

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHARKNINJA, INC.,
SHARKNINJA OPERATING LLC,
SHARKNINJA MANAGEMENT LLC, AND
SHARKNINJA SALES COMPANY,
Petitioners,

v.

DYSON TECHNOLOGY LIMITED,
Patent Owner.

Case No. IPR2024-00993

U.S. Patent No. 11,044,979

**Declaration of Dr. Daniel M. Nosenchuck in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,044,979**

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PETITIONERS' EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 11,044,979
1002	File History for U.S. Patent No. 11,044,979
1003	Declaration of Dr. Daniel M. Nosenchuck
1004	Japanese Unexamined Patent Application Pub. No. JP H11-178631 and Certified Translation Thereof
1005	U.S. Patent No. 5,868,148
1006	U.S. Patent No. 6,038,782
1007	U.S. Patent No. 8,092,166
1008	Caroline Lubert, <i>On Some Recent Applications of the Coanda Effect</i> , 16 Int'l J. Acoustics and Vibration 144 (2011)
1009	UK Patent Application Pub. No. GB 2,093,526
1010	U.S. Patent No. 2,052,869
1011	U.S. Patent No. 3,261,162
1012	Answer and Counterclaim to Complaint for Declaratory Judgment, D.I. 6, <i>SharkNinja Operating LLC v. Dyson, Inc.</i> , No. 1:23-cv-11277 (D. Mass. June 9, 2023)
1013	SharkNinja's Opening Claim Construction Brief, D.I. 87, <i>SharkNinja Operating LLC v. Dyson, Inc.</i> , No. 1:23-cv-11277 (D. Mass. Oct. 17, 2023)
1014	eBay Listing, <i>Vintage Clairol Pretty Power High Power Hair Brush Styling Dryer Curling Iron</i> , https://www.ebay.com/itm/192884562006 (last accessed May 22, 2024)
1015	eBay Listing, <i>Conair Hot Air Styler 2-in-1 Brand New Never Open Model BM20sbc(a)-320 ~</i> , https://www.ebay.com/itm/186171531603 (last accessed May 22, 2024)
1016	PCT Int'l Appl. Pub. No. WO 2014/006365
1017	PCT Int'l Appl. Pub. No. WO 2011/131965

Exhibit No.	Description
1018	Churchill, Randolph Allen, Ph.D., <i>Coanda effect jet around a cylinder with an interacting adjacent surface</i> , West Virginia University (1992)
1019	Robert J. Englar, <i>Circulation Control for High Lift and Drag Generation on STOL Aircraft</i> , 12 J. Aircraft 457 (1975)
1020	R. Neuendorf and I. Wygnanski, <i>On a turbulent wall jet flowing over a circular cylinder</i> , 381 J. Fluid Mech. 1 (1999)
1021	J. Dunham, <i>A theory of circulation control by slot-blowing, applied to a circular cylinder</i> , 33 J. Fluid Mech. 495 (1968)
1022	Video of Saito/Lindsey Model Attachment (I)
1023	Video of Saito/Lindsey Model Attachment (II)
1024	Video of Saito/Lindsey Model Attachment (III)
1025	G.I. Fekete, <i>Coanda Flow of a Two-Dimensional Wall Jet on the Outside of a Circular Cylinder</i> , McGill University (1963)
1026	U.S. Patent Appl. Pub. No. 2013/0111777
1027	<i>Sotera Stipulation</i> (June 7, 2024)
1028	U.S. Patent Appl. Pub. No. 2011/0010958

TABLE OF ABBREVIATIONS

Abbreviation	Term
'979 patent	U.S. Patent No. 11,044,979 (EX1001)
AIA	America Invents Act
Challenged Claims	Claims 1-32 of U.S. Patent No. 11,044,979
Fig.	Figure
IPR	<i>inter partes</i> review
Lindsey	U.S. Patent No. 5,868,148 (EX1005)
Litigation Petitioners	SharkNinja Operating LLC and SharkNinja Sales Company
Nicolas	U.S. Patent No. 8,092,166 (EX1007)
Nosenchuck Declaration	Declaration of Dr. Daniel M. Nosenchuck (EX1003)
Patent Owner	Dyson Technology Limited
Petitioners	SharkNinja, Inc., SharkNinja Operating LLC, SharkNinja Management LLC, and SharkNinja Sales Company
POSITA	Person[s] of ordinary skill in the art
Saito	Japanese Unexamined Patent Application Pub. No. JP H11-178631 and Certified Translation Thereof (EX1004)
Schepisi	U.S. Patent No. 6,038,782 (EX1006)
Shoemaker	UK Patent Application Pub. No. GB 2,093,526 (EX1009)

I, Dr. Daniel M. Nosenchuck, declare as follows:

1. I have been retained by counsel for SharkNinja, Inc., SharkNinja Operating LLC, SharkNinja Management LLC, and SharkNinja Sales Company to submit a Declaration in support of the Petition for *Inter Partes* Review of U.S. Patent No. 11,044,979 (“the Petition”), which I understand has been assigned to Dyson Technology Limited. (“Dyson” or “Patent Owner”).

2. I have been asked to opine on whether the claims of the ’979 patent are rendered obvious by the prior art. My opinions are based on my experience, knowledge, and skill in fluid mechanics and heat transfer, as well as in product development including the design and manufacture of personal care appliances, including hair dryers. In preparation for this declaration, I have reviewed the ’979 patent, its prosecution history, and all exhibits cited in this Declaration and in the Petition.

3. I may rely upon these materials, my experience and knowledge, and/or additional materials to rebut arguments raised by the Patent Owner. Further, I may also consider additional documents and information in forming any necessary opinions, including documents that may not yet have been provided to me.

4. My analysis of the materials produced in this investigation is ongoing and I will continue to review any new material as it is provided. This Declaration represents only those opinions I have formed to date. I reserve the right to revise,

supplement, and/or amend my opinions stated herein based on new information and on my continuing analysis of the materials already provided.

5. I am being paid at my normal hourly rate for my work on this matter. I have no personal or financial stake or interest in the outcome of the Petition.

I. QUALIFICATIONS

6. I received a B.S. degree in Aerospace Engineering and Mechanical Engineering from Syracuse University, and M.S. and Ph.D. degrees in Aeronautics from the California Institute of Technology.

7. In August, 1983, I joined the faculty of Princeton University as an Assistant Professor, where I became Associate Professor of Mechanical and Aerospace Engineering in 1988. I have taught classes in Heat Transfer, Thermodynamics, Fluid Dynamics, Viscous Flows, Energy Conversion and the Environment, Applications to Transportation, Mechanical Design, and Entrepreneurial Engineering (Product Design and Marketing). My curriculum vitae is submitted herewith as Appendix A.

8. I have conducted extensive research in fluid mechanics and heat transfer, including the design, prototyping and use of turbo-machines. My research has further included flow control, drag reduction and development of a special-purpose architecture computer for complex flow simulations (Navier-Stokes Computer). I have worked in Hollywood as a consultant on special effects related to

hydrodynamics and ballistics, and in 1984 I received an Academy of Television Arts and Sciences Primetime Emmy Award for Outstanding Individual Achievement in Special Visual Effects, for the ABC television movie, “The Day After.”

9. I have 10-15 years of experience in product development including the design and manufacture of personal care appliances, including curling irons, curlers, make-up mirrors and hair dryers. I am the named inventor on 12 issued patents, including D398,074 “Hair Dryer,” U.S. Patent No. 5,841,943 “Ducted flow hair dryer with multiple impellers,” and U.S. Patent No. 6,011,903 “Reduced-noise ducted flow hair dryer with multiple impellers and ambient air inlets.” This work was commercialized and extensively marketed by Revlon as the “Get Quiet” hair dryer.

10. In past courses I taught in Engineering and Mechanical design, students have designed personal care products such as hairdryers and curling irons. For several years in the late 1990s, I held a competition among the student teams for the best product design, as judged by industry representatives and a patent attorney. The ‘prize’ was an expense-paid trip to factories and overseas offices of US companies in China, Hong Kong and Thailand to present their design for consideration of further development by these entities. Details of the competition that I held in 1997 are described in a press release from Princeton University titled “Princeton Students Design a Better Hair Dryer,” which is attached as Appendix B. In the 1997

competition, I challenged the students to design a quiet hair dryer having an acoustic level of about 60 decibels (the average dryer at the time was around 80 decibels) despite operating at a higher wattage (2000 watts) than typical hair dryers (1800-1850 watts). *See generally* Appendix B.

11. In addition, in 2015 I was retained as an expert for TF3 Limited in the matter of the *inter partes* review of U.S. Patent No. 8,651,118, IPR2015-00649. In 2023 I was retained as an expert for SharkNinja, Inc., SharkNinja Operating LLC, SharkNinja Management LLC, and SharkNinja Sales Company in the matter of the *inter partes* reviews of U.S. Patent No. 11,589,660, IPR2023-01323 and IPR2024-00219 and of U.S. Patent No. 9,414,662, IPR2023-01324.

12. If asked, I will testify regarding my qualifications, background, and experience in the fields of fluid mechanics and heat transfer, general mechanical design and prototyping, and in product development including the design and manufacture of personal care appliances.

II. SCOPE OF OPINIONS

13. I have been asked to provide my opinions regarding whether the Challenged Claims of the '979 patent would have been obvious to one of ordinary skill in the art at the time of the alleged invention in view of the combination of Saito and Lindsey (Ground 1, claims 1-9 and 12-14); Saito, Lindsey, and Schepisi (Ground 2, claims 10 and 11); or Saito, Lindsey, and Nicolas (Ground 3, claims 15 and 16).

Likewise, the “hand held appliance” claims (17-32) are obvious over the same combinations in Grounds 1 and 2, in further view of the Shoemaker reference (Grounds 4 and 5).

14. This Declaration, including the exhibits cited herein, sets forth my opinions on these topics. It is my opinion that the Challenged Claims of the '979 patent would have been anticipated or obvious based on the five Grounds listed above.

III. MATERIALS REVIEWED AND CONSIDERED

15. The materials I considered and relied upon in preparing my Declaration and forming my opinions include all exhibits cited in this Declaration and the Petition, including the '979 patent, the file history of the '979 patent, and all of the relevant prior art. In addition, as I describe in Section I.A.1.g) below, I experimentally confirmed the function of the proposed Saito/Lindsey combination using a model intended to approximate the overall structure and resultant air flow in such a combination.

16. I also have relied on my professional experience, knowledge, and skill in fluid mechanics and heat transfer, general mechanical design and prototyping, as well as in product development including the design and manufacture of personal care appliances, including hair dryers in reaching the opinions expressed in this Declaration.

IV. LEVEL OF ORDINARY SKILL IN THE ART

17. In rendering the opinions set forth in this Declaration, I was asked to consider the patent claims and the prior art through the eyes of one of ordinary skill in the art at the effective filing date of the claimed invention.

18. I understand that various factors, such as the education level of those working in the field, sophistication of the technology, types of problems encountered in the art, prior art solutions to those problems, and speed at which innovations are made, may help establish the level of skill in the art. In determining the level of ordinary skill in the art, I have taken into account these factors as well as my years of experience in the personal care appliance industry related to the subject matter of the '979 patent.

19. It is my opinion that one of ordinary skill in the art would have had the equivalent of a Bachelor's degree or comparable technical degree in Industrial Design or Mechanical Engineering or equivalent work experience. In addition, it is my opinion that one of ordinary skill in the art would have had the equivalent of at least one year's worth of experience in research, design and/or development related to appliances for moving air such as hair dryers (or other comparable industrial design) at the time of the earliest claimed effective filing date of the claimed invention, March 20, 2014. Additional education could substitute for experience, and vice versa.

V. STATEMENT OF LEGAL PRINCIPLES**A. Claim Construction**

20. I understand that terms appearing in the patent claims are to be interpreted according to their “ordinary and customary meaning” in an IPR proceeding. In determining the ordinary and customary meaning, the words of a claim are first given their plain meaning as they would have been understood by one of skill in the art at the time of the effective filing date of the claimed invention, in light of the specification and file history. I understand that, under limited circumstances, evidence external to the patent and its prosecution may be used to determine the meaning attributed by a person of ordinary skill in the art at the time of the effective filing date of the claimed invention. I have followed this approach in my analysis and have applied the ordinary and customary meaning of the terms of the Challenged Claims throughout my analysis in this Declaration.

21. I understand that the words of the claims should be interpreted as they would have been understood by a person of ordinary skill in the art at the time of the effective filing date of the claimed invention. For purposes of my analysis, and for the reasons explained below, I have applied a date of March 20, 2014, as the effective filing date of the claimed invention in my analysis.

B. Anticipation

22. I have been informed that if each and every element of a claim is disclosed in a single prior art reference, then the claimed invention is anticipated and not patentable under AIA 35 U.S.C. § 102. In order for the invention to be anticipated, each element of the claimed invention must be described or embodied, either expressly or inherently, in a single prior art reference. I understand that a reference inherently discloses a claim limitation when that claim limitation is necessarily present in the reference. I also understand that a prior art reference must be enabling in order to anticipate a patent claim.

C. Obviousness

23. I have been informed that a patent claim is invalid as “obvious” under AIA 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. I have reviewed AIA 35 U.S.C. § 103.

24. I have also been informed that the framework for determining obviousness involves considering the following factors: (i) the scope and content of the prior art; (ii) the differences between the prior art and the claimed subject matter; (iii) the level of ordinary skill in the art; and (iv) any objective evidence of

obviousness as set forth in the case of *Graham v. John Deere Company*. I have been informed that in the case of *KSR International Company v. Teleflex*, the Supreme Court reaffirmed the framework for determining obviousness that was previously set forth in the case of *Graham v. John Deere Company*.

25. I have further been informed that the “objective” (or “secondary”) evidence of non-obviousness includes things such as: (1) a long-felt but unmet need in the prior art that was satisfied by the claimed invention; (2) commercial success or the lack of commercial success of the claimed invention; (3) unexpected results achieved by the claimed invention; (4) praise of the claimed invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the claimed invention; and (7) contemporaneous and independent invention by others.

26. I have been informed that a claim can be obvious in light of a single prior art reference or multiple prior art references. To be obvious in light of a single prior art reference or multiple prior art references, there must be a reason to modify the single prior art reference, or combine two or more references, in order to achieve the claimed invention. This reason may come from a teaching, suggestion, or motivation to combine, or may come from the reference or references themselves, the knowledge of one skilled in the art, or from the nature of the problem to be solved, and may be explicit or implicit from the prior art as a whole. I have been

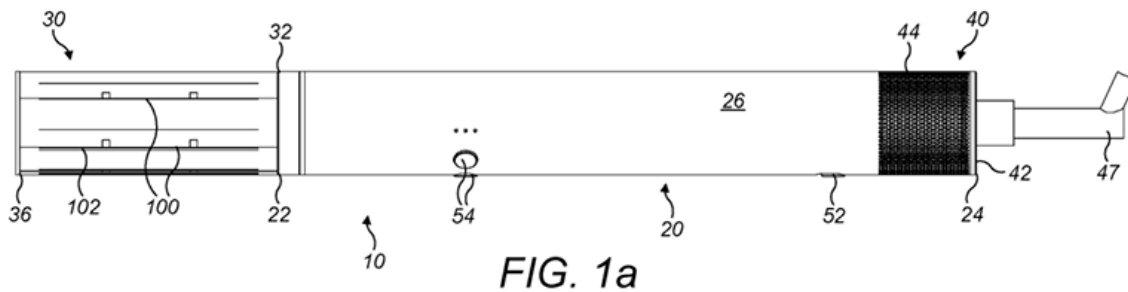
informed that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand it is improper to rely on hindsight in determining obviousness.

VI. SUMMARY OF THE '979 PATENT

27. The '979 patent is entitled "Attachment for a Hand Held Appliance." EX1001. I understand that the '979 patent was filed on March 12, 2015 as application number 14/656,357, and claims foreign priority to Great Britain Patent Application Nos. 1404982.9 and 1404985.2, which were each filed on March 20, 2014. EX1001. For purposes of my analysis, I have assumed that the effective filing date of the '979 patent is the filing date of the Great Britain foreign priority applications, March 20, 2014.

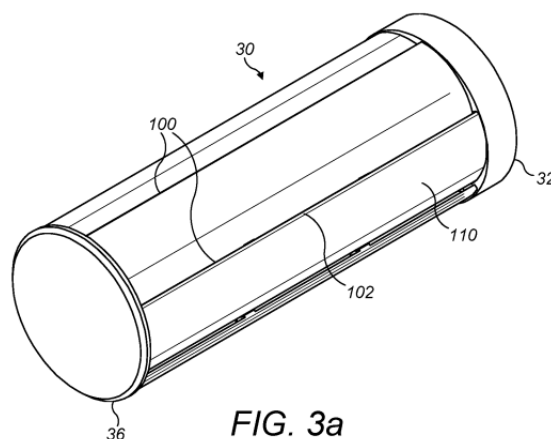
28. The '979 patent relates generally to an "attachment for a hand held appliance" having an "inlet; an outlet; and a fluid flow path between the inlet and the outlet," and "[f]luid emitted from the outlet flows around the external surface of the attachment, tangentially to the external surface, and is attracted to the surface of the attachment." EX1001, Abstract. The appliance described is "a hair care appliance such as a hot styling brush," EX1001 at 1:13-15, or a "hairdryer." EX1001 at 10:56-59.

29. Figure 1a of the '979 Patent depicts "a hot styling brush 10 with a handle 20 and a detachable head or attachment 30." EX1001 at 4:45-46.



30. The '979 patent explains that, at the time of filing, conventional hot styling brushes, “air is sucked into an inlet by a fan unit and directed towards the hair by an attachment or head,” and “[t]he head or attachment often includes bristles onto which hair is wrapped and held for styling.” EX1001 at 1:19-25.

31. The attachment head 30 includes a first end 32 “for connection to a handle,” a second end 36 “distal to the first end 32,” and a number of slots 102. EX1001 at 6:58-7:15.



EX1001, Fig. 3a.

32. The slots 102 are formed “between adjacent plates 110” such that fluid flowing out of a slot 102 is tangential to the outer surface of a plate 110 and “joins

with the fluid flowing out of the other slots,” “forming a fluid flow around the circumference of the head 30.” EX1001 at 7:9-15. The fluid exiting the slots 102 “is attracted to the curved surface of the head 30 by the Coanda effect,” a natural phenomenon initially described in a 1936. EX1001 at 7:9-17. The patent explains that due to the Coanda effect, fluid blown out “along the external surface of the head [30] ... encourages hair to wrap around the head 30 automatically.” EX1001 at 7:1-17.

33. Although the head 30 is generally depicted as “cylindrical in shape ... alternative shapes could be used such as ovals.” EX1001 at 10:49-11:10. The head 30 “could be provided with bristles,” “used with or without a heater,” used with “any appliance that draws in a fluid and directs the outflow of that fluid from the appliance.” EX1001 at 10:49-11:10. The ’979 patent specification made clear that the “invention is not limited to the detailed description given above,” and that “[v]ariations will be apparent to the person skilled in the art.” EX1001 at 11:11-13.

A. Challenged Claims

34. The ’979 patent has two independent claims, (1 and 17). The Challenged Claims 1 and 17 are provided below:

[1pre] An attachment for a hand held appliance comprising

[1a] an inlet in a proximal first portion of the attachment;

[1b] an outlet in a cylindrical second portion of the attachment;
and

[1c] a fluid flow path between the inlet and the outlet,

[1d] wherein the outlet in the cylindrical second portion of the attachment comprises at least one slot extending continuously from the proximal first portion to a distal end of the attachment,

[1e] wherein the outlet is at least partially defined by an external surface of a substantially contiguous wall of the attachment and

[1f] is configured to direct fluid flow emitted from the outlet tangentially along and around the external surface of the substantially contiguous wall to form a circumferential fluid flow around the cylindrical second portion of the attachment that encourages hair to automatically wrap around the cylindrical second portion,

[1g] wherein the external surface of the substantially contiguous wall is an outermost surface of the attachment along an entire length of the attachment from a beginning of the at least one slot to an end of the at least one slot, and

[1h] wherein the distal end of the attachment is closed.

[17pre] A hand held appliance comprising a handle having a fluid flow path from a handle inlet to a handle outlet, a fan unit

for drawing fluid into the handle inlet, and an attachment for attaching to the handle, the attachment comprising

[17a] an inlet in a proximal first portion of the attachment;

[17b] an outlet in a cylindrical second portion of the attachment; and

[17c] a fluid flow path between the inlet and the outlet,

[17d] wherein the outlet in the cylindrical second portion of the attachment comprises at least one slot extending continuously from the proximal first portion to a distal end of the attachment,

[17e] wherein the outlet is at least partially defined by an external surface of a substantially contiguous wall of the attachment and

[17f] is configured to direct fluid flow emitted from the outlet tangentially along and around the external surface of the substantially contiguous wall to form a circumferential fluid flow around the cylindrical second portion of the attachment that encourages hair to automatically wrap around the cylindrical second portion,

[17g] wherein the external surface of the substantially contiguous wall is an outermost surface of the attachment along an entire length of the attachment from a beginning of the at least one slot to an end of the at least one slot, and

[17h] wherein the distal end of the attachment is closed.

B. Prosecution History of the '979 Patent

35. The '979 patent issued from U.S. Patent Application No. 14/656,357, which was filed on March 12, 2015. The '979 patent claims foreign priority to Great Britain Patent Application Nos. 1404982.9 and 1404985.2, which were both filed on March 20, 2014. EX1001, Cover Page.

36. In response to a restriction requirement issued on September 16, 2016, Applicant elected originally filed claims 1-16 drawn to an attachment to a hand held appliance, on February 14, 2017, the Examiner issued a first Office action rejecting the claims as anticipated by Lindsey (U.S. Pat. No. 5,868,148) or McDougall (U.S. Pat. No. 5,212,366) and as obvious over Lindsey in combination with Tomaro (U.S. Pat. No. 4,295,283). EX1002 at 735-748. In response, Applicant amended the claims to require that the outlet of the attachment “is configured to direct fluid flow emitted from the outlet along and” around the external surface of the attachment. EX1002 at 912-22.

37. On August 9, 2017, the Examiner again rejected the claims as anticipated by Lindsey or McDougall and as obvious over Lindsey and Tomaro. In response to Applicant’s argument that “this ‘Coanda’ effect is merely caused by the airflow being somewhat tangential to the surface of the attachment,” the Examiner noted that “the airflow of McDougall and Lindsey are able to emit air tangentially to the surface of their attachments,” and thus Lindsey and McDougall anticipated

the claim limitation. Because “it has been held by the courts that where a prior art apparatus is identical or substantially identical in structure, claimed properties or functional characteristics are presumed to be inherent,” and because Lindsey and McDougall were substantially identical in structure to the claimed attachment, the Examiner found that each reference disclosed all of the properties or functional characteristics claimed. EX1002 at 1028-1039.

38. Applicant then attempted, but failed due to it being new matter, to add the negative limitation “wherein the external surface of the attachment is free of bristles.” EX1002 at 1056-1057, 1070-1072.

