assembly/disassembly steps. The string shooter housing should also allow visual and tactile feedback for users during operation, troubleshooting, string loop exchanges, etc. The string shooter housing of the ‘774 Patent uniquely provides these features. [‘774 9:17-11:47] For example, the structural design of the ‘774 housing is sturdy, reliably integrated into the device body, minimizes exposing the wheels to ambient effects, and minimizes exposing

users or bystanders to wheel entanglement (e.g., hair, apparel, appendages, etc.). The ‘774 Patent housing is also user friendly, enabling a minimal number of steps to install and/or remove the string loop, and providing visual and tactile feedback during the process.

154. In contrast, neither Wagner nor Yeany disclose a housing, as defined by the ‘774 Patent. A POSITA would not agree that Yeany’s little plastic tube [Yeany 1:30] to which Dr. Kudrowitz improperly maps the “housing” term covers the wheels and instead teaches a hazardous unsafe mechanism in which hair, fingers, clothing, etc. may become entangled, and with which potentially hazardous projectiles are launched. [Yeany 3:30-4:00] A POSITA would also recognize that Yeany’s little plastic tube is not actually “attached” in the way a housing on a kinetic device should be to what Dr. Kudrowitz maps the “body” term. Instead, a POSITA would notice a crudely applied piece of red tape that that adheres in a temporary manner a non-housing object to the wooden structure holding the motors.

155. Dr. Kudrowitz states that Wagner teaches a housing attached to the body comprised of rotatable cup 100, and a cover 150, implying that the housing at least partially covers wheels 50 and 60. This is incorrect because, as an initial matter, Wagner refers to the device’s body as the “housing” which is not the same “housing” described in the ‘774 Patent. Dr. Kudrowitz also states that Wagner teaches that “removing the cover and then reinstalling the cover after the loop of string has been

replaced” [Wagner at 3:46-4:45] “is an inconvenient process that requires a user overcoming the ‘friction fit’ to remove the cover and then lining up complementary structures on the cover and the cup to reattach the cover.” [Kudrowitz, ¶174]

156. Thus, Wagner in view of Yeany does not teach this limitation.

(d) *[1.3] pair of wheels, wherein at least one of the pair of wheels is a driven wheel;*

157. At this time, I do not dispute that Wagner in view of Yeany teaches this limitation.

(e) *[1.4] a string, wherein the string comprises a surface texture configured to increase air friction in response to the string being propelled through air by the pair of wheels, wherein the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis.*

158. Regarding Wagner, Dr. Kudrowitz acknowledges that “Wagner does not explicitly state that the surface texture of the string is configured to increase air friction in response to the string being propelled through air by the pair of wheels.”

159. Discussed above, Yeany is silent about the role surface texture, including when and if the texture changes or materializes, plays on the strings shown in the Yeany video. Thus, Yeany does not teach this limitation. Not only does Professor Yeany not discuss the texture of the string, much less the presence or lack of fibers on the strings he uses, he also does not describe the use history of the strings

in his video. A POSITA would not agree with Dr. Kudrowitz that a single close-up of a fuzzy string constitutes a teaching about any potential role of such fuzziness, including being “configured to increase air friction.” Dr. Kudrowitz provides no support from the Yeany video that expressly mentions air friction in response to the string be propelled through the air.

160. A POSITA would notice that Professor Yeany does not describe how or when one of the strings became fuzzy. Instead, a POSITA would reasonably assume that the string may have begun its employment without the “plurality of fibers” that Dr. Kudrowitz suggests were present all along and intentionally exploited, and instead developed the fuzziness overtime in multiple potential ways. For example, Professor Yeany’s string shooter rig uses two motors to drive two counter-rotating wheels. A POSITA would understand that while same-model motors have similar *nominal* performance, each motor has a unique speed-torque character. Thus, even if both motors received the same power from the same source, one of the motors may spin at a slightly different speed and/or torque response than the other. This speed differential will rough up the surface of a string, even if it started out smooth. But even in the unlikely scenario where both motors spin at exactly the same speed and at exactly the same torque, the friction from the wheels would also rough up the surface of the string.

161. Dr. Kudrowitz’s comparison of the aforementioned brief clip of a fuzzy

string to the ‘774 Patent’s description of how “extending fibers would appear fuzzy” might seem backwards to a POSITA. [Kudrowitz, ¶¶84-85] A POSITA would not presume that a disclosure in a patent “merely describes principals [sic] of physics that would likely apply to” an alleged prior art reference.

162. A POSITA would also be confused that Dr. Kudrowitz would advance such an assumption that contrasts with statements from at least another alleged prior art reference. For example, Abello states that “we noticed that the most dense strings as well as the smoothest strings were the ones to have the highest takeoff speeds”. [Abello, pp 4-5] Yeany’s video provides no details about the motor speeds (or torques) at which any of the videoed string shooters operated. Some may have rotated faster than others. Even if a faster motor speed is needed to shoot a smooth speed, a POSITA would know that Yeany’s strings could have been smooth, even if just at the beginning of their use.

163. Given the lack of any express discussion about the strings’ texture, and the lack of any background about the strings (which may have been smooth and still functional, as confirmed by Abello), Yeany does not teach that the string has a surface texture configured to increase air friction in response to the string being propelled through air by the pair of wheels, wherein the string defines an axis along which the string extends, and wherein the string comprises a plurality of fibers extending away from the axis.