39. On December 11, 2017, still focused on bristles, Applicant added the limitation that “the external surface of the attachment forms an outermost surface of the attachment along a length of the attachment from a beginning of the at least one slot to an end of the at least one slot.” Applicant argued that although the bristles were the outermost surfaces of Lindsey’s and McDougall’s appliances, it was the vanes of Lindsey’s deflector means or the barrel bases of McDougall’s barrel that corresponded to the external surface of the attachment that partially defined the outlet as recited in the claim language. According to Applicant, the inclusion of these bristles—which, as noted by the Examiner, were explicitly discussed and illustrated in the ’357 application itself—served to distinguish Lindsey and McDougall from

the claimed structure and prevented either reference from disclosing this new claim limitation. EX1002 at 1084-1087.

40. In response, the Examiner reiterated that Lindsey and McDougall are structurally “identical or substantially identical” to the claimed structure and issued rejections based on Lindsey, McDougall, and Tomaro for the third time. EX1002 at 1155-1165. On May 10, 2018, focusing again on the bristles, Applicant amended the claims for the third time to require that the “outlet is at least partially defined by an external surface of a wall of the attachment,” that the flow is “along and around the external surface of the wall,” and that the external surface of the “wall” is an outermost surface of the attachment along a length of the attachment. EX1002 at 1289-90.

41. On June 27, 2018, the Examiner issued the same rejections over the same references for the fourth time, noting that the claim language required only that “the outlet is at least partially defined by an external surface of a wall of the attachment,” and “d[id] not require that the outermost surface be free from bristles and other components.” EX1002 at 1297-1309. Applicant then amended the claims for a fourth time to recite the “cylindrical” structure of the attachment. EX1002 at 1331-1335, 1346-1347.

42. Those amendments failed to convince the Examiner to allow the claims, instead they were rejected based on one or more of McDougall, Doran (U.S. Pat.

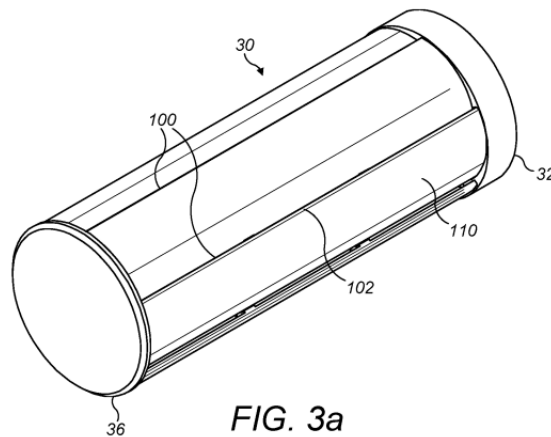
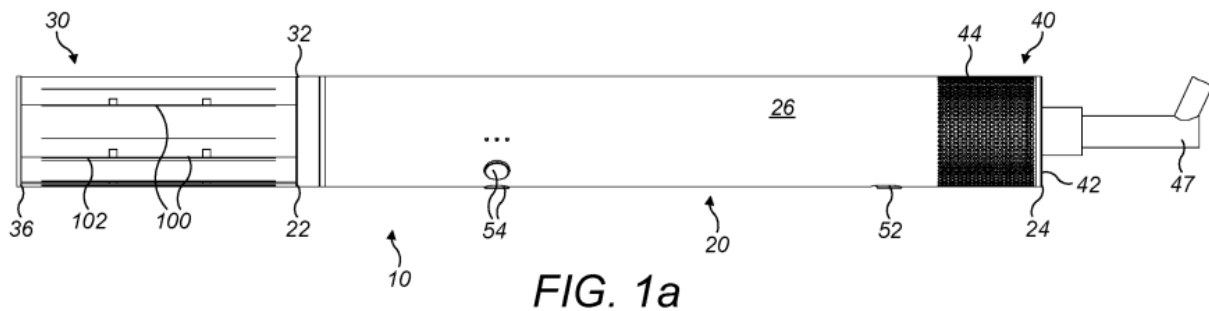
Appl. Pub. No. 2016/0000201), Glassman (U.S. Pat. No. 4,214,597), and Speetjens (U.S. Pat. No. 1,504,988). Applicant amended the claims for a fifth and a sixth time requiring the outlet to be configured to “direct fluid flow emitted from the outlet tangentially along and around the external surface of the wall to form a circumferential fluid flow around the cylindrical second portion of the attachment that encourages hair to automatically wrap around the cylindrical second portion,” and that the wall of the attachment that partially defined the outlet is “substantially contiguous” and the distal end of the attachment is “closed.” EX1002 at 1741-1753, 1833-1841.

43. Applicant then appealed and in response, on May 10, 2021, the Examiner issued a notice of allowance along with an Examiner’s Amendment that required the outlet comprise at least one slot extending “continuously from the proximal first portion to a distal” end of the attachment and that the external surface of the substantially contiguous wall is an outermost surface of the attachment along “an entire length” of the attachment. EX1002 at 1941-1958. The Examiner also allowed the unelected claims drawn to a hand held appliance with amendments corresponding to those made to the elected claims. The ’357 application issued as the ’979 patent on June 29, 2021. EX1002 at 1998.

VII. STATE OF THE ART

A. Hot Styling Brushes

44. The '979 patent “relates to an attachment for a hand held appliance, in particular a hair care appliance such as a hot styling brush.” EX1001 at 1:13-15. Figure 1a “shows a hot styling brush 10 with a handle 20 and a detachable head or attachment 30,” and Figure 3a shows an isometric view of an attachment 30:



EX1001, Figs. 1a, 3a. In its “Background of the Invention,” the '979 patent explains that, “[i]n a conventional hot styling brush, air is sucked into an inlet by a fan unit and directed towards the hair by an attachment or head,” and “[t]he head or

attachment often includes bristles onto which hair is wrapped and held for styling.”

EX1001 at 1:19-25.

45. When the '979 patent was filed, hot styling brushes with detachable heads had been available for nearly half a century. One commercially available example from 1975 is the Clairol Pretty Power hairbrush styling dryer, shown below:



46. As shown in the photo above, the Clairol Pretty Power included five styling attachments, including one with elongated slots, to be used with its dual-fan, hand held dryer. *See* EX1014.

47. By the 1990s and early 2000s, commercially available hot air stylers having cylindrical attachments were commonplace. For example, the Conair Aircare 2-in-1 Hot Air Styler, available in 2008, featured two detachable cylindrical brush heads, as shown below. *See* EX1015.

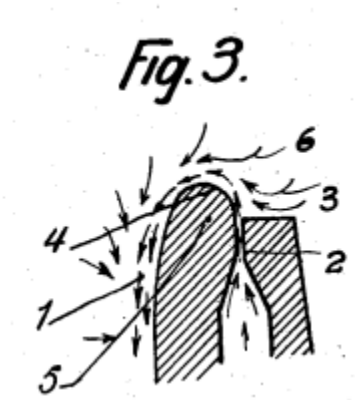


B. Coanda Effect

48. The '979 patent explains that the fluid (*i.e.*, air) exiting the slots of its attachment/head “is attracted to the curved surface of the head 30 by the Coanda

effect.” EX1001 at 7:16-17. According to the patent, “[t]his in turn causes hair that is presented to the head 30 to automatically wrap around the surface and then styled into curls.” EX1001 at 7:17-19.

49. The Coanda effect—a natural phenomenon—is the tendency of a fluid jet (*e.g.*, air) in the presence of a relatively quiescent environment to stay attached to (or follow) an adjacent flat or curved surface. The effect was initially described in a 1936 patent issued to its namesake, Henri Coanda, which claimed a structure including “a slot-shaped passage” for utilizing the effect, and a later 1966 patent to Coanda referred to such as a “Coanda slot.” EX1010 at claim 4; EX1011 at 2:7-18.



EX1010, Fig. 3. The Coanda effect has applications in a variety of fields, including aircraft, air conditioning, vacuum cleaners, and fans. For example, the Coanda effect has been used in aircraft design since the mid-1950s and is still in use in that field (and others) today. EX1008 at 2.

50. The Coanda effect is present in virtually all air-based hair dryers and hair stylers, to varying degrees depending on the structure and geometry of the

appliance. Designs explicitly intended to take advantage of the Coanda effect in haircare appliances were described prior to the effective filing date of the '979 patent (March 20, 2014).

51. As one example, US 2013/0111777 (“Jeong”), which is assigned to BA Solutions Co., Ltd. and entitled “Hair Dryer,” was published on May 9, 2013 and discloses a “hair dryer in which an amount of air current generated by a fan rotated by an operation of a motor is increased by a coanda effect to transfer a relatively large amount of air current into user’s hair.” EX1026 at ¶ [0009]. The Jeong hair dryer utilizes “a discharge nozzle coupled to one end of the housing, the discharge nozzle having a coanda surface on which the air passing through the inside of the housing passes to suction the external air by the air passing on the coanda surface, thereby discharging the mixed air together.” EX1026 at ¶ [0011].

52. Another example is US 2011/0010958 (“Clark”), entitled “Quiet Hair Dryer” was published on Jan. 20, 2011 and discloses “a special fan rotor configuration having blades with airfoil shapes and a curved trailing edges and diffuser ring in its outlet that employs the Coanda effect in the air exiting the dryer.” EX1028, Abstract. Clark explains that the outlet of its hair dryer includes a “diffuser tube” that incorporates a ring having a “curved outer surface,” which “also employs the Coanda effect to increase velocity of the air exiting the dryer with an

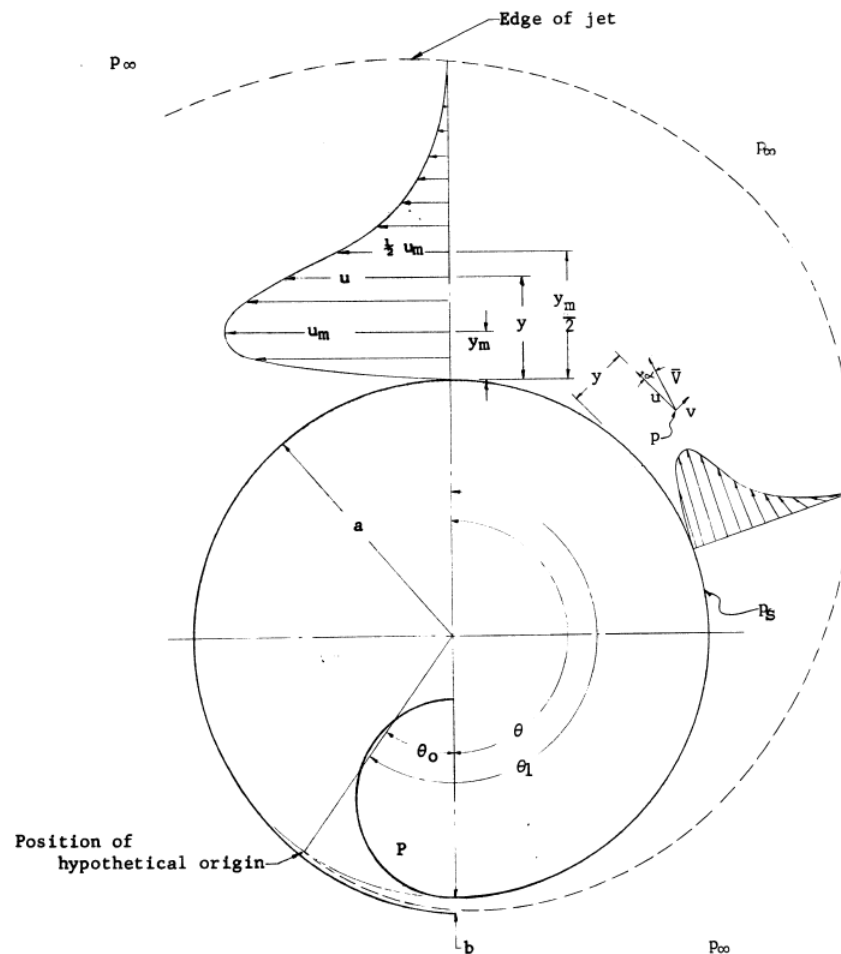
accompanying decrease in noise, similar to a diffuser used in air conditioners.”

EX1028 at ¶ [0036].

53. Yet another example is WO 2014/006365 (“Courtney”), which is assigned to Dyson Technology Limited and entitled “Attachment for a hand held appliance,” was published on January 9, 2014 and discloses a hair dryer that “achieves the output and cooling effect described above with a nozzle which includes a Coanda surface to provide an amplifying region utilising the Coanda effect.” EX1016 at 22:30-23:1. The Courtney patent explains that a “Coanda surface is a known type of surface over which fluid flow exiting an output orifice close to the surface exhibits the Coanda effect,” and that “[t]he fluid tends to flow over the surface closely, almost ‘clinging to’ or ‘hugging’ the surface.” EX1016 at 23:1-3. The Courtney patent states that “[t]he Coanda effect is already a proven, well documented method of entrainment whereby a primary air flow is directed over the Coanda surface,” and cites an article found in the June 1963 issue of Scientific American. EX1016 at 23:3-7.

54. WO 2011/131965 (“Tweedie”), also lists Dyson Technology Limited as the applicant, is entitled “An air treating appliance,” and was published on Oct. 27, 2011. Tweedie describes an “air treating appliance, such as . . . a hairdryer” having an air outlet that “comprises a Coanda surface” and a “diffuser surface” that is “located downstream of the Coanda surface.” EX1017 at 1, 17.

55. Use of the Coanda effect to create an entrained airflow around a cylinder by means blowing slot has also been known since at least the 1960s. For example, a 1963 thesis by G.I. Fekete titled “Coanda Flow of a Two-Dimensional Wall Jet on the Outside of a Circular Cylinder” describes “[a]n experimental investigation of the relatively simple flow where a jet flows around the surface of a circular cylinder, the surroundings being stationary and the fluid in the jet being the same as that in the surroundings.” EX1025 at 8. Specifically, “[t]he flow shown in Figure (1) is a wall jet which emanates from a slot of width b and flows around the outer surface of a circular cylinder of radius a .” EX1025 at 8, Fig. 1.

TWO-DIMENSIONAL WALL JET ROUND A CIRCULAR CYLINDER

56. The jet emanating from the slot “entrains fluid” from the surrounding fluid. EX1025 at 8. Fekete states that, even with just a single slot, “[e]xperiments show that separation [of the jet from the cylinder] does not occur before the value of θ exceeds well over 180° when the Reynolds number is high and [the ratio of slot width to cylinder radius] b/a is small. EX1025 at 9.

57. Similarly, an article published in 1968 in the Journal of Fluid Mechanics by Dunham that is entitled “A Theory of Circulation Control by Slot

Blowing Applied to a Circular Cylinder” describes “blowing air through narrow tangential slots” in order to “re-energize the boundary layer and delay its separation” in circulation control for aircraft. EX1021 at 1. Dunham’s Figure 1, reproduced below, illustrates “a circular cylinder with its axis normal to a uniform incited air flow” with “one or more narrow tangential slots *S* on the upper surface.” EX1021 at 2, Fig. 1.

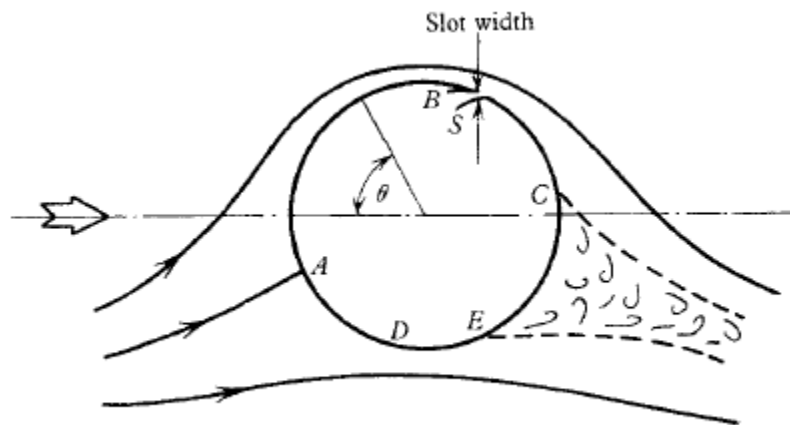


FIGURE 1. Circulation control.

58. Dunham explains that air “is injected through these slots, which re-energizes the boundary layer and delays its separation until *C*.” EX1021 at 2. Dunham also describes cylinder models having “more than one slot,” as shown in models *J* and *R2* in Dunham’s Figure 8, reproduced below. EX1021 at 13.

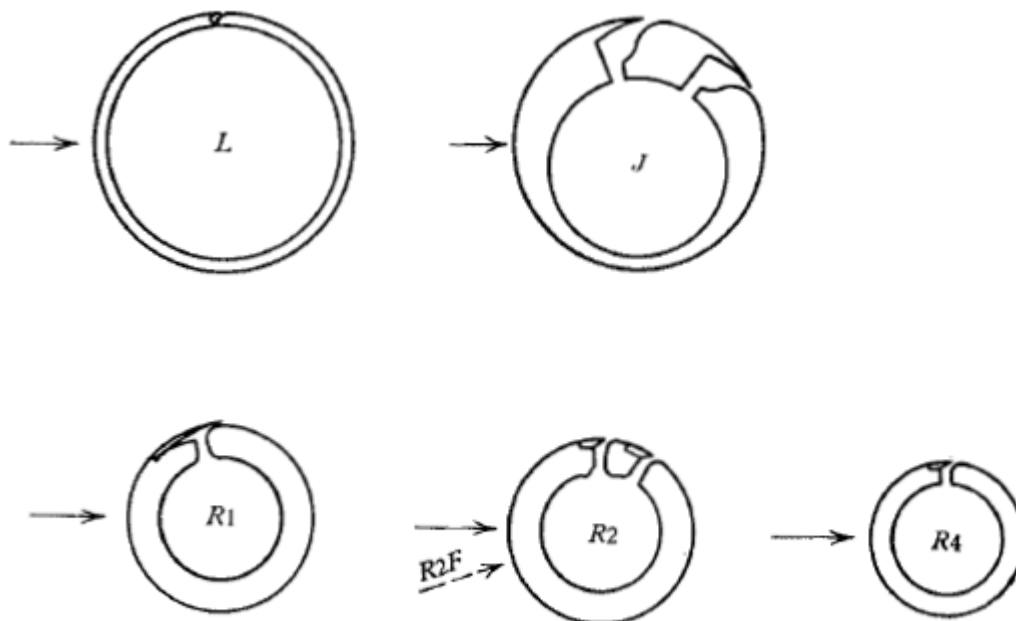


FIGURE 8. Wind-tunnel model cross-sections. Only those slots used in the tests quoted are shown.

59. As another example, an article published in 1975 in the Journal of Aircraft that is entitled “Circulation Control for High Lift and Drag Generation on STOL Aircraft” (“Englar”) describes “the well-known Coanda principle, where a thin jet of air remains attached to an airfoil’s rounded trailing edge due to the balance between centrifugal force and the pressure differential produced by the jet velocity. EX1019 at 1. Englar’s Figure 1 shows “tangential blowing over [a] rounded Coanda surface” and the resulting jet sheet that remains attached to the airfoil.

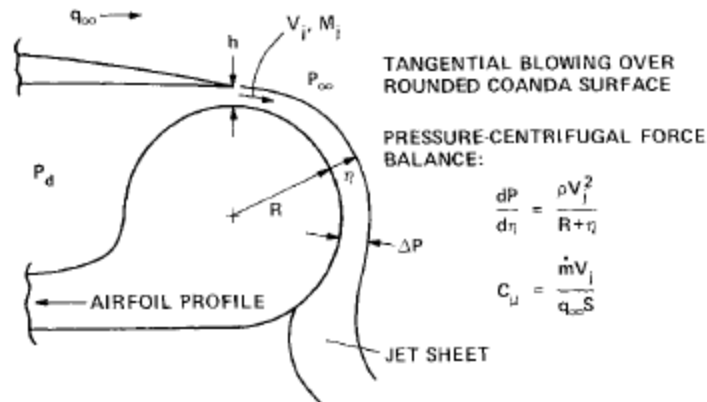
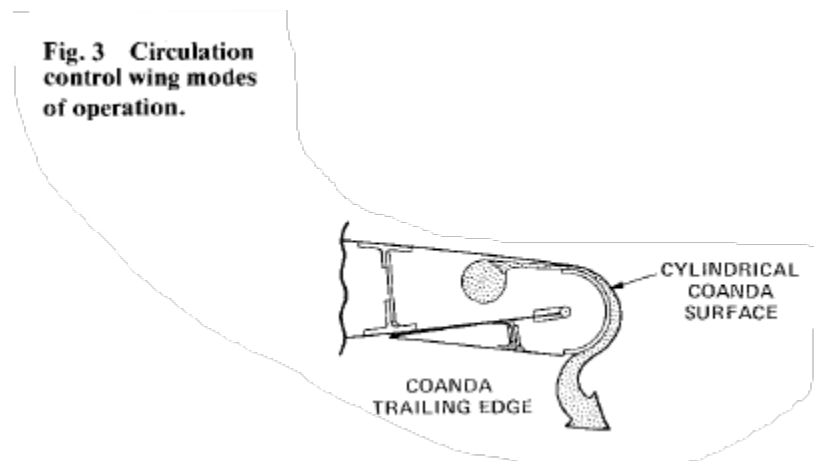


Fig. 1 Basic circulation control aerodynamics.

60. Englar describes a wind tunnel investigation of a 1/5 scale model of a Navy T-2C aircraft that was modified to include a Coanda trailing edge similar to that shown in Figure 3, the relevant portion of which is shown below. EX1019 at 2, 4, Fig. 3.



61. Englar explains that a “[cotton] tuft attached to the trailing edge” showed “[f]ull 180° Coanda turning,” that is, the cotton tuft wrapped from the top of the trailing edge and around the cylindrical Coanda surface until it separated from

the lower portion of the trailing edge. EX1019 at 4. This 180° Coanda turning is shown by the cotton tuft in Englar's Figure 10, reproduced below.

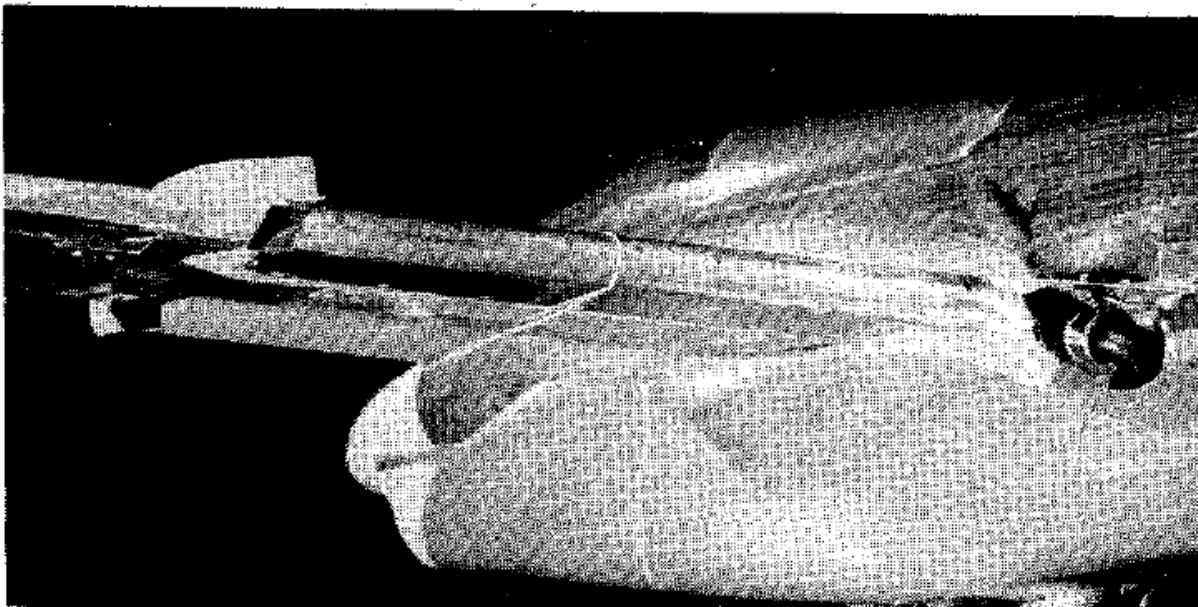


Fig. 10 Coanda jet static turning.