164. Thus, Wagner in view of Yeany does not teach this limitation.

2. **Claim 2: The string shooting device of claim 1, wherein the plurality of fibers extending away from the axis generate a turbulent air boundary layer around the string in response to the string being propelled through the air by the pair of wheels**

165. In my discussion about Ground 1, I point out that Yeany is silent about the existence of fibers on each of the strings shown in its video, and silent about the role of any fibers when and if they materialize. Additionally, Regarding Wagner, Dr. Kudrowitz acknowledges that “Wagner does not explicitly state that the surface texture of the string is configured to increase air friction in response to the string being propelled through air by the pair of wheels.” Furthermore, Wagner in view of Yeany does not teach Claim 1, from which Claim 2 depends. Thus, Wagner in view of Yeany does not teach a string shooting device of claim 1, wherein the plurality of fibers extending away from the axis generate a turbulent air boundary layer around the string in response to the string being propelled through the air by the pair of wheels.

3. **Claim 3: The string shooting device of claim 2, wherein the string is a looped string, wherein the looped string, at a distal portion furthest from the body, generates lift from the turbulent air boundary layer.**

166. Wagner in view of Yeany does not teach Claim 1, from which Claim 2 depends. Thus, Wagner in view of Yeany does not teach Claim 2, from which Claim

3 depends. Therefore, Wagner in view of Yeany does not teach this claim.

4. Claim 12:

(a) [12.0] A method of propelling a looped string through air comprising:

167. At this time, I do not dispute that Wagner in view of Yeany teaches this limitation.

(b) [12.1] receiving a looped string into a housing between a pair of wheels, wherein at least one of the pair of wheels is a driven wheel,

168. Supplemented by the above regarding Claim element 1.2, neither Yeany nor Wagner teach a housing between a pair of wheels. Therefore, Wagner in view of Yeany does not teach this limitation.

(c) [12.2] wherein the looped string defines an axis along which the string extends, and wherein the looped string comprises a plurality of fibers extending away from the axis;

169. At this time, I do not dispute that Wagner in view of Yeany teaches this limitation.

(d) [12.3] driving the at least one driven wheel;

170. At this time, I do not dispute that Wagner in view of Yeany teaches this limitation.

(e) [12.4] propelling the looped string from the at least one driven wheel; and

171. At this time, I do not dispute that Wagner in view of Yeany teaches

this limitation.

- (f) *[12.5] generating, from the looped string propelled by the at least one driven wheel, lift at an end of the looped string distal from the housing based on a surface texture of string configured to increase air friction in response to the looped string being propelled.*

172. Discussed above regarding Claim 1, Yeany is silent about the role surface texture, when and if the texture changed or materialized, plays on the strings shown in the Yeany video. Thus, Yeany does not teach this limitation. Additionally, Regarding Wagner, Dr. Kudrowitz acknowledges that “Wagner does not explicitly state that the surface texture of the string is configured to increase air friction in response to the string being propelled through air by the pair of wheels.” Therefore, Wagner in view of Yeany does not teach this limitation.

- 5. **Claim 15: The method of claim 12, wherein propelling the looped string from the at least one driven wheel comprises: receiving the looped string through an intake aperture of the housing; guiding the looped string between the pair of wheels; and propelling the looped string through an exit aperture of the housing.**

173. Neither Wagner nor Yeany teach Claim 12, from which Claim 15 depends. Additionally, as previously discussed regarding Claims 1, 12 and 15, neither Wagner nor Yeany teaches a housing. Thus, Wagner in view of Yeany does not teach Claim 15.

D. Ground 4 – Claims 4, 16 and 17 are patentable over Wagner in view of Yeany and Scorch

174. Petitioner and Dr. Kudrowitz admit that Dependent claim 4 and independent claim 16 add limitations for a “loading slot” that are not expressly taught by Wagner or Yeany. However, they then rely on Scorch, representing that it is a YouTube video prior to the time of the invention that teaches a string shooter device with a loading slot on the side, ignoring the fact that the so-called loading slot is a separate element that does not cover the wheels in any manner. Petitioner, relying on the opinion of Dr. Kudrowitz claims that a POSITA would be motivated to apply this teaching to the Wagner device to increase the convenience of loading a string into the device without having to remove a portion of the housing. Moreover, Petitioner further claims that a POSITA would have a reasonable expectation of success given that Wagner already teaches loading new strings on the side of the device and flange structures around the wheels to keep the string in place if a loading slot on the side were present.” [‘774 Petition, pg 83]

175. While I agree that a “loading slot” is not taught by Wagner or Yeany, I disagree with Petitioner and Dr. Kudrowitz otherwise for the reasons provided below.

1. **Claim 4: The string shooting device of claim 1, wherein the housing covers, at least partially, the pair of wheels, and wherein the housing defines a loading slot through which the string is loaded or removed from between the pair of wheels.**

176. A POSITA would understand that a housing for a kinetic device like a string shooter should have at least the following qualities. First, the housing should be stable and structurally sound in such a way that it simultaneously protects the device's moving components and does not inadvertently expose the moving components to pose a safety risk to users or bystanders. Second, the string shooter housing should be user-friendly, enabling string loop installation and removal without the need for special tools, motions or complex assembly/disassembly steps. Third, building on the second feature, the string shooter housing should allow visual and tactile feedback for users during operation, troubleshooting, string loop exchanges, etc. Exemplified by the following figures, the string shooter housing of the '774 Patent uniquely provides these features. ['774 9:17-11:47] For example, the structural design of the '774 housing 100 is stable and structurally sound, reliably integrated to the device body, minimizes exposing the wheels to ambient effects, and minimizes exposing users or bystanders to wheel entanglement (e.g., hair, apparel, appendages, etc.). The '774 Patent housing is also user friendly, enabling a minimal number of motions to install and/or remove the string loop, and providing visual and tactile feedback during the process. For example, a POSITA would notice that the

‘774 Patent loading slot requires the user to simply lower the string into loading slot 101, slightly rotate the string counter clockwise, and then lower the string in a flossing-like manner into a seat between the two wheels, all while having visibility through the openings to see the string install (or be removed), as well as having tactile feedback to feel when the string is seated between the wheels.

177. In contrast, Dr. Kudrowitz’s proposed combination of Wagner in view of Yeany and Scorch results in a housing design that is impractical, unsuitable for a kinetic device, unsafe and unnecessarily complicated to use, including string loop installation and removal. Dr. Kudrowitz’s modification of Wagner actually results in a worse design than if Wagner was left as-is. Regardless, the combinations proposed cannot match the invented system of the ‘774 Patent. For these reasons, and the reasons stated below, it would not be obvious for a POSITA to combine Wagner in view of Yeany and Scorch. Even if such a combination were made, it would not yield the results claimed by Petitioner.

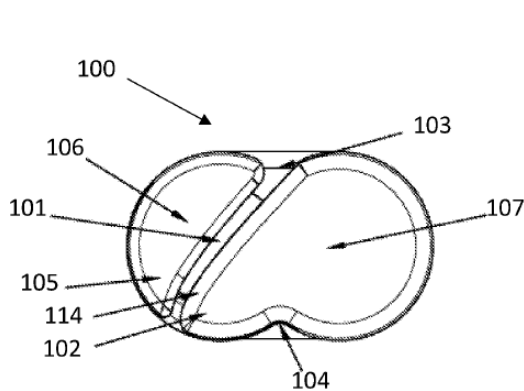


FIG. 6

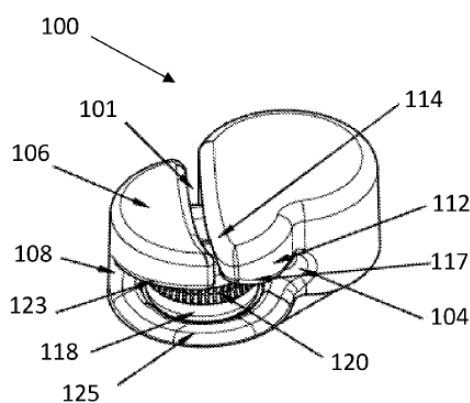


FIG. 7

‘774 Patent, Figures 6 and 7.

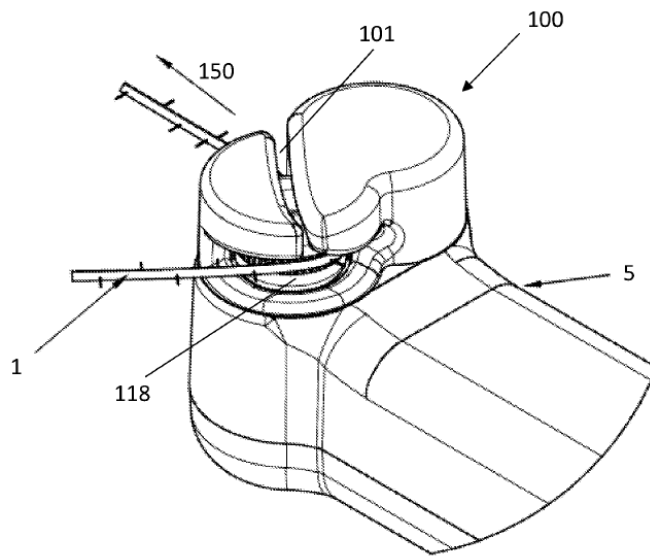


FIG. 14

178. Dr. Kudrowitz and Petitioner state that Wagner teaches a housing attached to the body comprised of rotatable cup 100, and a cover 150, implying that the housing at least partially covers wheels 50 and 60. Figs. 2 and 3 from Wagner are reproduced below, highlighting added.