62. Note that Englar explicitly illustrates that a cotton tuft, which is how human hair may be modeled for experimental investigations, wraps around a portion of a circular cylinder with a single slot that generates an attached Coanda jet. Note that the application described in Englar is not unique to aircraft design, nor is it substantially different from the other material referenced in this declaration. Rather, Englar is direct evidence of a prior art system capable of encouraging the equivalent of hair (*i.e.*, the cotton tuft) to wrap around a slot-blown cylinder in the same manner as described in the '979 patent.

63. As yet another example, a 1991 dissertation entitled “Coanda Effect Jet around a Cylinder with an Interacting Adjacent Surface” (“Churchill”) described “[t]he affects of placing a plane solid surface in close proximity to a Coanda effect jet turning over a cylinder surface.” EX1018 at 7. Churchill discusses several examples of applied Coanda jet flows, including use of circulation control wings, “where a jet issues on the top surface and adheres to the circular tail portion preventing boundary layer (BL) separation.” EX1018 at 18. The trailing edge of a circulation control wing and the entrained airflow around the circular Coanda surface is depicted in Churchill’s Figure 2, reproduced below.

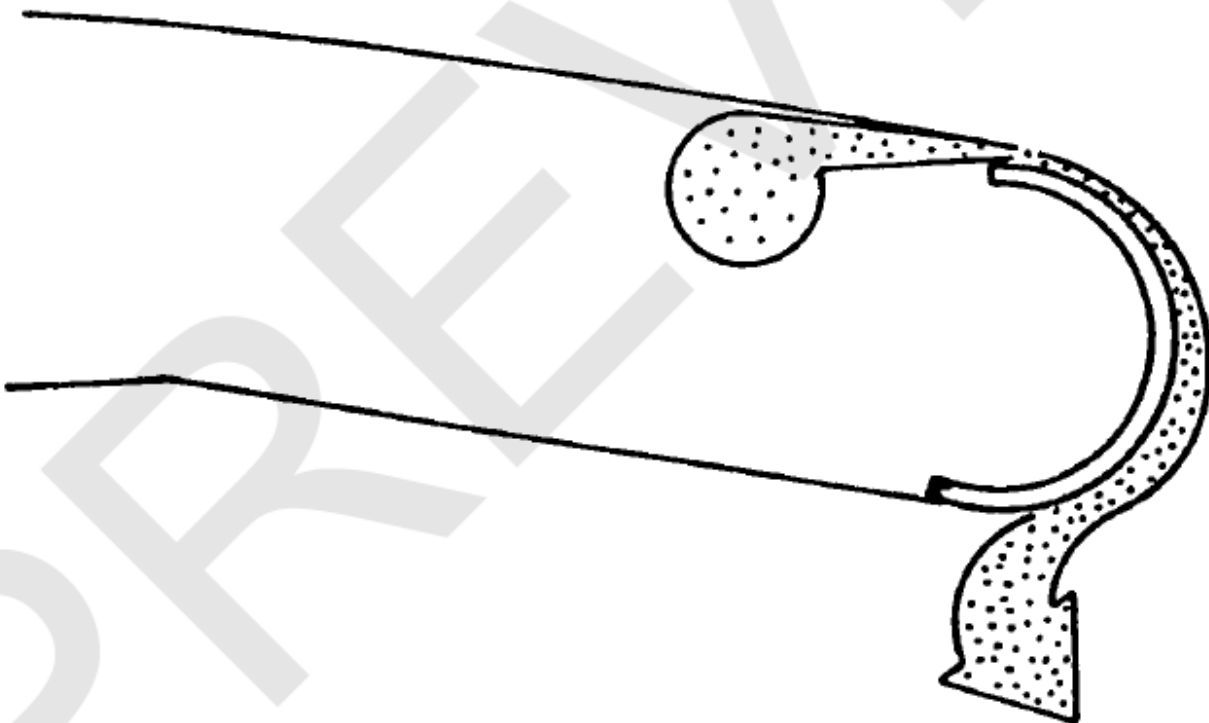


Fig. 2 Trailing edge of a circulation control wing.²

VIII. APPLICATION OF THE PRIOR ART TO THE CLAIMS

A. Effective Filing Date

64. As noted above, for purposes of my analysis I have assumed that the effective filing date of the '979 patent is March 20, 2014, which is the date of filing of the Great Britain foreign priority applications.

B. Overview of the Prior Art

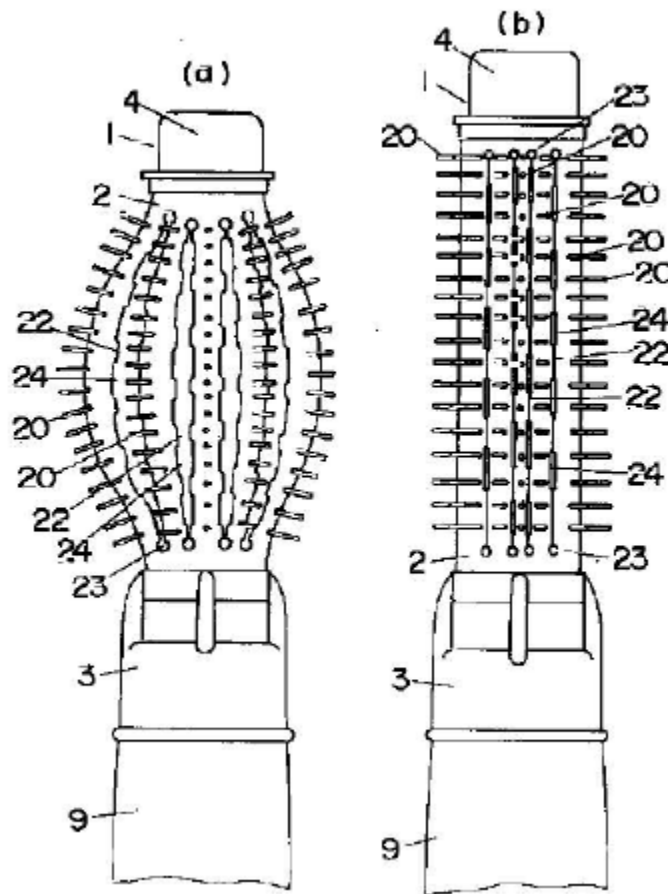
1. Saito (EX1004)

65. The Saito reference is a Japanese Unexamined Patent Application Publication that was filed on December 23, 1977 and published on July 13, 1979. Saito is entitled “Hair Winding Tool,” and the applicant is listed as Matsushita Electric Works, Ltd. EX1004, Cover Page.¹ I understand that Saito is available as prior art because it was published prior to the effective filing date of the '979 patent (March 20, 2014).

66. Saito discloses “a hair dryer with an attached brush” that comprises “a bristle base” that “is connected to a blowing port of a hair dryer body and air or steam is blown out from the hair dryer body via discharge ports formed in the bristle base of the brush”:

¹ All citations to Saito refer to the certified English translation that begins on page 10 of EX1004.

(Figure 5)



EX1004 at ¶ (0005), Figs. 5(a) & 5(b).

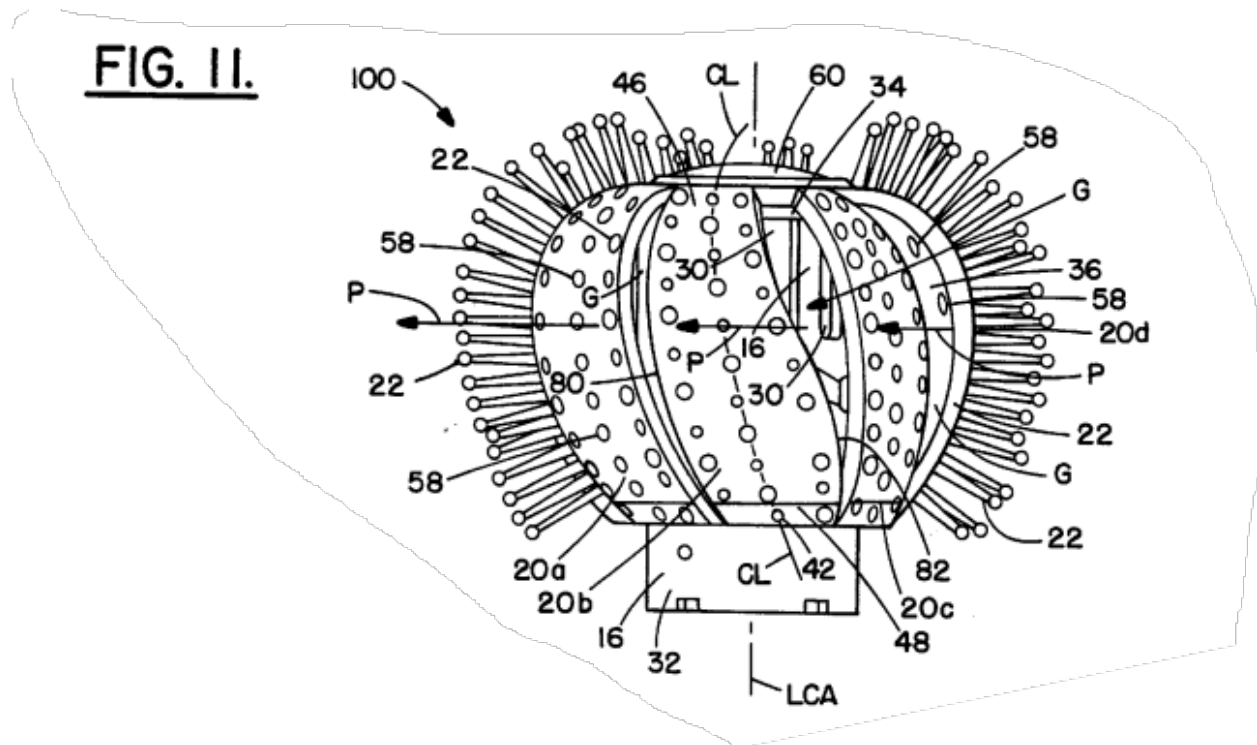
67. As shown in Saito's Figures 5(a) and 5(b), Saito's attached brush "is mounted onto the hair dryer body 9 by covering a portion of a blowing port of the hair dryer body 9 with the brush base 3 of the brush 1." EX1004 at ¶ (0013). The air that is "discharged from the hair dryer body 9 enters a space between an outer surface of the tube 34 and an inner surface of the bristle base 2 from the airflow channel 39 within the tube . . . and is discharged to the outside from discharge ports 24." EX1004 at ¶ (0013).

68. Saito states that the bristle base “is formed from a material with flexibility, such as a polyester elastomer or polypropylene.” As shown in Figure 5(b), the bristle base can take a cylindrical shape when the distance between the brush bases 3 and 4 is maximized. As shown in Figure 5(a), “when the bristle base 2 is compressed in the axial direction by a change in the distance between the brush bases 3, 4, the bristle base 2 flexes so that the middle thereof in the axial direction bulges outward, as shown in Figure 5(a).” EX1004 at ¶ (0017)-(0018). Based on my review, it is my opinion that a person of ordinary skill in the art reading Saito would have been able to implement Saito’s hair dryer and brush attachment with little or no experimentation required. Saito’s disclosure provides ample detail regarding its hair dryer and brush attachment such that a person of skill in the art would have been able to build it without undue experimentation.

2. Lindsey (EX1005)

69. Lindsey is a United States patent that was filed on June 9, 1998 and issued on February 9, 1999. Lindsey is entitled “Hair Styler,” and the applicant is listed as Conair Corporation. EX1005, Cover Page. I understand that Lindsey is available as prior art because it was published prior to the effective filing date of the ’979 patent (March 20, 2014).

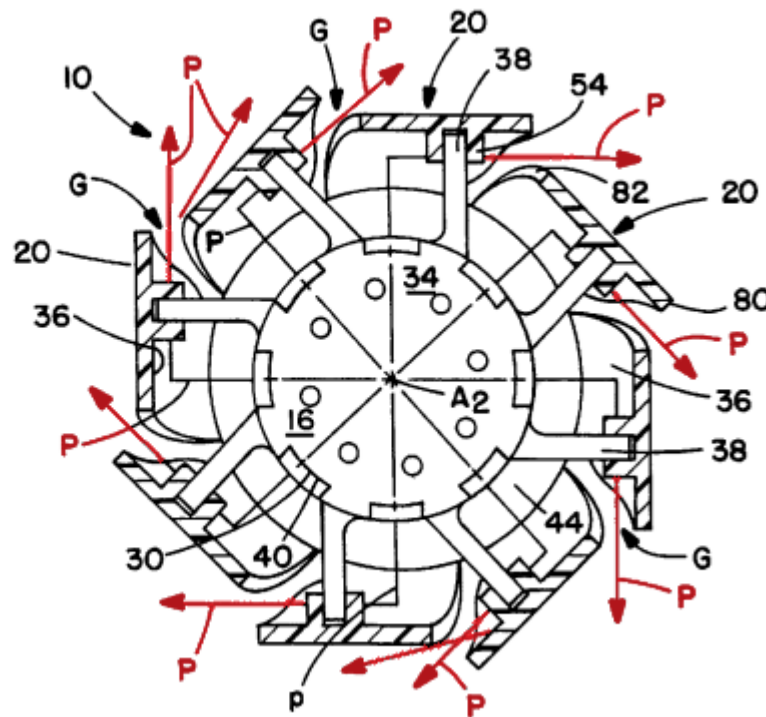
70. Lindsey discloses “a hair styler which is attachable to an air blower, for example, to a hand-held hot air hair blower such as a hair dryer.” EX1005 at 2:37-39. Lindsey’s Figure 11 is a front elevational view of the “hair styler”:



71. A key feature of the hair styler described in Lindsey is that it has “a turbinate design comprised of an array of vanes angularly disposed about the axis of air flow through, or about the central axis of, the internal chamber of the hair styler.” EX1005 at 3:10-14. The vanes “are disposed in a turbinate arrangement about central axis CA of internal chamber 26, in the paths of the air exiting internal chamber 26, through vents 28, 30, in flow paths p which are approximately transverse or perpendicular to central axis CA of internal chamber 26.” EX1005 at 5:55-60. Lindsey’s vanes are described as being preferably formed from a flexible material,

e.g., “an elastomeric material, such as the thermal plastic elastomer (TPE).” EX1005 at 10:13-19.

72. Lindsey explains that “[t]he air impinging on interior surfaces 36 of vanes 20 in plural flow paths which are approximately transverse or perpendicular to, and manifest different angular or tangential directions about central axis CA of internal chamber 26,” and that the vanes “are spaced from one another and have gaps G therebetween, which allows of the air exiting vents 28, 30 to be discharged through spaces or gaps G.” EX1005 at 5:60-67. The air exits the spaces or gaps G in “plural flow paths P which are approximately transverse or perpendicular to central axis CA of core internal chamber 26” and “manifest in different angular directions entirely about central axis CA.” EX1005 at 8:13-16. These “plural flow paths P” are shown in the annotated Figure 9 of Lindsey, reproduced below.

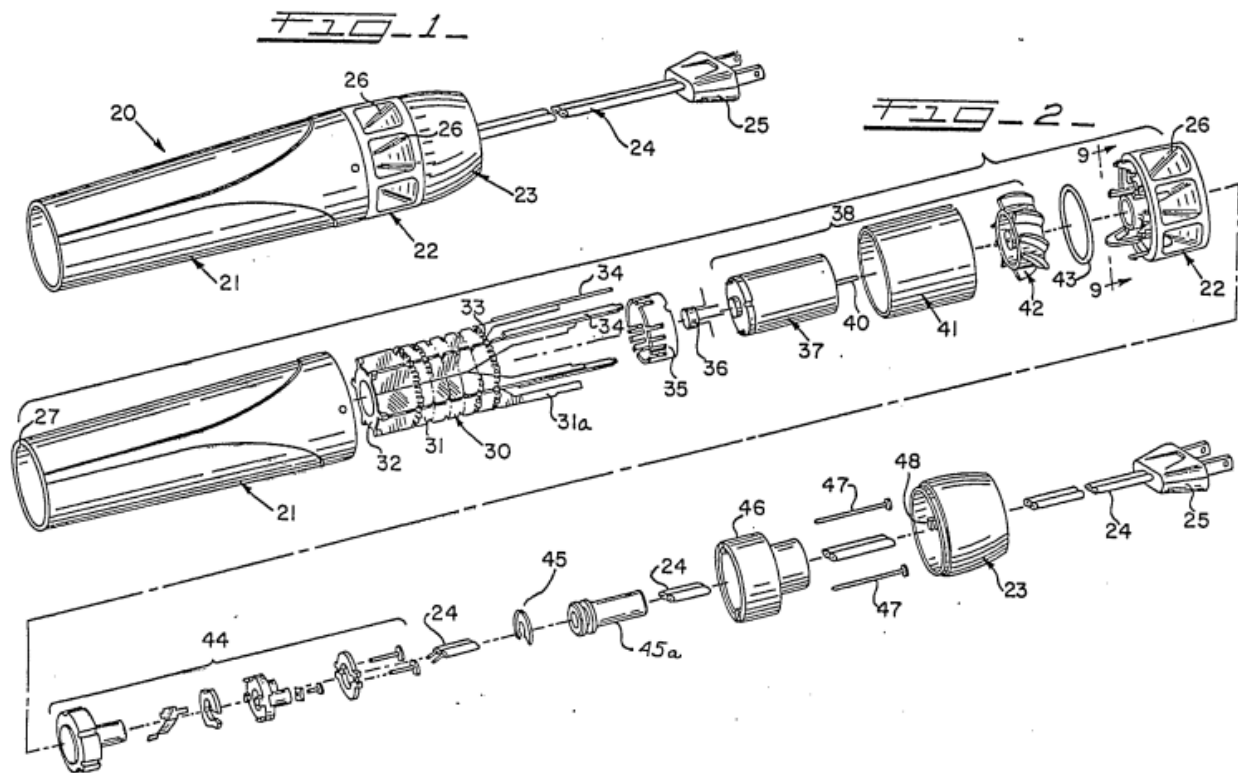
FIG. 9.

Based on my review, it is my opinion that a person of ordinary skill in the art reading Lindsey would have been able to implement Lindsey's hair styler attachment with little or no experimentation required. Lindsey's disclosure provides ample detail regarding its hair styler attachment such that a person of skill in the art would have been able to build it without undue experimentation.

3. Shoemaker (EX1009)

73. Shoemaker is a UK Patent Application that was filed on July 17, 1978 and published on September 2, 1982. Shoemaker is entitled "Hand Held Air Dryers," and the applicant is listed as Conair Corporation. EX1009, Cover Page. I understand that Shoemaker is available as prior art because it was published prior to the effective filing date of the '979 patent (March 20, 2014).

74. Shoemaker describes a “hand-held hair dryer or styler” that “is of tubular shape and is not provided with the normal handle grip.” Shoemaker’s “axial-flow fan,” which has “a small diameter,” “enables the housing 21, 22 of the dryer or styler to be small enough to be comfortably held in the hand.” EX1009 at Abstract. Shoemaker’s Figures 1 and 2, reproduced below, show “a perspective view of the hand-held hair styling appliance incorporating an axial-flow fan embodying the present invention,” and “an exploded perspective view of the hair styling appliance of Figure 1 showing the interrelation of the heating element, motor, fan, and control switching assembly utilized therein,” respectively. EX1009 at 1:23-29, Figs. 1 & 2.



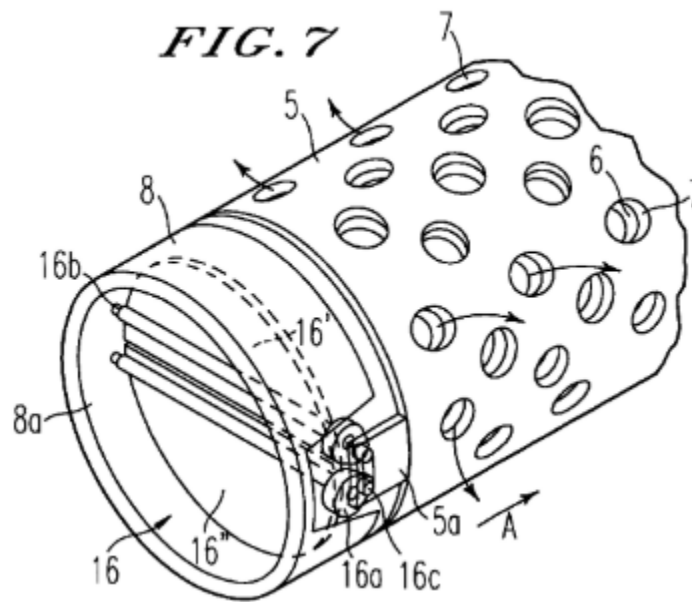
75. Additionally, Shoemaker explains that “styling attachments” may be “releasably connected to the air outlet housing 27 to adapt the appliance for various combing and brushing operations in connection with the styling and drying of a user’s hair.” EX1009 at 2:64-69. Based on my review, it is my opinion that a person of ordinary skill in the art reading Shoemaker would have been able to implement Shoemaker’s hand-held hair dryer/styler with little or no experimentation required. Shoemaker’s disclosure provides ample detail regarding its hand-held hair dryer/styler such that a person of skill in the art would have been able to build it without undue experimentation.