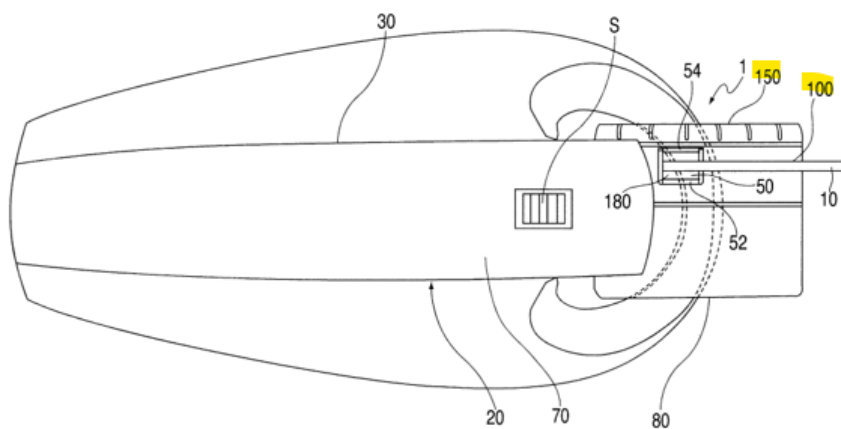


FIG. 2

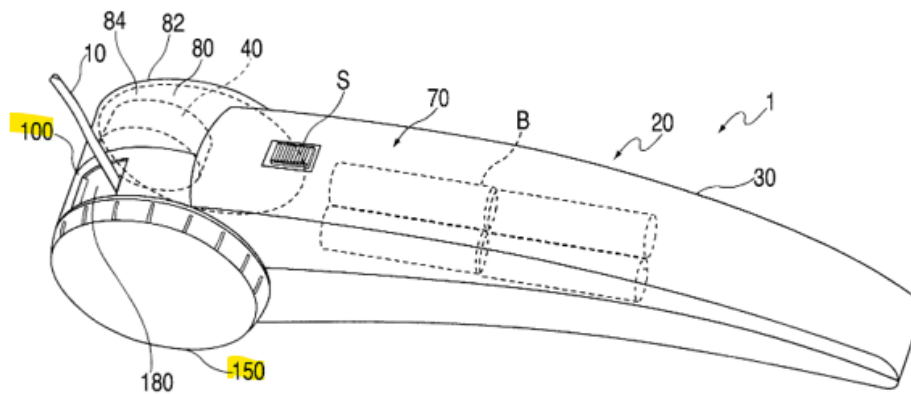


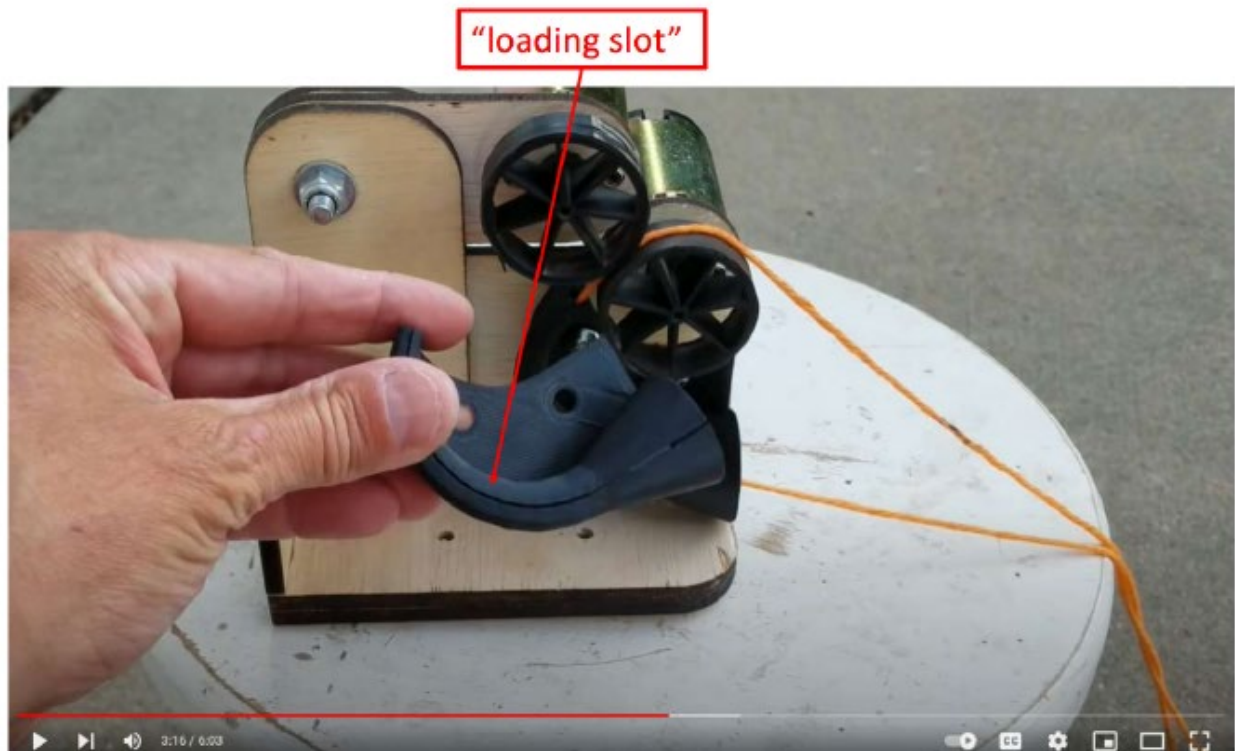
FIG. 3

179. Additionally, a POSITA would notice that Wagner's housing is deficient as defined in the '774 Patent, because it does not include a loading slot that allows one to insert or remove a looped string. The '774 Patent defines its housing that defines a loading slot through which the string is loaded or removed from between the pair of wheels [‘774, 1:63-66] Wagner's cover 150 and rotatable cup 100 do not comprise a channel, groove or long, narrow aperture or slit defining a slot in order to insert a looped string.

180. In addition to the foregoing, Wagner does not have a loading slot as defined at one edge by a loading tab. [‘774, 2:50-54] Wagner does not have a “loading slot” that is oblique. [‘774, 8:45-57] Wagner does not have a loading tab that guides the string from the loading slot to the intake aperture. [‘774, 8:66-9:3] Wagner also does not have a loading slot that connects with the exit aperture on a front and intersects with the guiding slot on a back side of the left wheel housing [‘774, 10:17-19]

181. Instead, Wagner states, “The ejection hole 158 is preferably open-ended to permit the loop 10 to be removed from the device 1 or reinstalled between the drive wheel 50 and the backup wheel 60 and to permit the cover 150 to be put in place **with the loop 10 installed.**” [Wagner, 3:57-62] A POSITA would understand this to mean that the string needs to be installed on Wagner’s device **before** cover 150 is installed. In addition, a POSITA would understand this to mean that the cover 150 would need to be removed for the looped string to be removed.

182. Petitioner and Dr. Kudrowitz state that “Scorch teaches a string shooter with a hollow tubular funnel, which houses the looped string, attached to a wooden body where ‘the string runs through this funnel’ and exits the housing between the pair of wheels. Ex.1007, 1:13:1:47; see Ex.1001, 2:11-13 (embodiment in ’774 Patent ‘receiv[es] a looped string into a housing between a pair of wheels.’); Ex.1002, ¶172. Scorch also discloses that the housing can have ‘a slot in the side’ so one can put a loop of string around the wheels through the housing. Ex.1007, 3:00-3:30; Ex.1002, ¶172. This loading slot is shown in the screen shot below. Ex.1002, ¶172.” [’774 Petition, pg 84; Kudrowitz, ¶172]

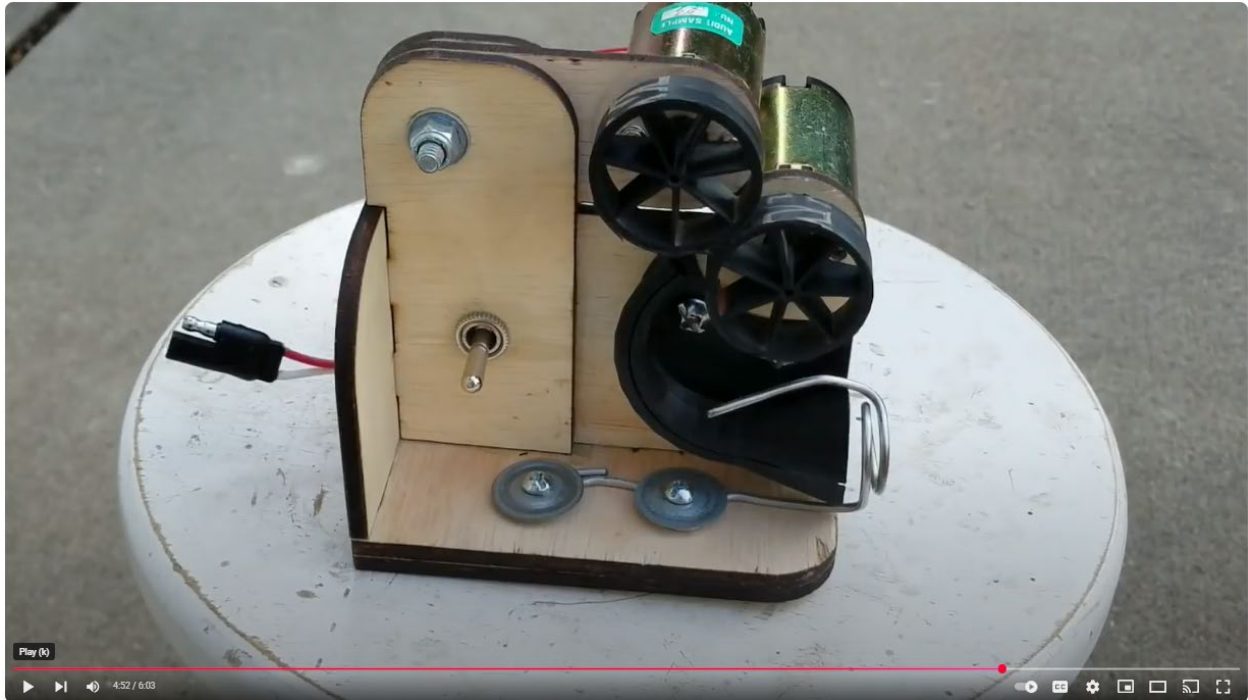


Scorch's funnel with a slot. ['774 Petition, pg 84; Kudrowitz, ¶172; Scorch 3:00-3:30]

183. As with Wagner, Scorch's "funnel" is not a "housing" as defined in the claims of the '774 patent because it does not cover the wheels of Scorch's string shooter, in whole or in part. In addition, a POSITA would understand from reviewing the '774 Patent that , Scorch's slot is not a "slot through which the string is loaded or removed between the pair of wheels". (See table below) because Scorch's slot terminates a substantial distance from where the two wheels meet; Scorch's slot is not over the area between the pair of wheels. In fact, Scorch moves the wheels apart substantially to load the string as shown in the video. Even under Petitioner's claim construction, Scorch's funnel slot is not a "slot that facilitates loading of the looped string through the string loading slot to a position between a first wheel and a second