4. Schepisi (EX1006)

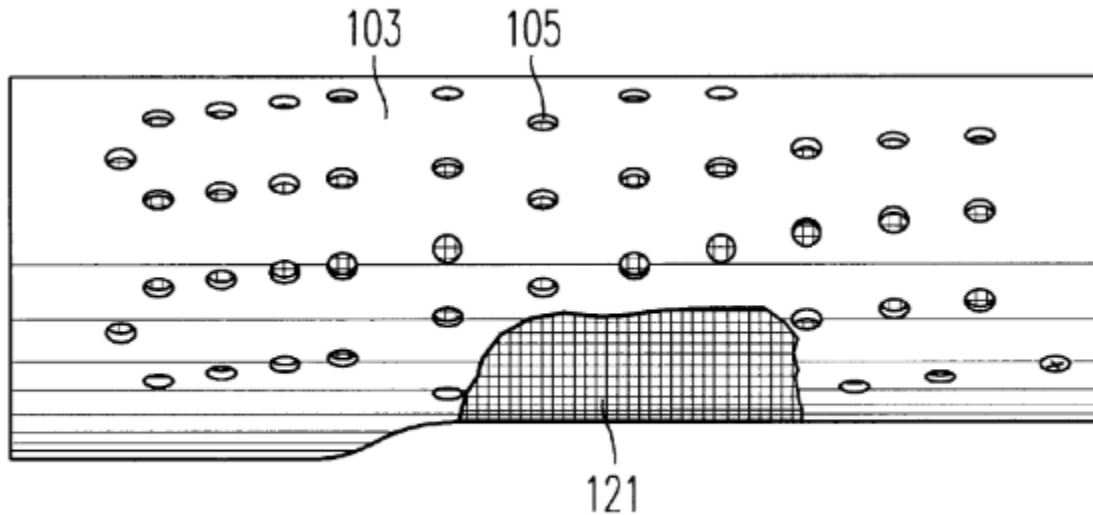
76. Schepisi is a United States patent that was filed on February 2, 1998 and issued on March 21, 2000. Schepisi is entitled “Blow Dryer Having Airflow Control Means,” and the applicant is listed as Vital Hair Tools, LLC. EX1006, Cover Page. I understand that Schepisi is available as prior art because it was published prior to the effective filing date of the ’979 patent (March 20, 2014).

77. Schepisi describes “a blow dryer” that “includes a barrel having an opening,” as well as a “deflector, having an aperture, positioned within or substantially within the barrel.” Schepisi’s blow dryer has two modes: (1) “first or open mode in which air flow is directed through the barrel opening of the barrel;” and (2) “fully deflecting mode” where air flow is directed to the “aligned holes 6 and

7 of the inner and outer cylinders 4, 5,” which results in the air being “discharged through the surface of the barrel 3.” EX1006 at Abstract, 5:39-44. Schepisi’s Figure 7, reproduced below, depicts “the flaps or deflecting means in the fully deflecting position.” EX1006 at 3:33-35.



78. Schepisi explains that the barrel of the blow dryer “can include a mesh-type screen” that “can be positioned cylindrically within the barrel,” as shown in Figure 23, reproduced below. EX1006 at 11:26-30. This “mesh-type screen 121 serves to block or obstruct some of the air travelling through holes 105.” EX1006 at

***FIG. 23***

Based on my review, it is my opinion that a person of ordinary skill in the art reading Schepisi would have been able to implement Schepisi's blow dryer with airflow control means with little or no experimentation required. Schepisi's disclosure provides ample detail regarding its blow dryer such that a person of skill in the art would have been able to build it without undue experimentation.

5. Nicolas (EX1007)

79. Nicolas is a United States patent that was filed on November 20, 2009 and issued on January 10, 2012. Nicolas is entitled "Fan," and the applicant is listed as Dyson Technology Limited. EX1007, Cover Page. I understand that Nicolas is available as prior art because it was published more than one year before the effective filing date of the '979 patent (March 20, 2014).

80. Nicolas describes a “fan assembly for creating an air current” that has a “nozzle” that includes “an interior passage for receiving the air flow from the base, a mouth through which the air flow is emitted, the mouth being defined by facing surfaces of the nozzle, and spacers for spacing apart the facing surfaces of the nozzle.” EX1007 at Abstract.

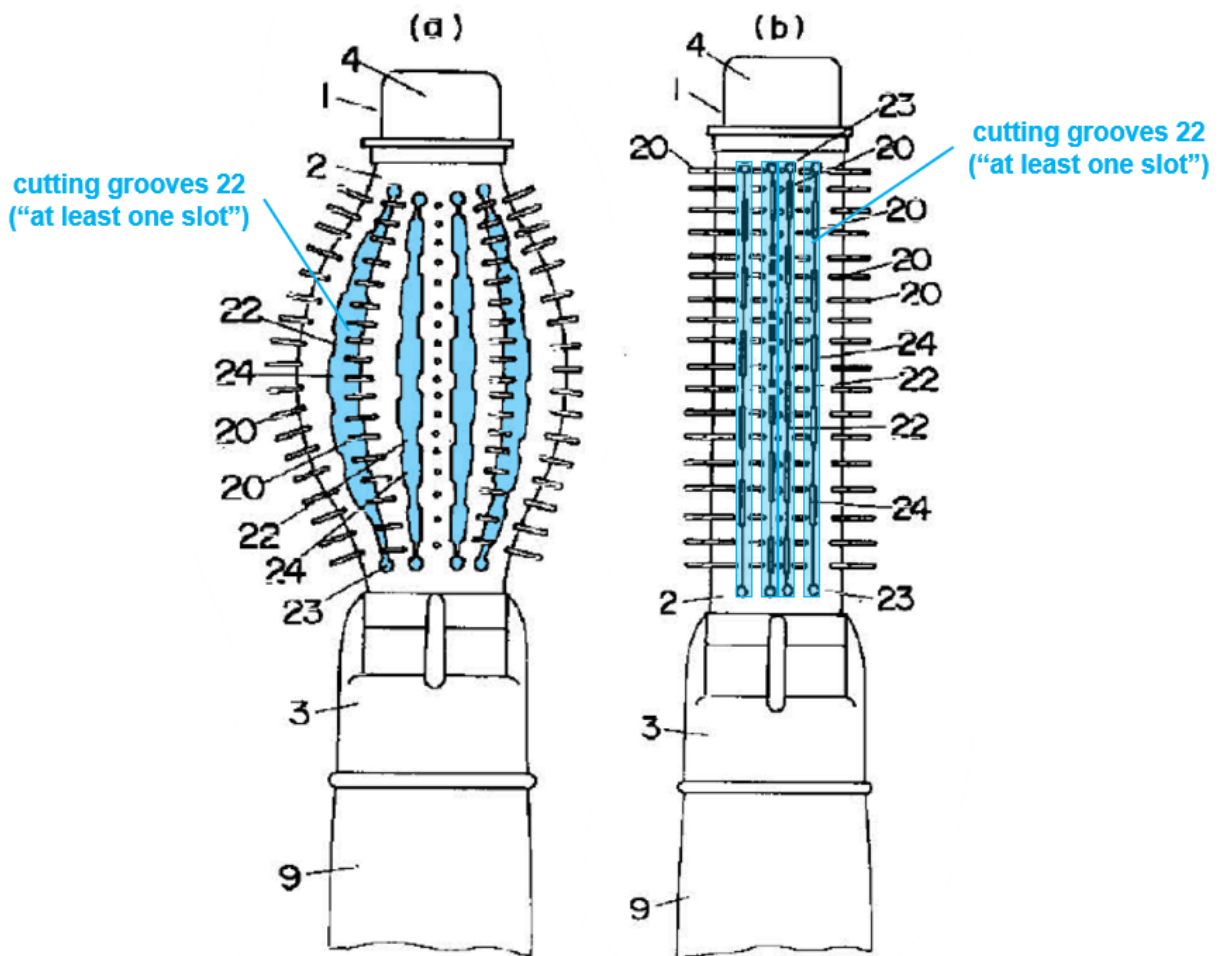
81. Nicolas explains that the “spacers are preferably arranged to maintain a set distance between the facing surfaces of the nozzle,” and “can provide for a reliable, reproducible nozzle of the fan assembly and performance of the fan assembly.” EX1007 at Abstract, 3:39-40. Based on my review, it is my opinion that a person of ordinary skill in the art reading Nicolas would have been able to implement Nicolas’s fan, including its spacers, with little or no experimentation required. Nicolas’s disclosure provides ample detail regarding its fan (and spacers) such that a person of skill in the art would have been able to build it without undue experimentation.

C. Ground 1: Claims 1-9 and 12-14 are Obvious Over the Combination of Saito and Lindsey

82. I have analyzed claims 1-9 and 12-14 of the ’979 patent, and it is my opinion that each claim is rendered obvious by Saito in view of Lindsey.

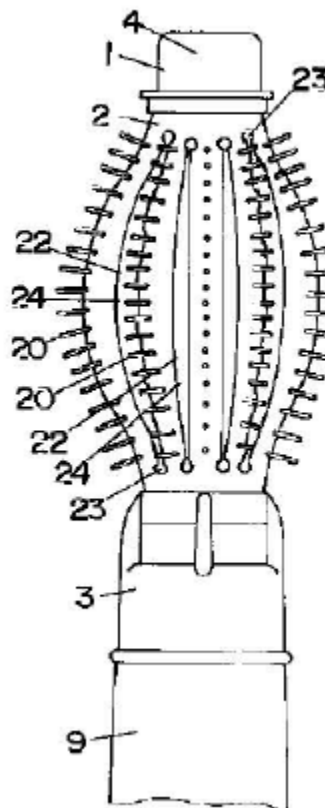
83. Saito discloses that “numerous discharge ports 24 are provided in the surface of the bristle base 2 that open between rows of the bristles 20.” EX1004 at ¶ (0012). As I explained above with respect to claim element [1b], the bristle base 2

“is formed in a cylindrical shape,” and is cylindrically shaped when “the distance between the brush bases 3, 4” is maximized, that is, when the bristle base 2 is fully extended. EX1004 at ¶ (0017)-(0018), Fig. 5(b). Saito further explains that, as shown in the annotated Figures 5(a) and 5(b), below, the bristle base 2 “is provided with a plurality of cutting grooves 22 that run in an axial direction thereof at equal intervals in a circumferential direction.” EX1004 at ¶ (0017), Figs. 5(a) & 5(b).

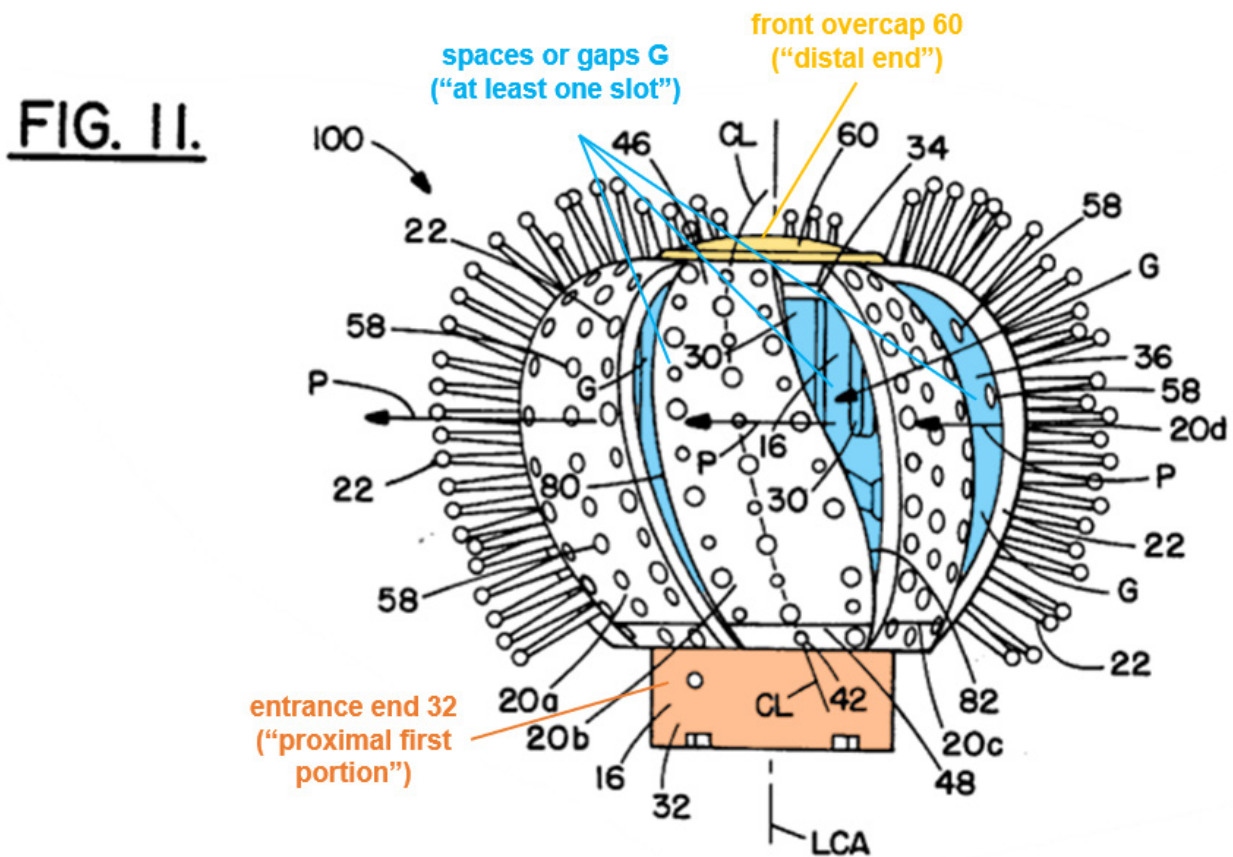


84. Saito teaches that “the intervals between the cutting groove 22 portions widen” when the distance between the brush bases 3 and 4 is compressed in the axial direction, which is depicted in Figure 5(a). EX1004 at ¶ (0017). And, “when the bristle base 2 is made to bulge” by compressing the bristle base, “the intervals between the cutting grooves 22 widens so that the hot air or steam is discharged not only from the discharge ports 24, but also from portions of the cutting grooves.” EX1004 at ¶ (0019). Saito also discloses an embodiment, shown in Figure 7 below, where “the cutting grooves 22 are made into the discharge ports 24,” and “there is no need to provide separate discharge ports 24.” EX1004 at ¶ (0020).

(Figure 7)



85. As shown in the annotated Lindsey Figure 11 below, the “vanes 20 are elongated and, when viewed from their exterior, they are disposed generally longitudinally along and generally parallel to longitudinal central axis LCA of hair styler 100.” EX1005 at 8:29-31. This arrangement of the vanes “provide spaces or gaps G” that are “of varying widths and radial extends along and between side edges 80, 82 of mounted adjacent vanes.” EX1005 at 8:47-49, Fig. 11.

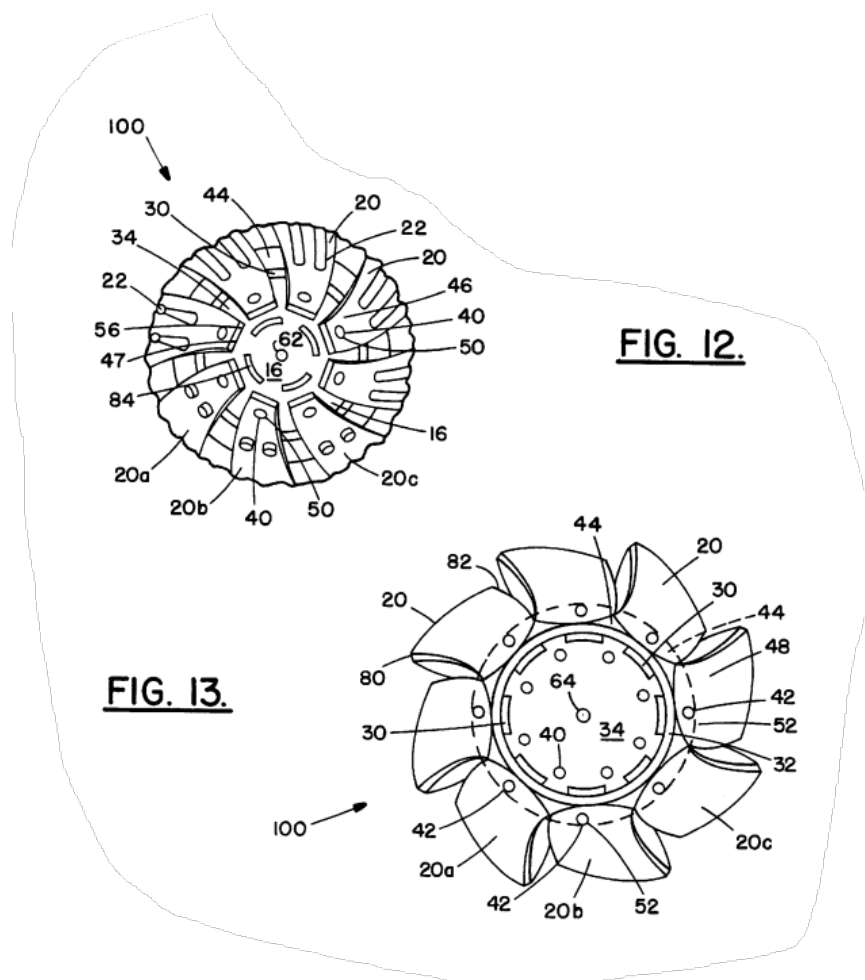


86. Lindsey explains that “[t]he means for mounting vanes 20 onto core 1[6] include . . . a circular array of pins 40 extending axially forward from the front surface of front wall 34, and a circular array of pins 42 extending axially rearward

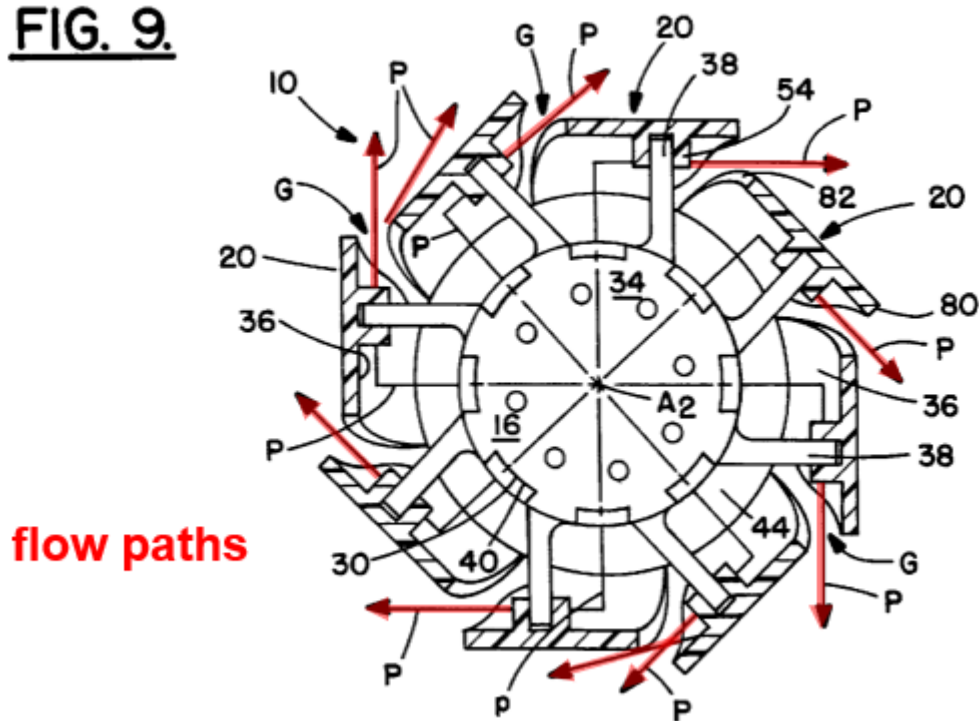
from vertical annular flange 44 located adjacent entrance end 32 of core 16.”

EX1005 at 6:32-40.

87. Figure 11 also shows that at the distal end of the attachment, the “front ends 46 of vanes 20 are maintained in their mounted positions on pins 40 by front overcap 60 when it is secured to core front wall 34, thereby retaining vane front ends 46 between overcap 60 and wall 34.” EX1005 at 7:31-34. Likewise, “vane back ends 48 are mounted on pins 42 extending axially to the rear of core annular flange 44,” and the “[b]ack end edges 49 of vanes 20 are near or touch the outer surface of core entrance end 32.” EX1005 9:22-26, Figs. 12 & 13.



88. It is my opinion that it would have been obvious to one of ordinary skill in the art to use an array of vanes, as taught by Lindsey, to comprise Saito's bristle base to provide the tangential air flow resulting from the turbinate arrangement of the vanes, as Lindsey explains: "vanes 20 are disposed in a turbinate arrangement about central axis CA of internal chamber 26, in the paths of the air exiting internal chamber 26, through vents 28, 30, in flow paths p which are approximately transverse or perpendicular to central axis CA of internal chamber 26." EX1005 at 5:55-60. These flow paths are annotated in Lindsey's Figure 9, below:

FIG. 9.

89. In my opinion, it would have been obvious to one of ordinary skill in the art to use individual vanes to form Saito's bristle base rather than Saito's one-piece construction that is provided with cutting grooves, and one of ordinary skill in the art would have had a reasonable expectation of success in doing so. This modified Saito configuration would have retained the ability to have its shape changed between cylindrical and bulbous by changing the distance between the brush bases, while also providing the tangential airflow described in Lindsey. Both Saito and Lindsey generally describe hair styling attachments for hair driers having similar structures that are manufactured from similar materials. For example, both attachments are described as using flexible materials. Saito's bristle base 2 "is formed from a material with flexibility, such as a polyester elastomer or

polypropylene” in a “cylindrical shape.” EX1004 at (0017). For Lindsey, “the preferred material for the preferred embodiments of the vanes described herein is an elastomeric material, such as the thermal plastic elastomer (TPE).” EX1005 at 10:13-19.

90. A person of ordinary skill in the art would have recognized the advantages present in the use of Lindsey’s vanes, specifically, the tangential or circumferential flow around the attachment, and would have been motivated to combine the vanes with Saito. Saito teaches the use of circumferentially disposed longitudinal slots; however, Saito’s flow path is radial, outwardly from the attachment. A combination of the two would have created an attached circumferential flow around a right circular cylinder, which I note is the traditional hair curler/styler geometry.

91. Lindsey teaches the benefits of its “turbinate arrangement of vanes to rapidly and efficiently discharge air from the hair styler,” as well as “the features and disposition of the vanes.” Lindsey likewise describes “the discharge of air from the hair styler in plural flow paths P which are substantially transverse or perpendicular to central axis CA of the internal chamber, and which manifest in different angular directions about such axis” as one of the “main features” of the hair styler. EX1005 at 10:20-27.

92. Lindsey also notes that “[a]nother main feature of the invention is that the air discharged from one vane is directed over, preferably at shallow angles over, and through the prongs on the outer surface of an adjacent vane to thereby provide above-mentioned advantages of air flow along, rather than perpendicular to the lie of hair strands among the prongs.” EX1005 at 10:28-33. Yet another main feature of Lindsey “is that, due to the preferred longitudinally concave shape of the vanes, air is discharged in a spinning, turbulent manner from a central portion of the concavely shaped elongated vanes, to thereby render the hair styler capable of providing additional lift and volume to hair.” EX1005 at 10:33-37.

93. In Lindsey’s Background of the Invention section, Lindsey identifies shortcomings in existing hair brush attachments (like the attachment in Saito) that would have been overcome by use of Lindsey’s vanes. For example, Lindsey explains that “such attachment hair brushes have had the shortcoming that the air discharged through the holes in their cylindrical wall flows in paths which are radial and perpendicular to the axis of flow from the hair blower and to the axis of flow through the attachment device,” which “can result in an inefficient or limited use of the discharged air.” EX1005 at 1:45-50.