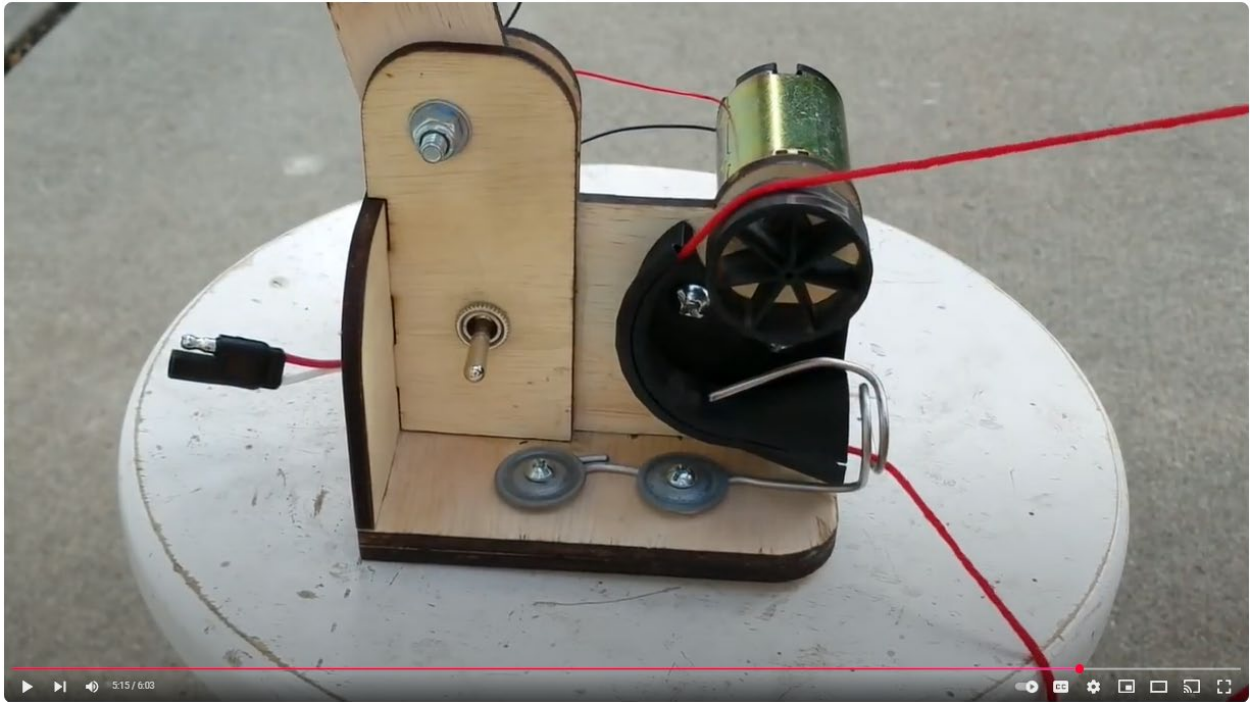
wheel”. Again, Scorch’s slot and funnel terminate a substantial distance from the area between the two wheels and Scorch’s design moves the wheels apart to load the string so much that a POSITA would not be able to find the “position between a first wheel and a second wheel”.

184. A POSITA when reviewing the video would hear the narrator stating that “the string can shoot out the slot” [Scorch 4:00-4:04] and understand that Scorch’s slotted funnel does not actually “house the looped string”. To reinforce this, the Scorch narrator adds “an extra piece that’ll go on there” which is “basically a bent wire with a corkscrew at the end” to “prevent the string from coming out the side”. [Scorch 4:05-4:30] A POSITA would understand that Scorch’s “separate piece” is not part of the funnel but, instead, a completely different component which does not join or otherwise become part of the funnel, and neither has nor is a slot. Petitioner and Dr. Kudrowitz do not show or mention this “separate piece”, which is in the metal corkscrew in the figure below.



Scorch's slotted funnel with a separate piece. [Scorch 4:00-4:30]

185. The Scorch narrator says that not using the slotted funnel and, instead, gluing the ends of string together when it is fully assembled “is a much simpler scenario to have. To have this extra piece in here is a little bit of a complication”. [Scorch 5:35-5:45] Scorch also explains that “sometimes the string will actually get stuck around this” separate piece, and that he’s “thought about extending that back even further”. [Scorch 5:55-6:05]



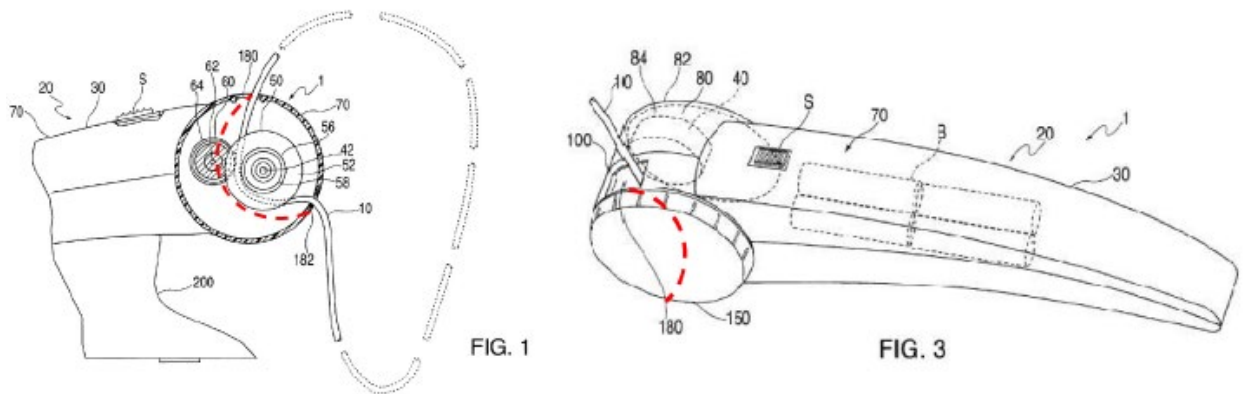
Scorch's design moves wheels apart significantly during string load. [Scorch 5:15]

186. Ignoring these differences and deficiencies, Petitioner and Dr. Kudrowitz state that “A POSITA would apply the teaching of a side loading slot from Scorch to the Wagner device in order to improve the convenience of replacing a loop of string. Wagner already teaches that a loop of string may need to be “removed from the device 1 or reinstalled between the” wheels. Wagner at 3:58-62. However, Wagner teaches doing so by removing the cover and then reinstalling the cover after the loop of string has been replaced. Wagner at 3:46-4:45. Petitioner goes on to characterize the removal of the Wagner cover as an inconvenient process that requires a user overcoming the “friction fit” to remove the cover and then lining up complementary structures on the cover and the cup to reattach the cover. *Id.* Instead

of removing a friction fit cover, Petition states that using a loading slot to replace a loop of string instead of Wagner's existing process, the replacement of string in Wagner's string shooter device can be easier and quicker for a user.[774 Petition pg. 83].

187. While I agree that removing Wagner's cover and then reinstalling the cover after the loop of string has been replaced may be viewed as an inconvenient process, a POSITA would recognize that the cylindrical cover's fit into a matching circular pocket represents a stable design that is suitable for kinetic devices. A POSITA would also notice that Petitioner and Dr. Kudrowitz do not mention that Wagner teaches that the user also removes the "top flange 54" to install the loop between hub 56 of the drive wheel and hub 64 of the back wheel. [Wagner 2:42-48] A POSITA would understand that the top flange 54 is removed in part because "[t]he base flange 52, intermediate hub 56 and removable top flange 54 of drive wheel 50, and the hub 64 of backup wheel 60, form a channel for trapping and guiding loop 10." [Wagner 2:48-53] The flange removal may also seem inconvenient but, again, a POSITA would recognize the design as suitable for a kinetic device.

housing defines a loading slot through which the string is loaded or removed from between the pair of wheels



Kudrowitz's proposed slot in Wagner's cover. [Kudrowitz, ¶175]

188. A POSITA would also understand that adding a slot to Wagner's cover still does not allow the top flange 54 to be removed. Petitioner and Dr. Kudrowitz say that a "POSITA would understand that the slot would extend between the intake and exit apertures of Wagner's housing while also going around wheel 50 so that user has sufficient access to load the string around the flanges of wheel 50." [Kudrowitz, ¶175] But neither Petitioner nor Dr. Kudrowitz provide support for the assumption that Wagner's design allows the string to slide between top flange 54 and the top surface of wheel 60, especially since they are designed to "trap" the loop 10, a point that Dr. Kudrowitz acknowledges. [Kudrowitz, ¶176]

189. It should also be pointed out that a POSITA would notice that Dr. Kudrowitz's proposed slot in Wagner's cover, shown above, requires a more complex set of motions to place the string loop between hubs 56 and 64, even if space exists between top flange 54 and the top surface of wheel 60. Dr. Kudrowitz's

design requires a user to create a loose arc with the portion of string and align it with the proposed arcing slot, finesse the loose string portion in a first direction through the slot (i.e., *pushing* on a string), then blindly move the loose string portion in a second direction to between the top flange 54 and the top surface of wheel 60, then blindly move the string portion in a final direction parallel to the axes of rotation for drive wheel 50 and back wheel 60 until it the string is seated between the two. Furthermore, Wagner's takeup and ejection holes do not align with the point where the drive wheel hub 56 meets back wheel hub 64, making it not only impossible to see (because it would be blocked by hub 56), but also difficult to directly stretch the string as it is being moved into place. A POSITA would not want to incorporate a complex and blind installation process as suggested by Petition and Dr. Kudrowitz.

190. Finally, a POSITA would notice that Dr. Kudrowitz's proposed modification would split Wagner's single-piece cover 152 into two separate pieces. Dr. Kudrowitz does not address the added complexity of associated with retaining two partial-arc pieces, nor does he acknowledge that adding parts increases assembly complexity, cost and fragility.

191. Petitioner and Dr. Kudrowitz's design assumes that a POSITA would choose to incorporate the funnel of Scorch into the cover of Wagner by only selecting certain portions of the funnel, namely the slot. This assumes that a POSITA would see the open design of Scorch where the wheels are not covered and which is

supported on a table base and decide that the Scorch funnel, which includes elements not present once the cover of Wagner is cut in two, would operate as a less “inconvenient process” than removing a friction fit cover for inserting and removing the looped string despite the obstacles described above. Ultimately, a POSITA would not choose to modify Wagner in the manner proposed by Petitioner and Dr. Kudrowitz because the proposed modifications result in a more complicated and overall less functional design.

2. Claim 16

(a) [16.0] – A string shooting device comprising:

192. It is acknowledged that Wagner, Yeany and Scorch each teach this limitation individually.

(b) [16.1] – A body;

193. It is acknowledged that Wagner teaches this limitation. However, a POSITA upon reading the ‘774 Patent would understand that the body is configured to be held by a user [‘774 Patent Col. 6, lines 14-17] and neither Yeany nor Scorch are so configured.

(c) [16.2] – a housing attached to the body and defining a loading slot;

194. Limitation [16.2] is not taught by Wagner, Yeany and Scorch for the reasons previously provided for the combination of Wagner, Yeany and Scorch for claim 4, Paragraphs (178-180 above).