94. Lindsey also indicates that “when hair strands are wrapped around the [existing] cylindrical attachment, much of the air so discharged through the holes of the attachment strikes the hair strands perpendicularly to their lie and in limited

areas, and passes between the strands into the atmosphere,” which “tends to cause fly-aways, i.e., hair strands which are driven by the air flow to depart from or fly away from the cylindrical brush.” EX1005 at 1:50-57. And, “since most of the air exits the device in radial paths which are perpendicular to the axis of flow through the cylinder, their capability of styling the hair in a variety of waves, flips and shapes and of providing increased lift and volume to the hair is limited.” EX1005 at 1:62-67.

1. Claim 1

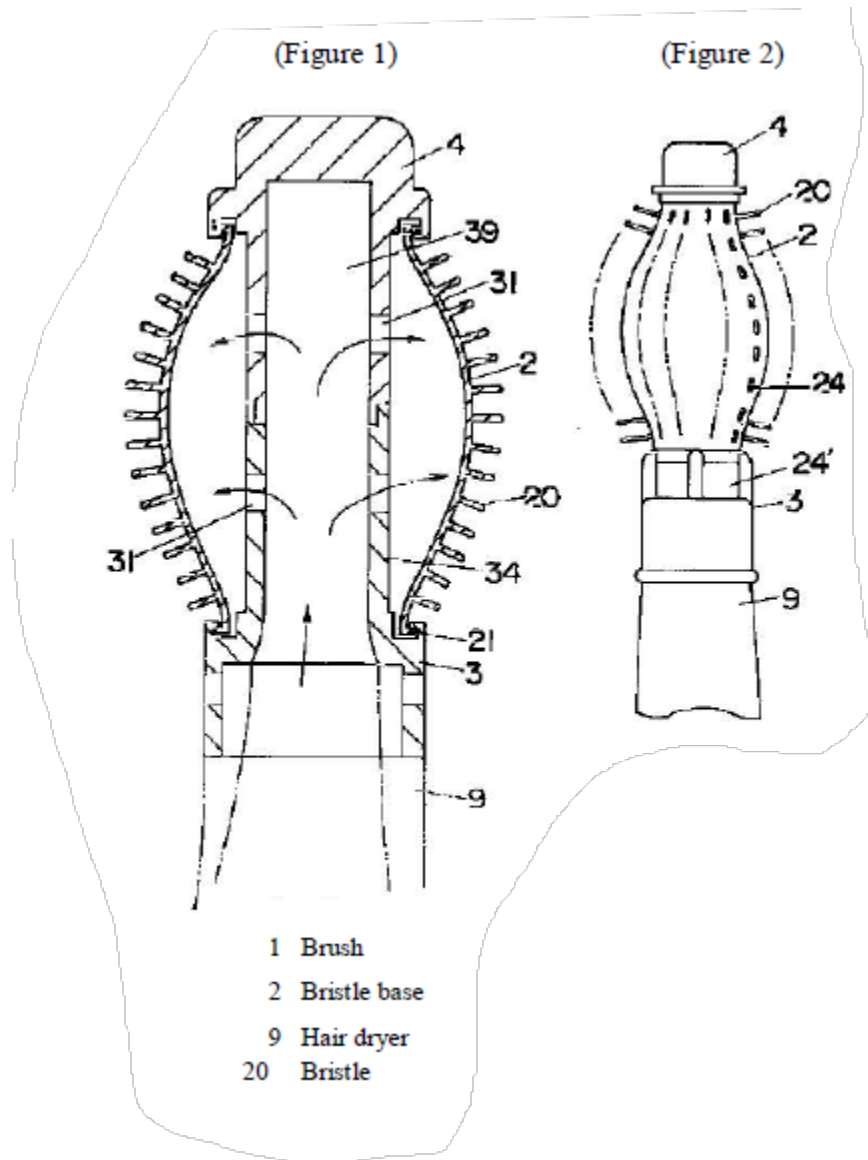
95. It is my opinion that the modification of Saito in view of the teachings of Lindsey renders obvious claim 1, for the reasons discussed below.

a) [1pre]: “An attachment for a hand held appliance comprising”

96. I understand that a preamble typically does not limit a claim. Regardless of whether the preamble of claim 1 is limiting, it is my opinion that the modification of Saito in view of the teachings of Lindsey renders this limitation obvious to one of ordinary skill in the art.

97. As I explained above in the Overview of the Prior Art, Saito is directed to a hair dryer. EX1004 at Abstract. Saito discloses a hair dryer that “comprises a hair dryer body 9, into which is built a hot air blowing device or a steam generation device, and a brush 1 that is detachably mounted on a blowing port portion of this hair dryer body 9.” EX1004 at ¶ (0011).

98. Figures 1 and 2 of Saito (reproduced below) are a cross-sectional and front view (respectively) of an embodiment of Saito. EX1004 at ¶ (0034).



99. Saito discloses “a hair dryer with an attached brush” that comprises “a bristle base” that “is connected to a blowing port of a hair dryer body and air or steam is blown out from the hair dryer body via discharge ports formed in the bristle base of the brush.” EX1004 at ¶ (0005). In my opinion, Saito’s “attached brush”

meets the “an attachment for a hand held appliance” of claim limitation [1pre]. The modification of Saito to use vanes as instructed by Lindsey would not change this aspect of Saito. Therefore, in my opinion claim limitation [1pre] is obvious over the modification of Saito in view of the teachings of Lindsey.

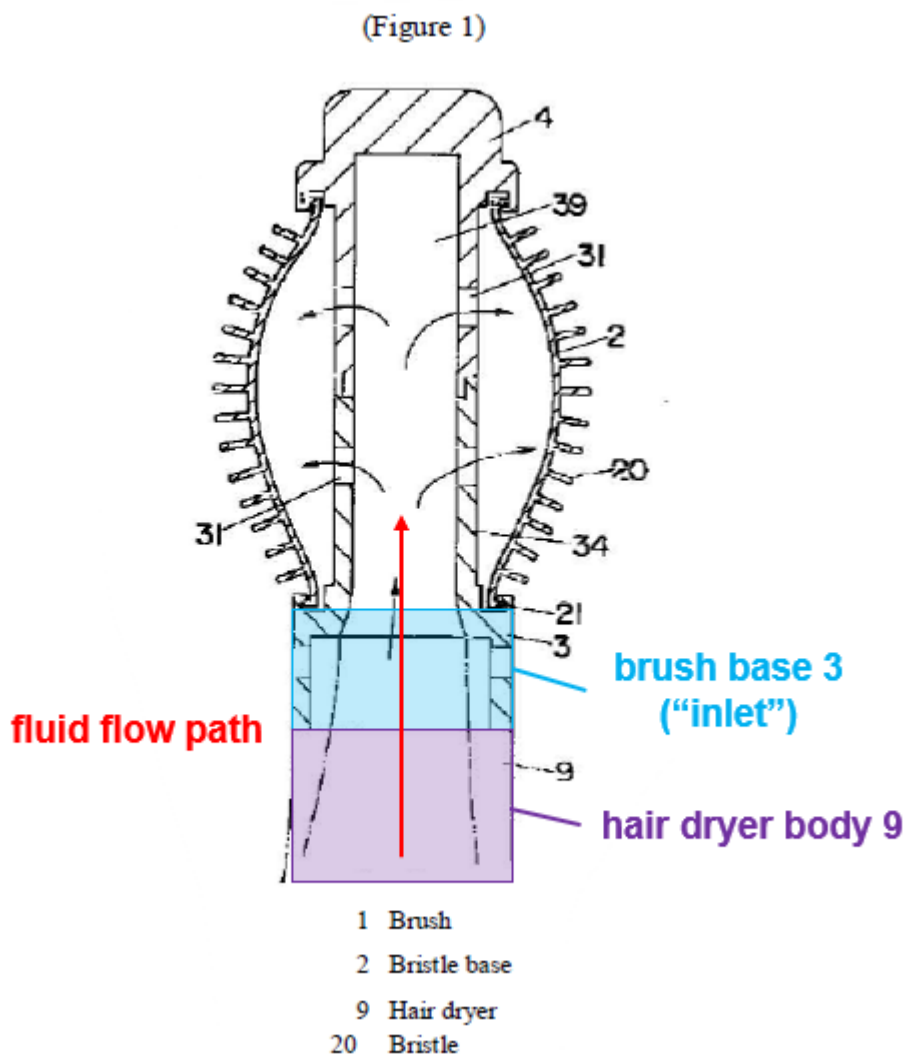
b) [1a]: “an inlet in a proximal first portion of the attachment;”

100. It is my opinion that the modification of Saito in view of the teachings of Lindsey renders this limitation obvious to one of ordinary skill in the art.

101. As I explained above with respect to claim element [1pre], Saito’s “attached brush” has a “brush base 3” that attaches to the hair dryer. Thus, Saito’s “brush base 3” is a “proximal first portion of the attachment” as required by claim limitation [1a]. Moreover, the “brush base 3” works as an “inlet” into the attachment, because it receives “air or steam discharged” from the hair dryer.

102. As shown in the annotated Figure 1 of Saito below, Saito’s attachment is “a brush 1 that is detachably mounted on a blowing port portion of [a] hair dryer body 9.” EX1004 at ¶ (0011). Saito indicates that “[t]his brush 1 is mounted onto the hair dryer body 9 by covering a portion of a blowing port of the hair dryer body 9 with the brush base 3 of the brush 1.” The air that is discharged from the “hair dryer body 9 enters a space between an outer surface of the tube 34 and an inner surface of the bristle base 2 from the airflow channel 39 within the tube 34 via openings 31

provided in the tube 34.” EX1004 at ¶ (0013). Thus, it is my opinion that Saito teaches “an inlet in a proximal first portion of the attachment.”



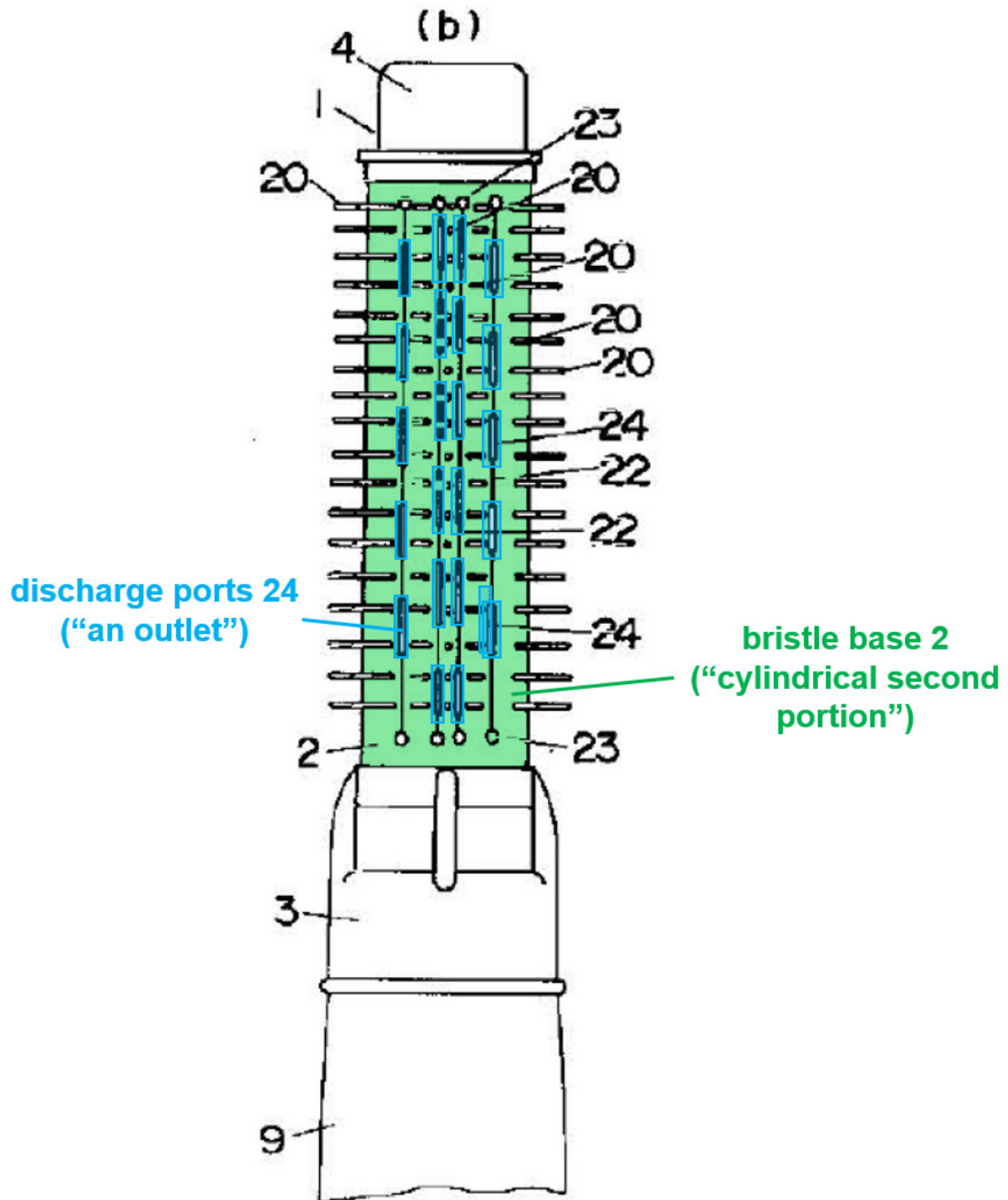
103. The modification of Saito to use Lindsey’s vanes would not change this aspect of Saito. Therefore, in my opinion claim limitation [1a] is obvious over the modification of Saito in view of the teachings of Lindsey.

c) [1b]: “an outlet in a cylindrical second portion of the attachment; and”

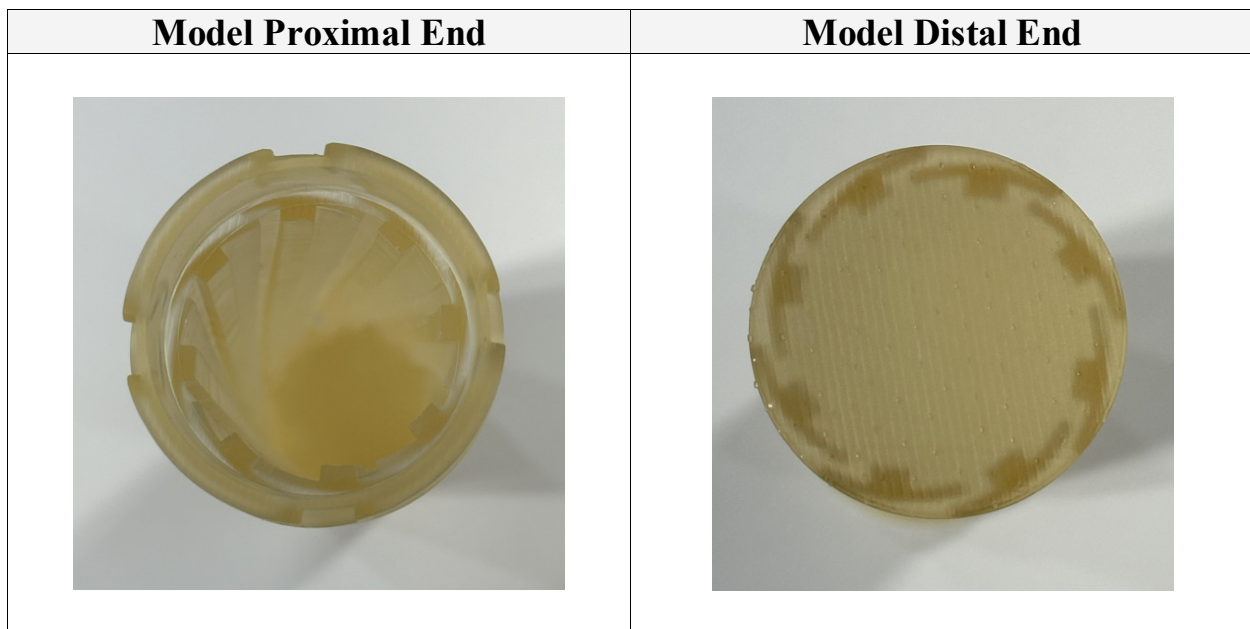
104. It is my opinion that the modification of Saito in view of the teachings of Lindsey renders this limitation obvious to one of ordinary skill in the art.

105. Saito’s “bristle base 2” is a cylindrical second portion that has an outlet. Saito explains that “numerous discharge ports 24 are provided in the surface of the bristle base 2 that open between rows of the bristles 20.” EX1004 at ¶ (0012). Saito also explains that when air is “discharged from the hair dryer body 9,” the air “enters a space between an outer surface of the tube 34 and an inner surface of the bristle base 2 from the airflow channel 39 within the tube 34 via openings 31 provided in the tube 34 and is discharged to the outside from discharge ports 24 formed in the bristle base 2.” EX1004 at ¶ (0014).

106. As shown in the annotated Saito Figure 5(b) below, the bristle base 2 “is formed in a cylindrical shape,” and is cylindrically shaped when “the distance between the brush bases 3, 4” is maximized, that is, when the bristle base is fully extended. EX1004 at ¶ (0017)-(0018), Fig. 5(b). Thus, in my opinion, Saito teaches “an outlet in a cylindrical second portion of the attachment.”



107. As I explain in more detail below with respect to claim element [1f], an example model that approximates a cylindrical attachment (as taught by Saito) outfitted with vanes (as taught by Lindsey) is shown below:



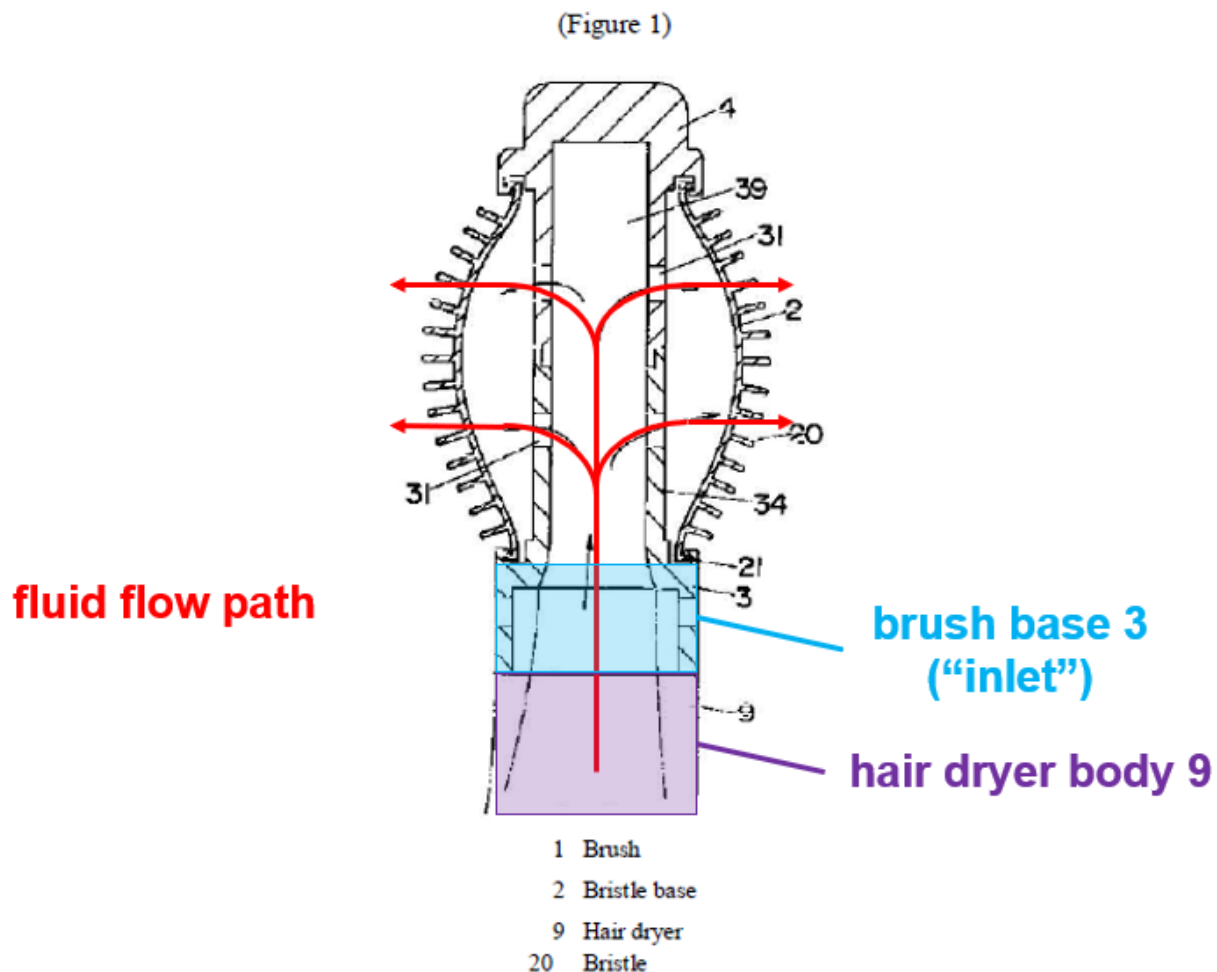
108. As shown in the photos above, the modification of Saito to use an array of vanes as taught by Lindsey in place of Saito's bristle base would result in a cylindrical attachment with outlets formed between the adjacent vanes. Therefore, in my opinion claim limitation [1b] is obvious over the modification of Saito in view of the teachings of Lindsey.

d) [1c]: “a fluid flow path between the inlet and the outlet,”

109. It is my opinion that the modification of Saito in view of the teachings of Lindsey renders this limitation obvious to one of ordinary skill in the art.

110. Saito explains that fluid flows in a path from the inlet in brush base 3, into the brush base 2, and out through the outlets in bristle base 2. Saito teaches that the brush 1 “is mounted onto the hair dryer body 9 by covering a portion of a blowing port of the hair dryer body 9 with the brush base 3 of the brush 1.” EX1004 at ¶ (0013).

111. As shown in the annotated Saito Figure 1 below, when “air or steam [is] discharged from the hair dryer body 9,” the air or steam “enters a space between an outer surface of the tube 34 and an inner surface of the bristle base 2 from the airflow channel 39 within the tube 34 via openings 31 provided in the tube 34 and is discharged to the outside from discharge ports 24 formed in the bristle base 2.” EX1004 at ¶ (0014). In my opinion, Saito teaches “a fluid flow path between the inlet and the outlet” as required by claim element [1c].



EX1004 at Fig. 1.