(d) [16.3] – pair of wheels, wherein at least one of the pair of wheels is a driven wheel,

195. It is acknowledged that Wagner, Yeany and Scorch each teach this limitation individually.

(e) [16.4] – wherein the loading slot is disposed at least partially over at least one of the pair of wheels; and;

196. Limitation [16.4] is not taught by Wagner, Yeany and Scorch for the reasons previously provided for the combination of Wagner, Yeany and Scorch for claim 4. See above.

197. As previously discussed, a POSITA would not apply the teaching of an acknowledged unstable slot in the side of a funnel tube from Scorch to the Wagner device. Discussed earlier, Scorch's tube is not a housing and the slot is not a loading slot as disclosed and defined in the '774 Patent. See Paragraphs (183-184 above).

198. While Dr. Kudrowitz's prescribed arcing slot is over Wagner's back wheel 60, a POSITA would not employ it for the reasons discussed above regarding the combination of Wagner, Yeany and Scorch for claim 4. See above.

(f) [16.5] – a looped string, wherein the looped string comprises a surface texture configured to increase air friction in response to the looped string being propelled through air by the pair of wheels;

199. It is acknowledged that Wagner, Yeany and Scorch each teach a looped string, but all are silent as to a looped string comprising a surface texture configured

to increase air friction in response to the looped string being propelled through air by the pair of wheels. Only Yeany shows a looped string that is shown during use where it appears that the surface of the strings are worn and have become fuzzy. There is no indication that this fuzzy surface texture has been “configured” i.e., purposely designed to increase air friction.

3. **Claim 17: The string shooting device of claim 16, wherein the surface texture comprises a plurality of fibers extending away from an axis along which the looped string extends to generate a turbulent air boundary layer around the looped string in response to the looped string being propelled through the air by the pair of wheels.**

200. Because limitations 16.5 are not taught by Wagner, Yeany and Scorch, as discussed earlier, this limitation is not met.

4. **A POSITA Would not be motivated to combine Scorch with Wagner and Yeany.**

201. Discussed above, Kudrowitz’s prescribed arcing slot in Wagner requires a significantly more complex string loop installation process where in a user must coax a loose string arc through an arced slot and make multiple direction changes, two of which are occluded by top flange 54.

202. A POSITA would see Wagner’s disclosure as an effective string shooter with performance and design stability as-is; a POSITA would not see the need to modify it unless the end result was an improvement. A POSITA would not

see Scorch's external slotted funnel tube as an improvement, much less a design fit for Wagner's cover 152, for the reasons articulated above. If a POSITA was inclined to bring over Scorch's slotted funnel tube, the POSITA may be more inclined to place Scorch's slotted funnel tube on Wagner's body, like Scorch's current design. Otherwise, a POSITA would not be motivated to move from a stable design to a two-piece cover that is unsuitable for kinetic devices, and may pose hazard(s)/risks to the device, users and bystanders.

203. Scorch's mechanism is completely different from Wagner and Yeany. Differences include the aforementioned act of pivoting the wheels apart from each other, unlike both Wagner and Yeany.

204. Scorch describes his slotted funnel as ineffective because the funnel still does not house the string and requires a separate piece to prevent the string from popping out of the slot.

205. Scorch teaches away from using his slotted funnel by describing it as complicated, prone to entanglement and incomplete.

206. Neither Scorch nor Yeany teach a loading slot through which string is loaded or removed from between the pair of wheels or the loading of the looped string to a position between a first wheel and a second wheel.

207. Dr. Kudrowitz's prescribed arcing slot in Wagner's cover 152 splits a stable full-circle single-piece component into two partial-arc pieces that are

significantly more difficult to retain, unnecessarily adding complexity to the design, production and assembly, as well as increasing costs and fragility.

208. Yeany does not teach or even mention or describe the material or fibers of the looped string, let alone their orientation. The Yeany video begins with a variety of tabletop string shooters in use with the looped string already being propelled. There would be no motivation to look to Yeany regarding the surface texture of the string as it is never described and, even if it was noticed that the string was fuzzy, the photos and video do not describe that the string has fibers extending away from an axis to generate a turbulent air boundary layer around the looped string in response to the looped string being propelled through the air by the pair of wheels.

209. Collectively or alone, the above reasons would deter a POSITA from the combination of Ground 4 and make for an uncertain outcome.

IX. RESERVATION OF RIGHTS

210. The opinions and analyses in this report are based on currently available documents and information. Accordingly, I reserve my right to supplement and amend my opinions if additional information becomes available. Similarly, this report may be supplemented by testimony, and I may also be asked to address issues raised by Petitioner.

211. I also reserve the right to adjust or supplement my analyses in light of any critique of my report or alternative opinion advanced by the Petitioner.

X. CONCLUSION

212. In my opinion, claims 1-4, 12 and 15-17 of the '774 Patent are not invalid in light of the prior art grounds asserted by Petitioner and Dr. Kudrowitz.

213. I hereby declare that statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. Should further information become available to me as this matter proceeds, I may revise my opinions accordingly as necessary. I declare under penalty of perjury that the foregoing Declaration is true and correct and understand that willful false statements and the like are punishable by fine or imprisonment, or both, pursuant to 18 U.S.C. § 1001.

Respectfully Submitted,

May 19, 2025

Date

/s/ Dr. Jason A. Janét

Dr. Jason A. Janét