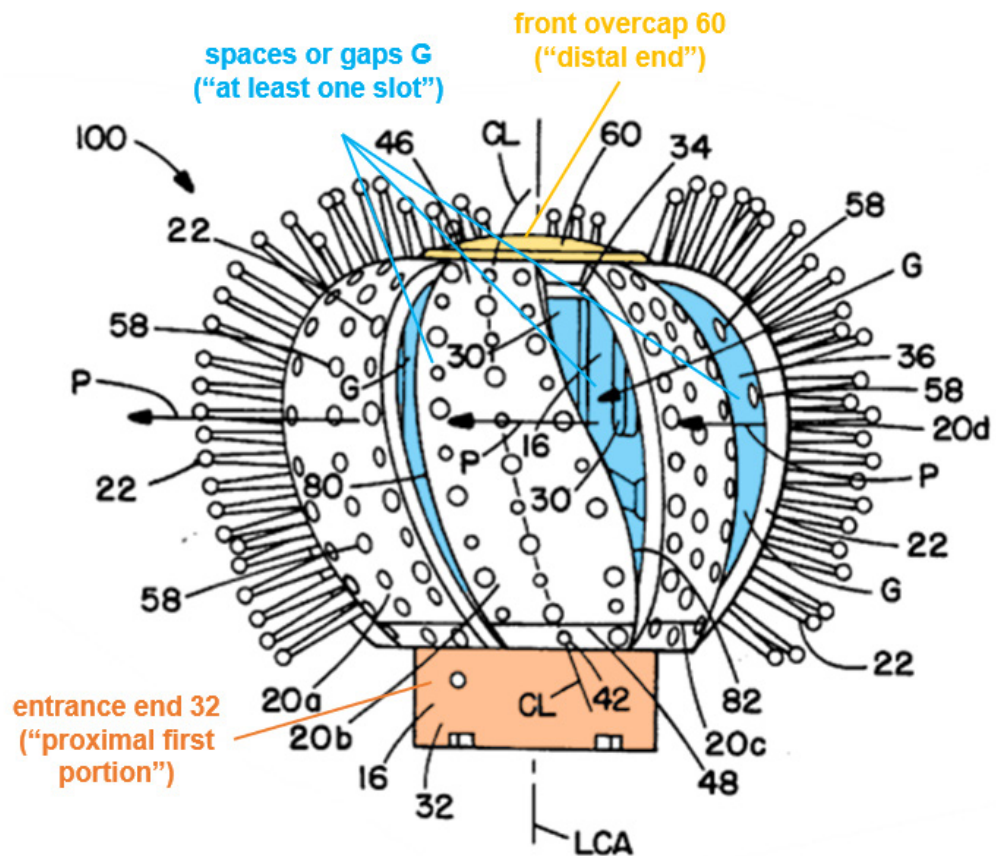
112. The modification of Saito to use Lindsey's vanes would not change this aspect of Saito. Therefore, in my opinion claim limitation [1c] is obvious over the modification of Saito in view of the teachings of Lindsey.

- e) **[1d]: “wherein the outlet in the cylindrical second portion of the attachment comprises at least one slot extending continuously from the proximal first portion to a distal end of the attachment,”**

113. It is my opinion that the combination of Saito and Lindsey renders this limitation obvious to one of ordinary skill in the art.

114. In my opinion, Lindsey teaches this limitation because the “spaces or gaps G” that are formed between each pair of adjacent vanes each extend from the “entrance end 32” of Lindsey’s attachment continuously, all the way to the “front overcap 60.”

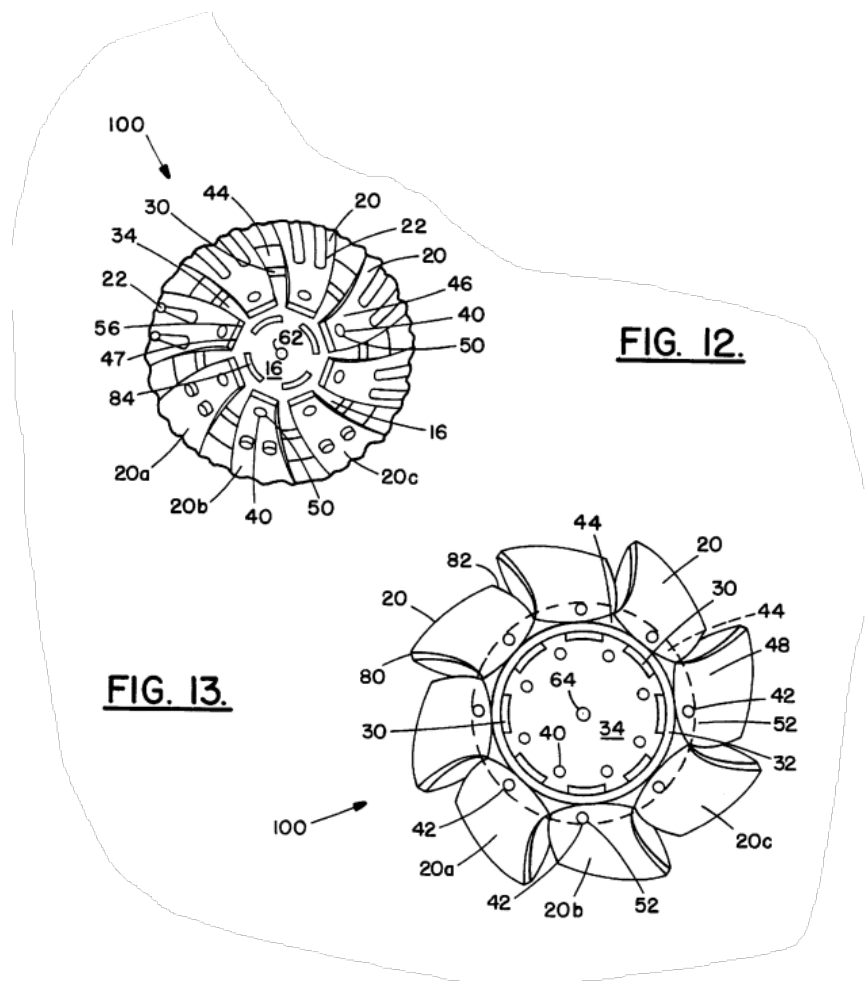
115. As shown in the annotated Lindsey Figure 11 below, the “vanes 20 are elongated and, when viewed from their exterior, they are disposed generally longitudinally along and generally parallel to longitudinal central axis LCA of hair styler 100.” EX1005 at 8:29-31. This arrangement of the vanes “provide spaces or gaps G,” (*i.e.*, “at least one slot” as claimed), “of varying widths and radial extends along and between side edges 80, 82 of mounted adjacent vanes.” EX1005 at 8:47-49, Fig. 11.

FIG. 11.

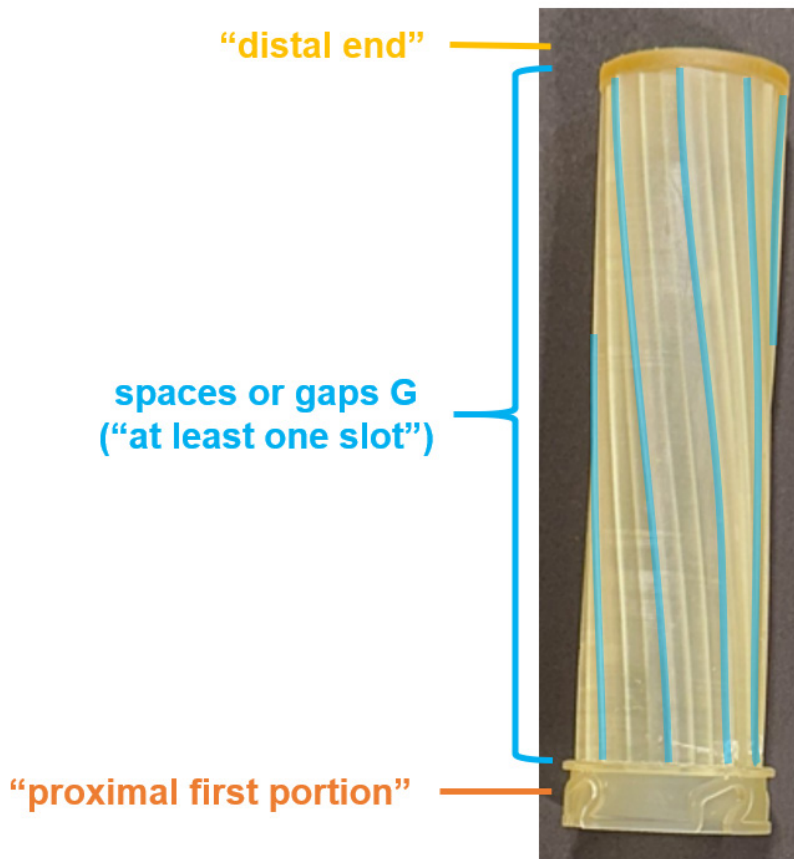
116. Also shown in the annotated Figure 11 above, Lindsey's gaps G (which, in my opinion, are "at least one slot" as required by this claim limitation [1d]) "extend continuously from the proximal first portion to a distal end of the attachment."

117. Lindsey explains that "[t]he means for mounting vanes 20 onto core 1[6] include . . . a circular array of pins 40 extending axially forward from the front surface of front wall 34, and a circular array of pins 42 extending axially rearward from vertical annular flange 44 located adjacent entrance end 32 of core 16." EX1005 at 6:32-40.

118. Figure 11 also shows that at the distal end of the attachment, the “front ends 46 of vanes 20 are maintained in their mounted positions on pins 40 by front overcap 60 when it is secured to core front wall 34, thereby retaining vane front ends 46 between overcap 60 and wall 34.” EX1005 at 7:31-34. At the proximal first portion of the attachment, “vane back ends 48 are mounted on pins 42 extending axially to the rear of core annular flange 44,” and the “[b]ack end edges 49 of vanes 20 are near or touch the outer surface of core entrance end 32.” EX1005 at 7:35-40, 9:22-26, Figs. 12 & 13.



119. An annotated photo of the model that approximates a cylindrical Saito attachment outfitted with vanes as taught by Lindsey is shown below:



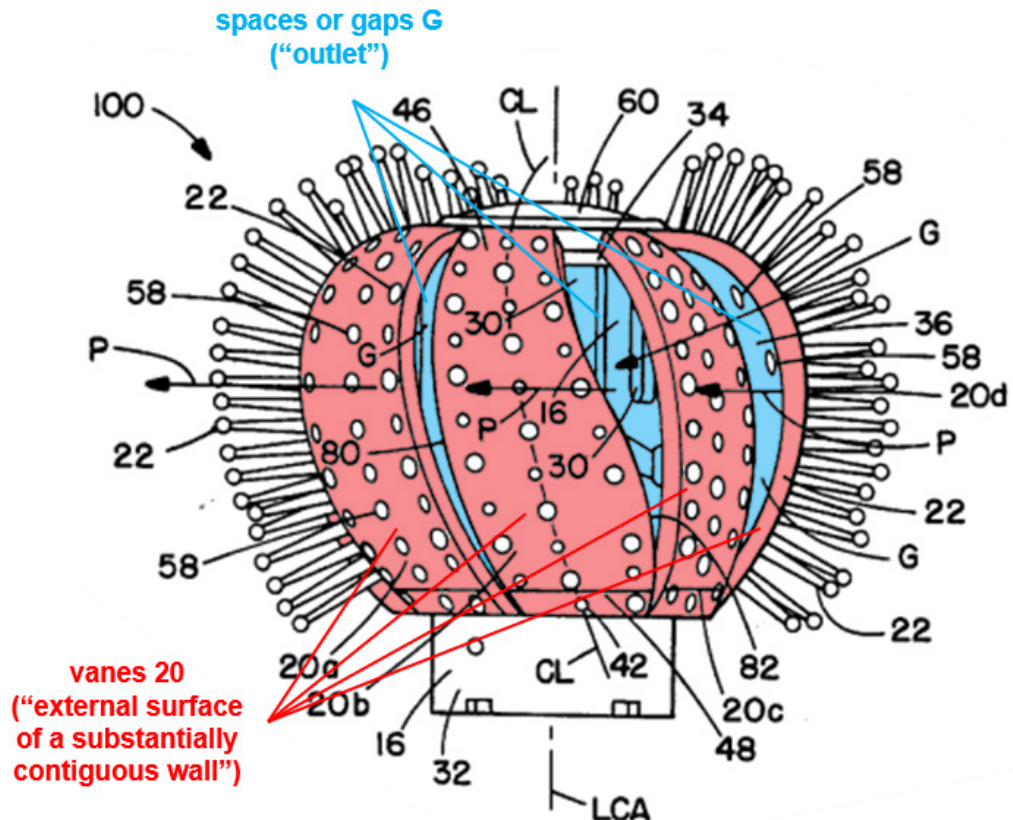
120. As shown in the photo, the modification of Saito to use an array of vanes as taught by Lindsey as a substitute for Saito's bristle base would have also resulted in a cylindrical attachment having outlets (Lindsey's gaps G) formed between each pair of adjacent vanes that each extend continuously from the proximal first portion of the attachment to the distal end. Therefore, in my opinion claim limitation [1d] is obvious over the modification of Saito in view of the teachings of Lindsey.

f) [1e]: “wherein the outlet is at least partially defined by an external surface of a substantially contiguous wall of the attachment and”

121. It is my opinion that the modification of Saito in view of the teachings of Lindsey renders this limitation obvious to one of ordinary skill in the art.

122. As I explained above, Lindsey’s “gaps G” that are formed between adjacent vanes are outlets. Lindsey explains that its “vanes” form the “exterior of a portion of the hair styler,” that is, an “external surface” as required by claim limitation [1e], and those vanes each are a substantially contiguous wall of the attachment. The outlet is at least partially defined by those substantially contiguous walls because as Lindsey explains, it “provide[s] spaces or gaps G of varying widths and radial extents along and between side edges 80, 82 of mounted adjacent vanes.” EX1005 at 4:15-20, 8:47-49.

123. Lindsey’s “gaps G,” that is, its “outlets,” are defined in part by the vanes, and those vanes are substantially contiguous because they extend from the distal end of the attachment (at “front overcap 60”) to the “outer surface of core entrance end 32,” which is a “proximal first portion” of the attachment, as required by claim element [1a], as shown in the annotated Lindsey Figure 11, below. EX1005 at 9:7-26, Fig. 11.

FIG. II.

124. Thus, in my opinion, Lindsey’s “gaps G” that would have been formed in the combined Saito/Lindsey attachment would have been “outlet[s]” that are “at least partially defined by an external surface of a substantially contiguous wall of the attachment,” as required by claim element [1e].

- g) [1f]: “is configured to direct fluid flow emitted from the outlet tangentially along and around the external surface of the substantially contiguous wall to form a circumferential fluid flow around the cylindrical second portion of the attachment that encourages hair to automatically wrap around the cylindrical second portion,”

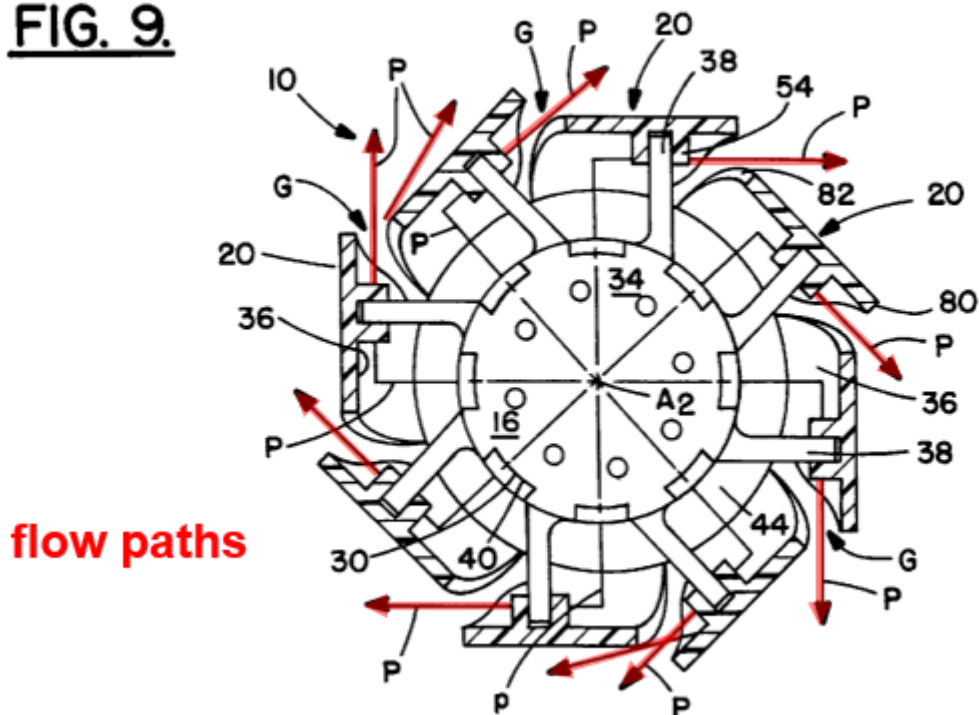
125. It is my opinion that the combination of Saito and Lindsey renders this limitation obvious to one of ordinary skill in the art.

126. Saito teaches air outlets in the form of at least one slot along the longitudinal direction of a cylindrical second portion of an attachment as discussed above. One of skill in the art modifying Saito would have used Lindsey's vanes to provide for the outlets in the form of slots and replaces Saito's radial airflow with tangential airflow as taught by Lindsey's structure. The proposed combination would have replaced Saito's single-piece design with Lindsey's "turbinate arrangement of vanes," to form Saito's cylindrical bristle base (*i.e.*, "the cylindrical second portion").

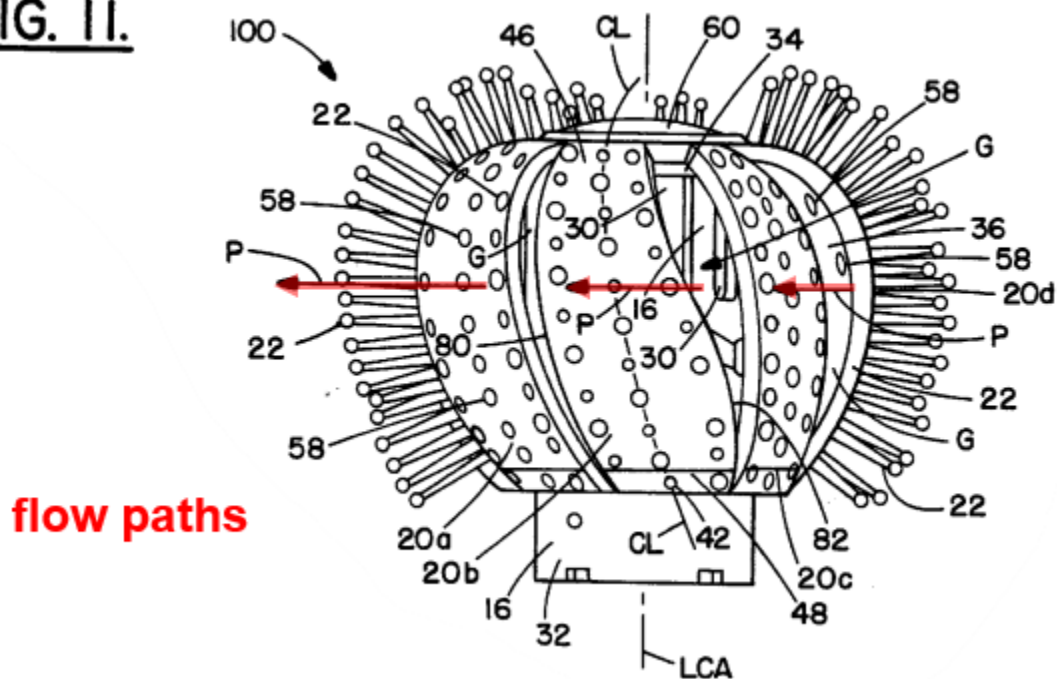
127. In my opinion, one of ordinary skill in the art would have been motivated to overcome Saito's shortcomings through Lindsey's vanes to generate the tangential airflow that yields the benefits of better hair styling. That tangential airflow would be along and around the Saito cylindrical base. It would have been obvious to one of ordinary skill in the art to combine Lindsey with Saito for the same reasons I have discussed above.

128. Lindsey discloses that its "vanes 20 are disposed in a turbinate arrangement about central axis CA of internal chamber 26, in the paths of the air exiting internal chamber 26, through vents 28, 30, in flow paths p which are approximately transverse or perpendicular to central axis CA of internal chamber 26." EX1005 at 5:55-60. These "exterior plural flow paths . . . manifest different angular directions about the central axis of the internal chamber," and the "different

angular directions can be approximately tangential to the hair styler.” EX1005 at 3:26-30, Figs. 9 & 11.

FIG. 9.

v

FIG. II.

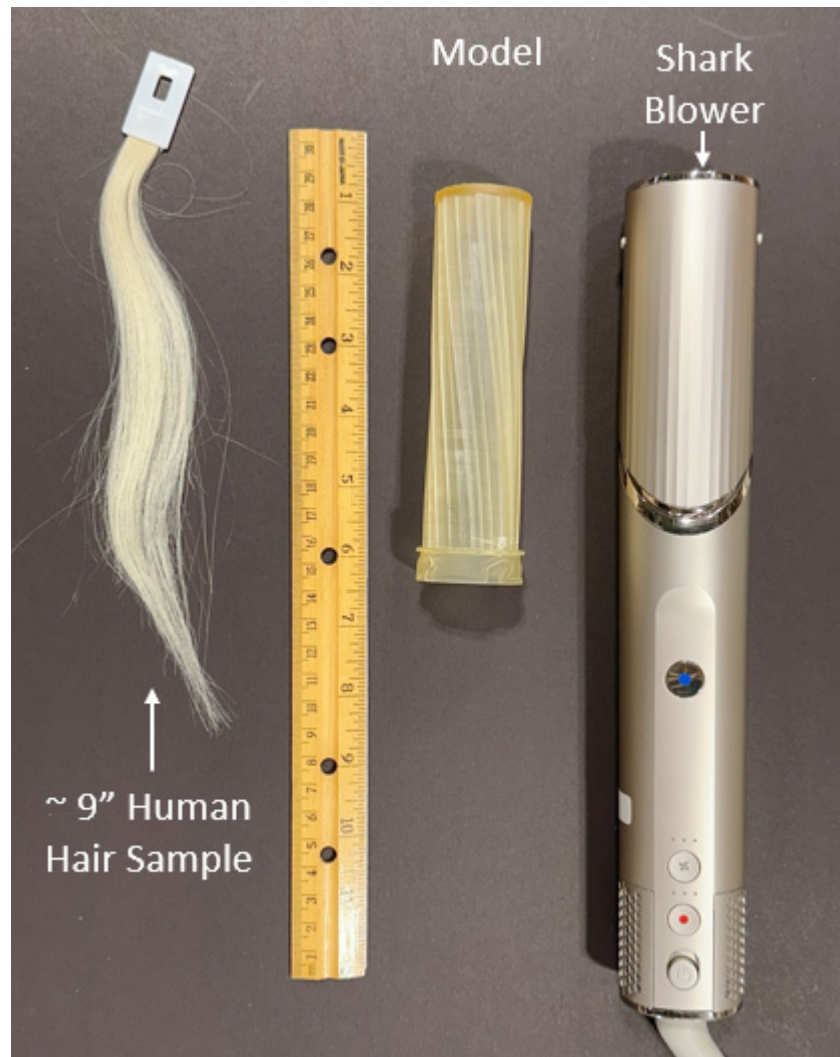
129. Lindsey further explains that “the air discharged from one vane is directed over, preferably at shallow angles over, and through the prongs on the outer surface of an adjacent vane to thereby provide above-mentioned advantages of air flow along, rather than perpendicular to the lie of hair strands among the prongs.” EX1005 at 10:28-33. The air flow is directed “around the external surface of the substantially contiguous wall,” (*e.g.*, the outer portion of a vane from Lindsey when applied to the Saito cylinder). That “spinning” air flow “render[s] the hair styler capable of providing additional lift and volume to hair.” EX1005 at 10:33-38.

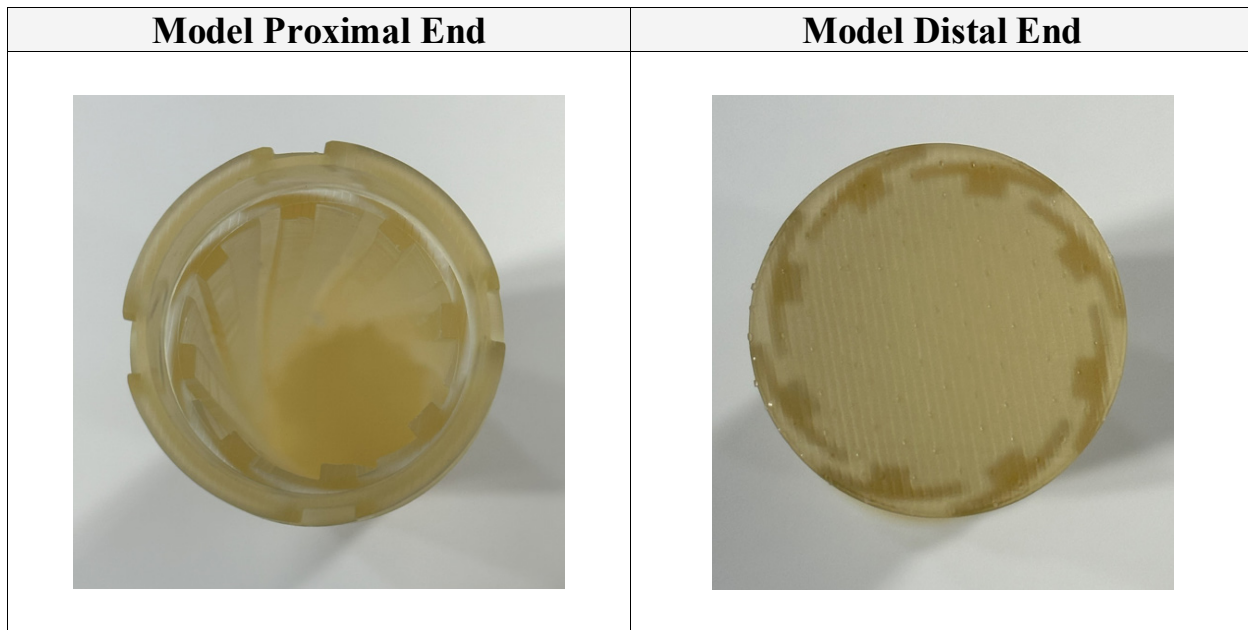
130. In my opinion, it would have been obvious to one of ordinary skill in the art that a modified Saito cylindrical attachment which used vanes in the manner taught by Lindsey would have produced the same spinning, turbulent fluid flow as Lindsey’s hair styler, and particularly would have done so in the fully extended, cylindrical shape.

131. Due to Lindsey’s disclosure of using multiple vanes around the circumference of the attachment, the airflow would have generated circumferential airflow around Saito’s cylindrical attachment. The modified Saito attachment with the teaching of Lindsey’s vanes would “encourage hair to automatically wrap around the cylindrical second portion” as required by claim limitation [1f]. It was well-known to persons of ordinary skill in the art that air that is directed tangentially to a surface will be attracted to the surface due to the Coanda effect, and that effect had

been used in hair care prior to the effective filing date of the '979 patent. *See, e.g.*, EX1016 at 22:30-23:3; EX1017 at 1, 17; EX1026 at ¶¶ [0009]-[0011]; EX1028 at ¶ [0036]; *see also, e.g.*, EX1018 at 14–15, Fig. 1 (describing a “Coanda jet” that “may . . . entrain a particulate stream,” which could include hair); EX1019 at 4, Fig. 10 (describing use of a cotton tuft to show “[f]ull 180° Coanda turning” or wrapping around the cylindrical Coanda surface).

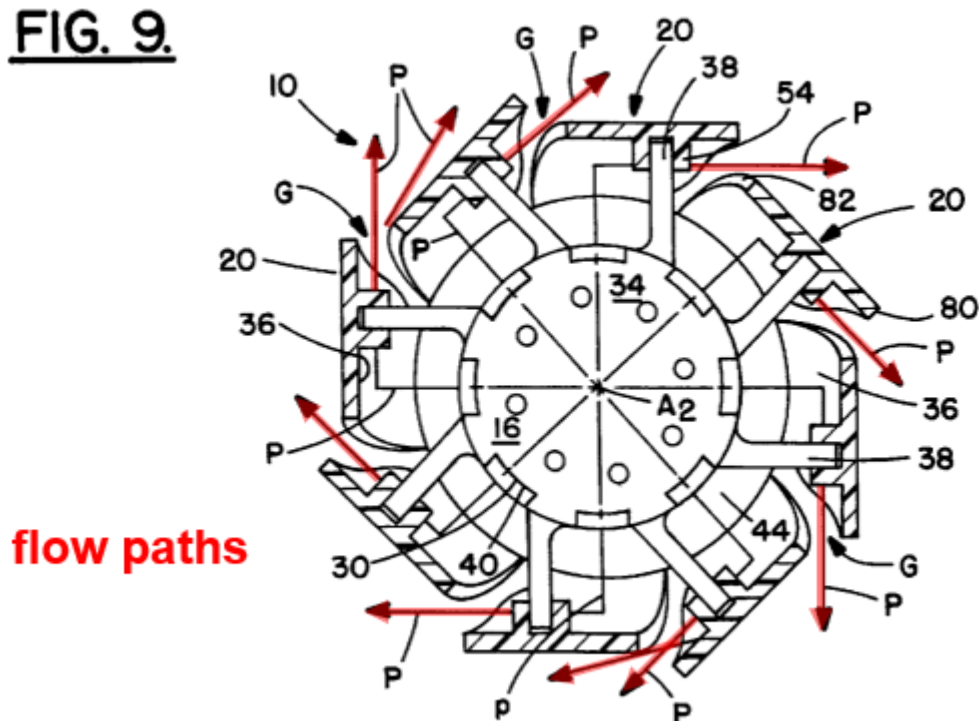
132. Further, I experimentally confirmed that the improved Saito configuration using Lindsey’s vanes would have “encourage[d] hair to automatically wrap around the cylindrical second portion,” as required by claim element [1f]. To test the proposed Saito/Lindsey combination, I requested the creation of the model shown below, which approximates a fully-extended Saito attachment, such that the attachment is cylindrical, that includes a plurality of vanes as taught by Lindsey:





133. As shown in the images above, the model includes eight vanes, which is the same as shown in Lindsey's Figure 9:

FIG. 9.



In essence, the model approximates the shape that would be created by viewing Lindsey's Figure 9 as a 2D cross-section, and extruding the cross section to form a cylindrical attachment. I note that two minor modifications were made to Lindsey's vanes (as depicted in Figure 9) in the model: (1) the vanes were given a slightly curved surface; and (2) the edges of the vanes were slightly extended in order to decrease the width of the gaps/slots formed between each vane. Both of these modifications would have been obvious to one of skill in the art.

134. For example, with respect to the slightly curved surface, it would have been well-known to a person of skill in the art that a longitudinally curved surface yields increased entrainment compared to a planar surface. *See, e.g.*, EX1008 at 1-2 ("When a jet attaches to a convex surface as a result of the Coanda effect, the accompanying longitudinal curvature yields increased entrainment and jet growth compared with a wall jet on a planar surface."); EX1020 at 1 ("In some instances curvature is used to generate supercirculation by altering the position of the rear stagnation point (i.e. the location at which the flow separates from the surface.>"). It would have been obvious to a person of skill in the art that adding a slight longitudinal curvature to Lindsey's vanes (as was done in the model) would have increased the tangential/circumferential airflow that is described as an advantage of Lindsey's vanes.

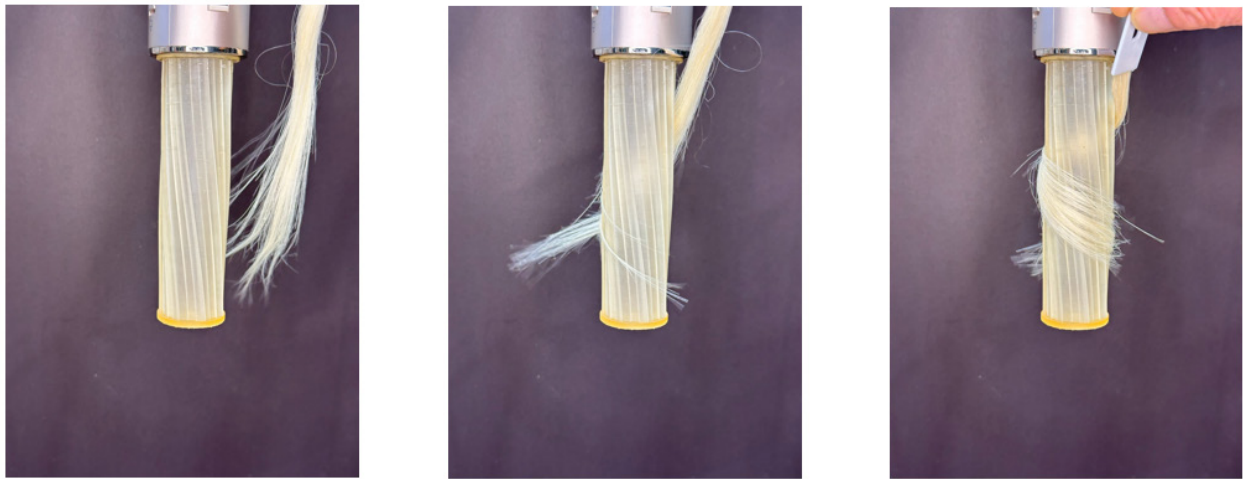
135. Extension of the edges of the vanes in order to decrease the width of the gaps/slots formed between each vane likewise would have been obvious to one of skill in the art. Saito describes the following problem in conventional brush attachments that was to be solved by the invention:

However, because the direction of discharge from the blowing port of the hair dryer is the same as the longitudinal direction (axial direction) of the bristle base and the direction of discharge from the discharge ports provided in the bristle base is perpendicular to that direction, the air or steam blown out from the discharge ports provided in the bristle base becomes concentrated in the vicinity of a tip section of the brush and is prone not to reach hair wound onto a central section of the brush, resulting in poor setting.

EX1004 at ¶ (0003). In my opinion, this statement reflects the recognition of a poor manifold design wherein the outlet ports (or slots) have a total discharge area that is a significant portion of the cross-sectional area of the manifold inlet. It would have been obvious to a person of skill in the art, in light of the above passage from Saito, that by establishing a smaller slot exit/discharge area, such that that total exit area of all the slots was a relatively small percentage of the cross-sectional area of the cylinder's interior (*e.g.*, at least less than 50%), the air blown from the slots would have been more uniformly discharged along the length of the slots (as opposed to concentrated in the vicinity of a "tip section" at the end of the attachment).

Accordingly, it would have been obvious to a person of skill in the art to have decreased the width of the vanes in a modified Saito configuration using Lindsey's vanes to create a more uniform slot discharge area.

136. To test whether the improved Saito configuration using Lindsey's vanes would have "encourage[d] hair to automatically wrap around the cylindrical second portion," as required by claim element [1f], I attached the model to a Shark FlexStyle air styling/drying blower. With the Shark FlexStyle blower on, I presented an approximately 9-inch sample of human hair to the model attachment. As shown in the photos below, the sample hair wrapped around the cylindrical attachment:



137. Exhibits 1022, 1023, and 1024 are videos of the tests that I performed using the model of the improved Saito configuration with Lindsey's vanes.

138. Accordingly, in my opinion claim limitation [1f] is obvious over the modification of Saito in view of the teachings of Lindsey.

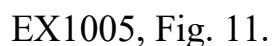
139. In any event, I understand that where a prior art apparatus is identical or substantially identical in structure, claimed properties or functional characteristics are presumed to be inherent. Thus, because the modified Saito configuration using an array of vanes as taught by Lindsey has all of the structural features of the claims, the additional functional limitations of the claim are inherently present.

h) [1g]: “wherein the external surface of the substantially contiguous wall is an outermost surface of the attachment along an entire length of the attachment from a beginning of the at least one slot to an end of the at least one slot, and”

140. It is my opinion that the modification of Saito in view of the teachings of Lindsey renders this limitation obvious to one of ordinary skill in the art.

141. In the proposed combination, the vanes of Lindsey are used to form the outlets in Saito and the Lindsey vanes used in Saito each forms a substantially contiguous wall. The external surface of Lindsey’s vanes is an outermost surface and run from the beginning of the slot to an end of the slot. Lindsey’s gaps G (*i.e.*, “at least one slot”) “extend[s] continuously from the proximal first portion to a distal end of the attachment.” Lindsey explains that “[t]he means for mounting vanes 20 onto core 1[6] include . . . a circular array of pins 40 extending axially forward from the front surface of front wall 34, and a circular array of pins 42 extending axially rearward from vertical annular flange 44 located adjacent entrance end 32 of core 16.” EX1005 at 6:32-36.

FIG. 11.



– 76 –

portion” of the attachment as claimed) to the distal end of the attachment (at “front overcap 60”).

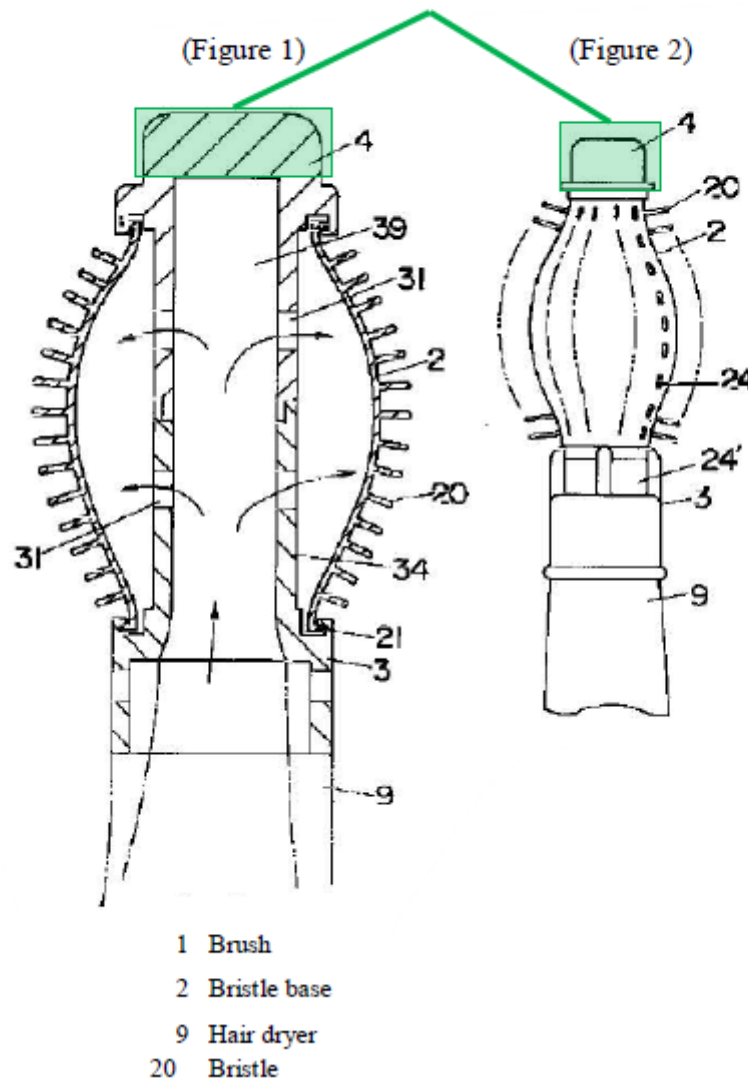
144. Accordingly, it is my opinion that Lindsey teaches that “the external surface of the substantially contiguous wall” (*i.e.*, Lindsey’s vanes), “is an outermost surface of the attachment along an entire length of the attachment from a beginning of the at least one slot to an end of the at least one slot,” (*i.e.*, Lindsey’s “gaps G” formed by the vanes), as required by this limitation. Therefore, in my opinion claim limitation [1g] is obvious over the modification of Saito in view of the teachings of Lindsey.

i) [1h]: “wherein the distal end of the attachment is closed.”

145. It is my opinion that the modification of Saito in view of the teachings of Lindsey renders this limitation obvious to one of ordinary skill in the art.

146. Saito’s brush attachment includes a “brush base 4” that is located at the distal end of the attachment, as shown in the following annotated versions of Figures 1 and 2:

brush base 4
(“distal end of the attachment is closed”)



EX1004 at ¶ (0011), Figs. 1 & 2.

147. The brush base 4 is connected to “tube 34 that penetrates a central section of the bristle base 2, and a plurality of ventilation ports 31 are formed in the tube 34, an interior space of which serves as an airflow channel 39.” EX1004 at ¶ (0012). The brush base 4 is depicted as closing the distal end of the “tube 34,” and

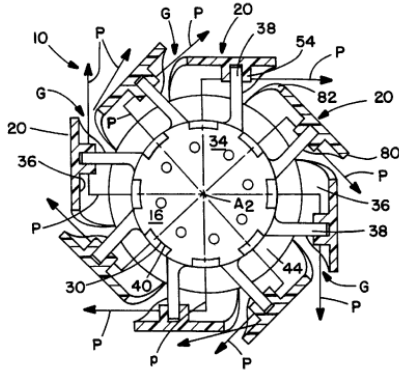
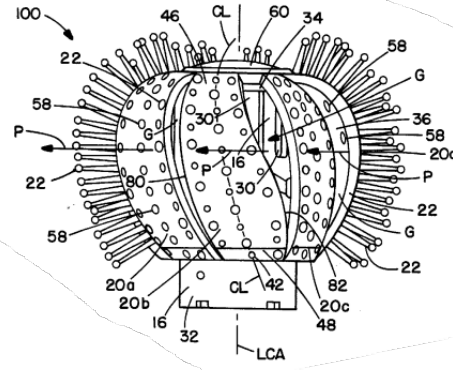
therefore Saito teaches that “the distal end of the attachment is closed,” as required by this limitation. The modification of Saito to use vanes as instructed by Lindsey would not change this aspect of Saito.

148. In any event, closing the distal end of the attachment would have been obvious to one of skill in the art because it would have increased the pressure drop across the slots, which would have beneficially increased the flow rate of the air exiting the slots. Therefore, in my opinion claim limitation [1h] is obvious over the modification of Saito in view of the teachings of Lindsey.

2. Claim 2: “The attachment of claim 1, wherein the outlet comprises a plurality of slots radially spaced around the attachment.”

149. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

150. Saito discloses a plurality of slots, and the proposed modification of Saito in view of Lindsey would provide slots that run the length of the attachment. As I explained above, Lindsey discloses that the arrangement of its vanes “provide[s] spaces or gaps G,” (*i.e.*, “a plurality of slots” as claimed), “of varying widths and radial extends along and between side edges 80, 82 of mounted adjacent vanes,” as shown in Figures 9 and 11:

FIG. 9.**FIG. 11.**

EX1005 at 8:47-54, Figs. 9 & 11.

151. In my opinion, Lindsey teaches that “the outlet comprises a plurality of slots radially spaced around the attachment.” Thus, one of ordinary skill in the art modifying Saito would have been motivated to replace Saito’s slots with a plurality of slots spaced around the attachment given the benefits of tangential airflow around the entire attachment as Lindsey provides. Therefore, in my opinion claim 2 is obvious over the modification of Saito in view of the teachings of Lindsey.

3. Claim 3: “The attachment of claim 1, wherein the attachment is configured so that, in use, the fluid emitted from the outlet is attracted to the external surface of the attachment.”

152. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

153. As I have discussed above with respect to claim limitation [1f], Lindsey discloses that “the air discharged from one vane is directed over, preferably at

shallow angles over, and through the prongs on the outer surface of an adjacent vane to thereby provide above-mentioned advantages of air flow along, rather than perpendicular to the lie of hair strands among the prongs.” The proposed modification of Saito to use an array of vanes as taught by Lindsey in place of the bristle base would have caused “the fluid emitted from the outlet [to be] attracted to the external surface of the attachment” as required by this additional limitation of claim 3. I note that this would have been the natural result of the Coanda effect, which would have caused an entrained airflow around the cylindrical attachment.

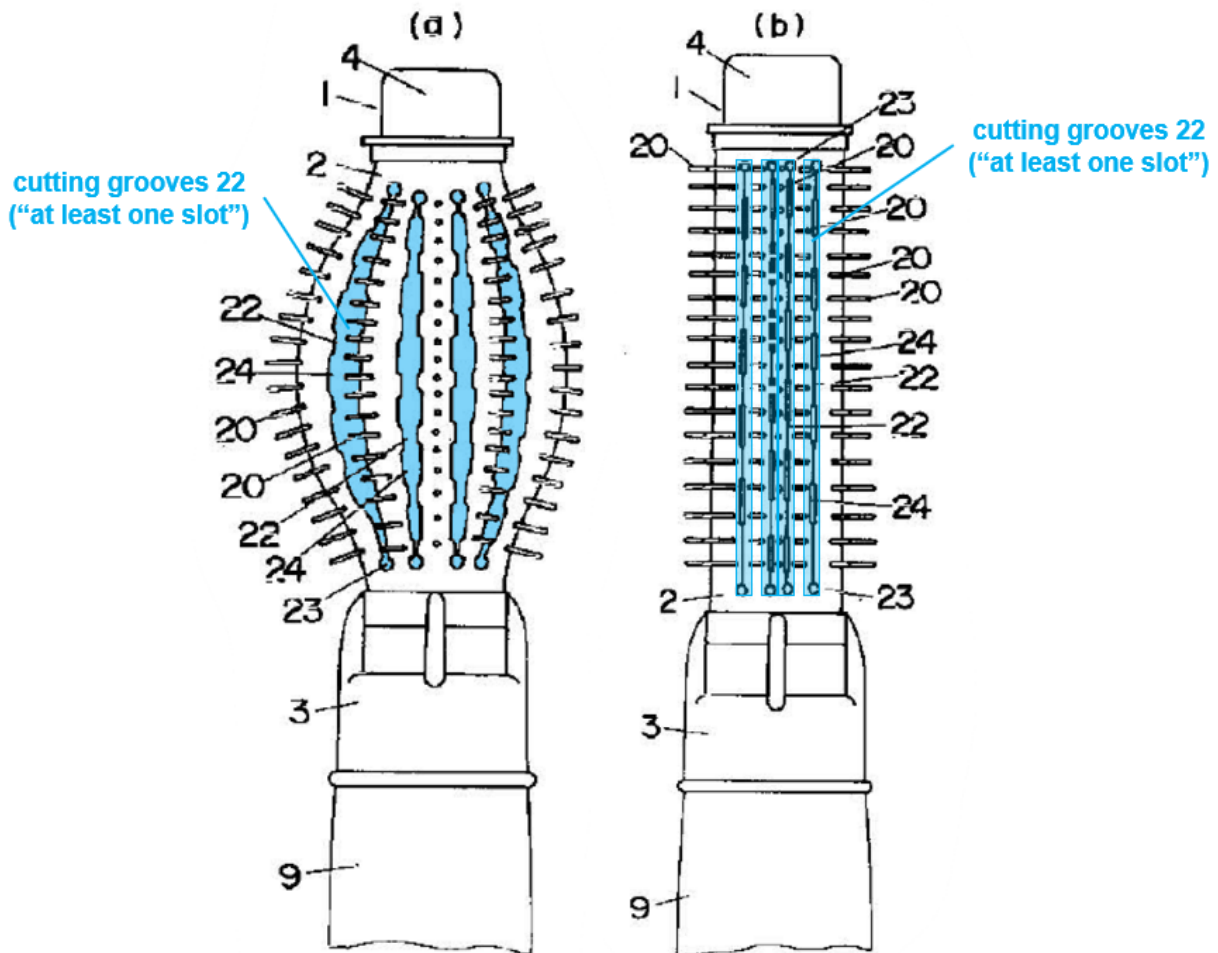
154. In any event, I understand that where a prior art apparatus is identical or substantially identical in structure, claimed properties or functional characteristics are presumed to be inherent. Thus, because the modified Saito configuration using an array of vanes as taught by Lindsey has all of the structural features of the claims, the additional functional limitations of this dependent claim are inherently present.

4. Claim 4: “The attachment of claim 1, wherein the outlet comprises two slots.”

155. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

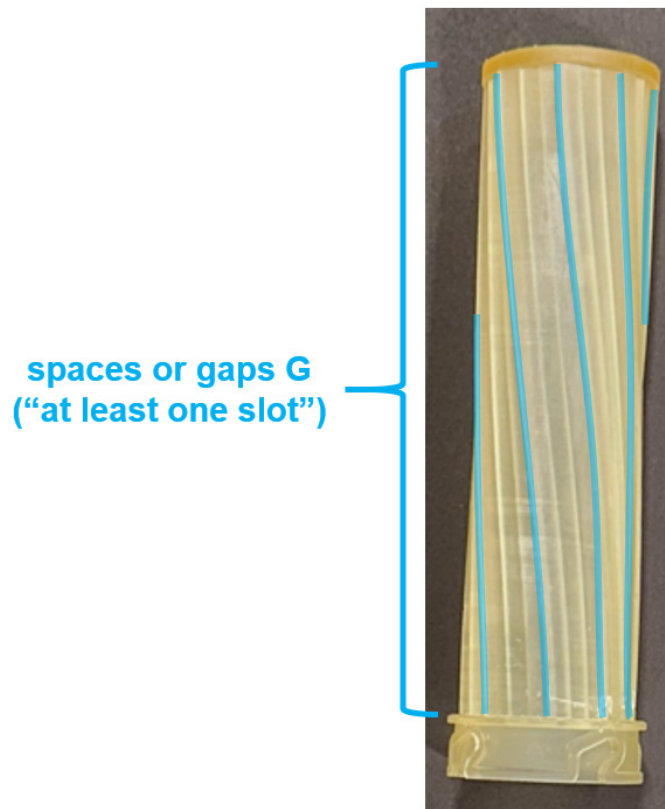
156. The proposed modification replaces Saito’s cutting grooves 22 (its “slots”) with longitudinal slots from Lindsey, around the circumference of the

attachment. Saito's bristle base 2 "is provided with a plurality of cutting grooves 22," (*i.e.*, it "comprises two slots"):



EX1004, (0017), Figs. 5a-5b.

157. Saito's slots would be replaced by an arrangement of vanes that "provides spaces or gaps G," (*i.e.*, comprising "two slots"), as shown in the annotated photo below:



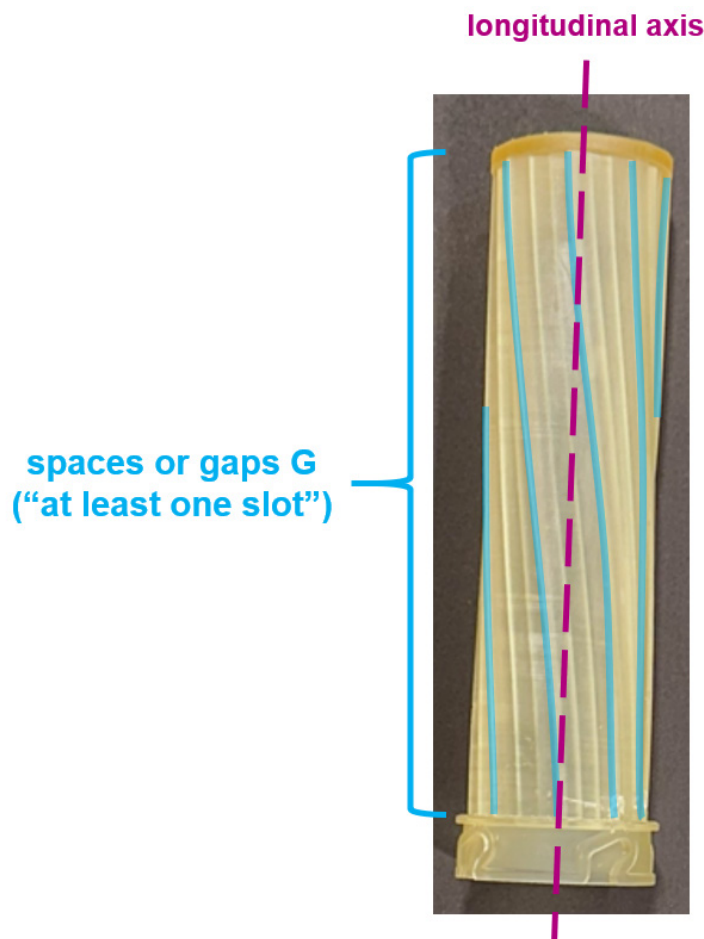
EX1005 at 4:15–20, Fig. 11. Therefore, in my opinion claim 4 is obvious over the modification of Saito in view of the teachings of Lindsey.

158. Additionally, I note that it would have been obvious to one of skill in the art that while a single slot may cause a wall jet flowing over a circular cylinder to remain attached to the cylinder more than halfway around (*i.e.*, more than 180°), two slots is sufficient to create a 360° flow. *See* EX1020 at 1, Figs. 1 and 15 (describing a theoretical/numerical exposition of a wall-jet emitted from a single slot remaining attached to a cylinder for greater than 180°).

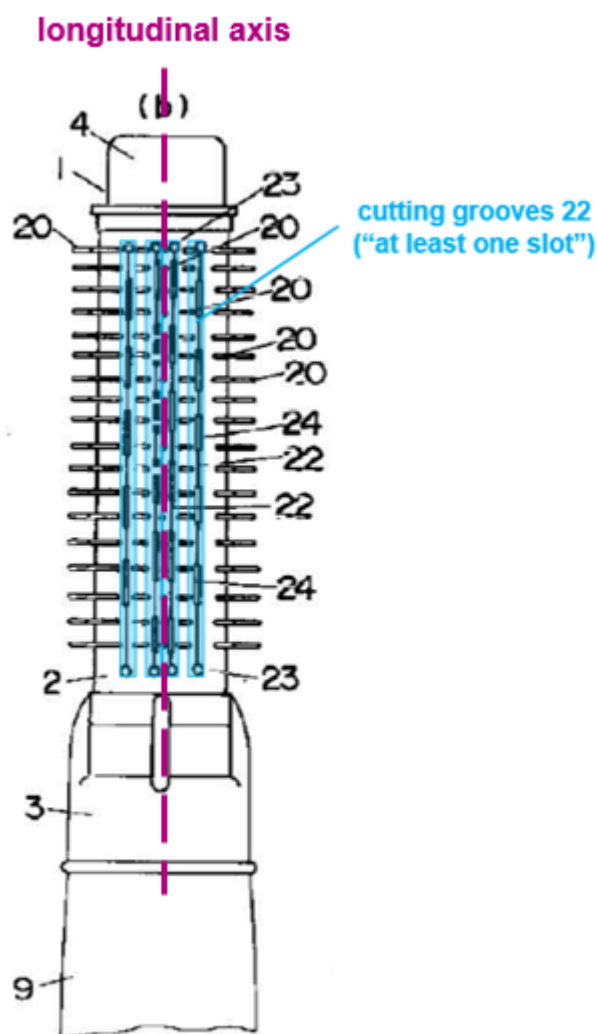
5. Claim 5: “The attachment of claim 1, wherein the attachment has a longitudinal axis and the at least one slot is parallel to the longitudinal axis.”

159. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

160. In the proposed modification, the vanes “are disposed in a turbinate arrangement,” as taught by Lindsey, which results in an attachment having slots that are non-parallel and are helical with respect to the longitudinal axis of the attachment, as shown in the annotated photo below:



161. Saito discloses an attachment having slots that are parallel to its longitudinal axis. EX1004 at ¶ (0006) (“[I]t is preferable for the bristle base to be divided into the plurality of pieces in the lateral direction by cutting grooves that run in the longitudinal direction, the discharge ports being formed in the cutting grooves.”).



EX1004, Fig. 5(b).

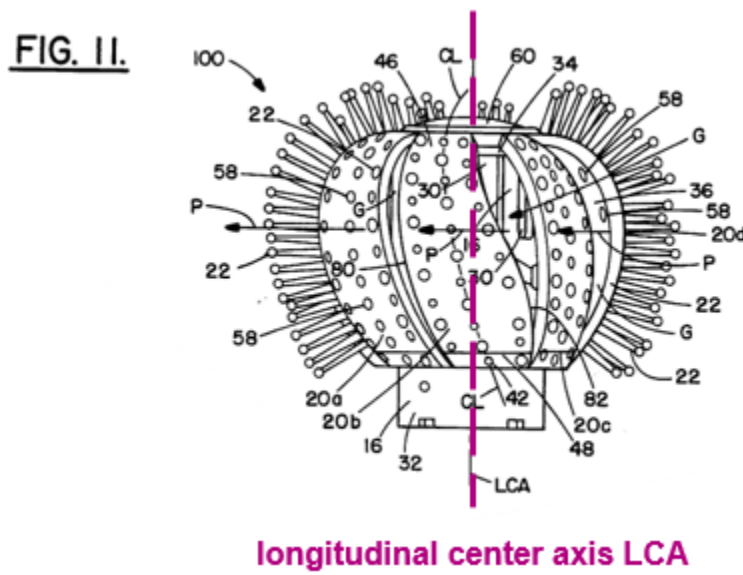
162. As shown in Figure 5(b) above, Saito's cutting grooves (*i.e.*, "the at least one slot") are parallel to the longitudinal axis. In my opinion, it would have been obvious to a person of ordinary skill in the art to have altered the geometry of the vanes used in the proposed Saito/Lindsey combination to result in the formation of parallel slots between the vanes, as taught by Saito's cutting groove configuration. Therefore, in my opinion claim 5 is obvious over the modification of Saito in view of the teachings of Lindsey.

6. Claim 6: "The attachment of claim 1, wherein the attachment has a longitudinal axis and the at least one slot is non-parallel to the longitudinal axis."

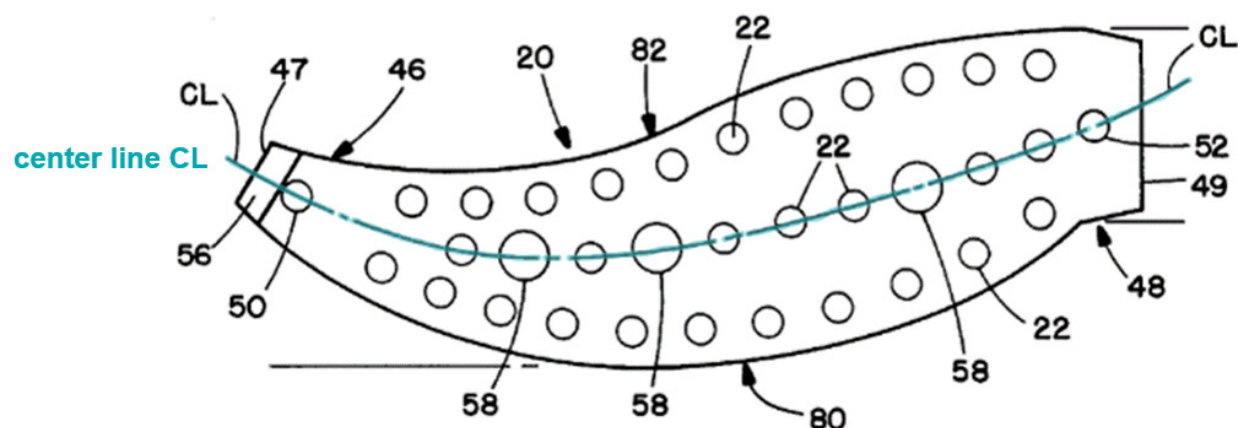
163. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

164. As I have discussed above, in the proposed modification of Saito, slots would have been formed by using Lindsey's vane system to generate tangential airflow. Lindsey teaches an example in which the slots are helical and thus, non-parallel to the longitudinal axis of the attachment.

165. Lindsey discloses an attachment with a "longitudinal central axis LCA":

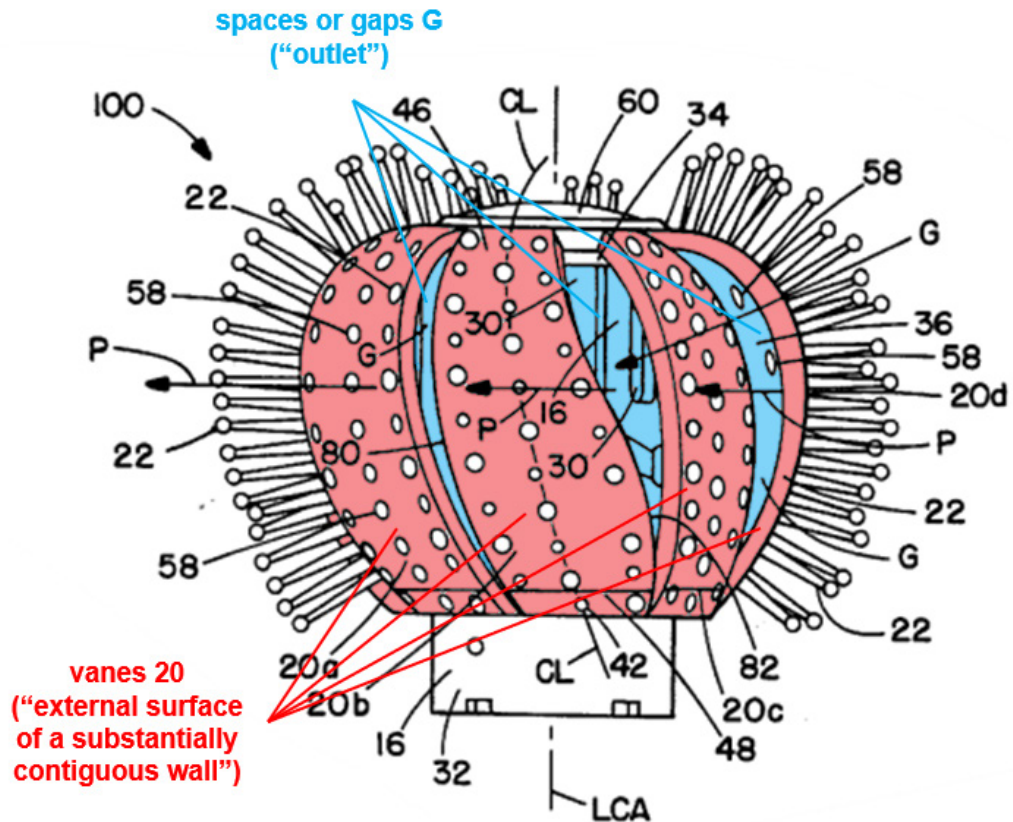


EX1005 at 8:29-32 (“FIG. 11 shows that vanes 20 are elongated and, when viewed from their exterior, they are disposed generally longitudinally along and generally parallel to longitudinal central axis LCA of hair styler 100 and to central axis CA of internal chamber 26.”). As shown in Figure 5, Lindsey’s vanes “have a center line CL that is curved, and that front end opening 50 and back end opening 52 are on center line CL, but they are not in direct linear alignment with each other”:

FIG. 5.

EX1005 at 6:57-60, Fig. 5.

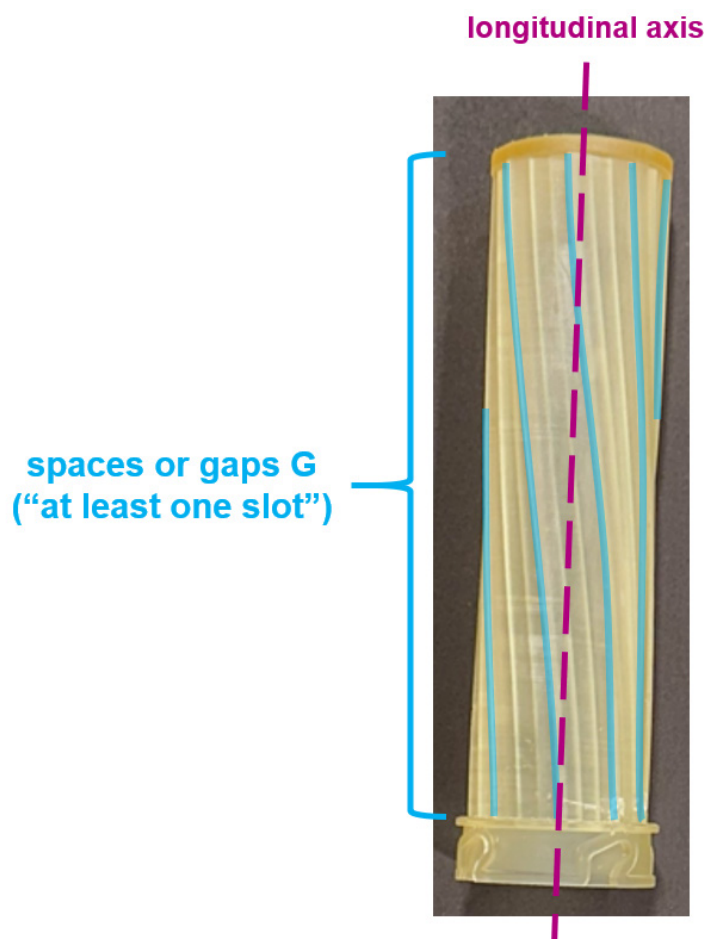
166. When attached to the hair styler, the “[v]ane center lines CL angularly intersect longitudinal central axis LCA and central axis CA,” and “portions of the upper ends of the vanes . . . are offset to the left of, and portions of the lower ends of the vanes . . . are offset to the right of, longitudinal axis LCA of hair styler 100”:

FIG. II.

EX1005 at 8:35-41, Fig. 11.

167. Accordingly, the gaps G (*i.e.*, “the at least one slot”) formed between each pair of adjacent vanes is non-parallel to the longitudinal axis LCA of Lindsey’s attachment, as required by claim 6.

168. As demonstrated by the model that approximates a fully-extended, cylindrical Saito attachment that uses an array of vanes as taught by Lindsey, the modified Saito/Lindsey attachment would have likewise resulted in slots that are “non-parallel to the longitudinal axis” as required by claim 6:



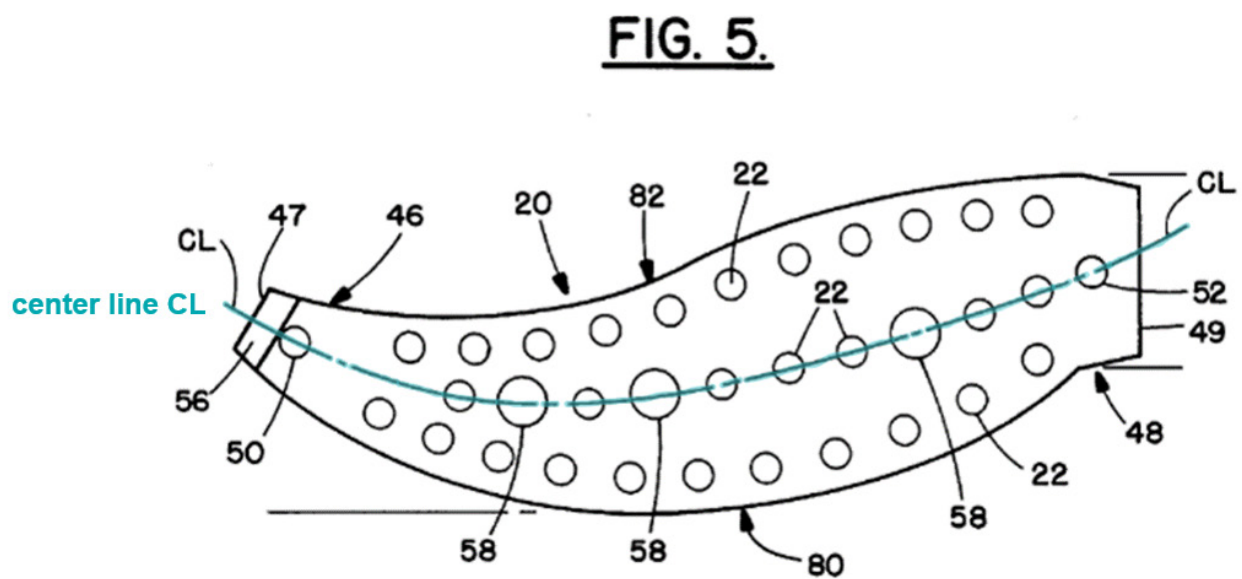
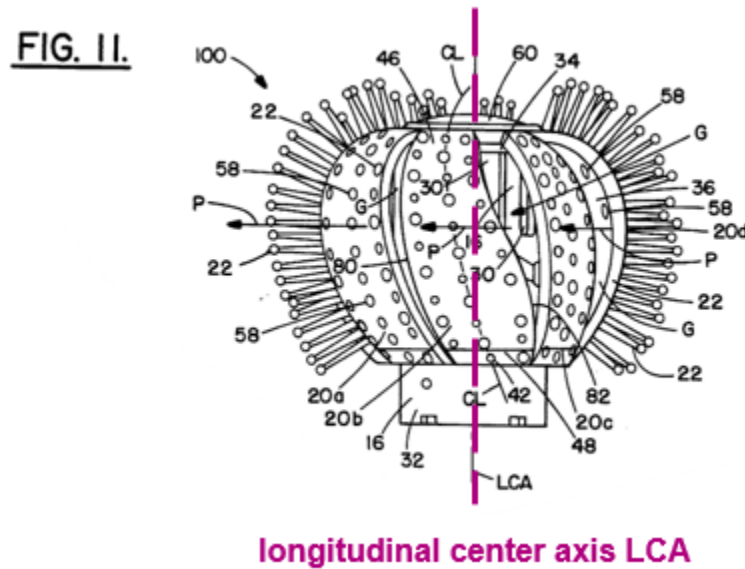
169. Therefore, in my opinion claim 6 is obvious over the modification of Saito in view of the teachings of Lindsey.

7. Claim 7: “The attachment of claim 6, wherein the at least one slot is helical with respect to the longitudinal axis.”

170. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

171. As I have discussed above, Saito’s slots would be formed by using Lindsey’s vane system to generate tangential airflow, and Lindsey teaches an

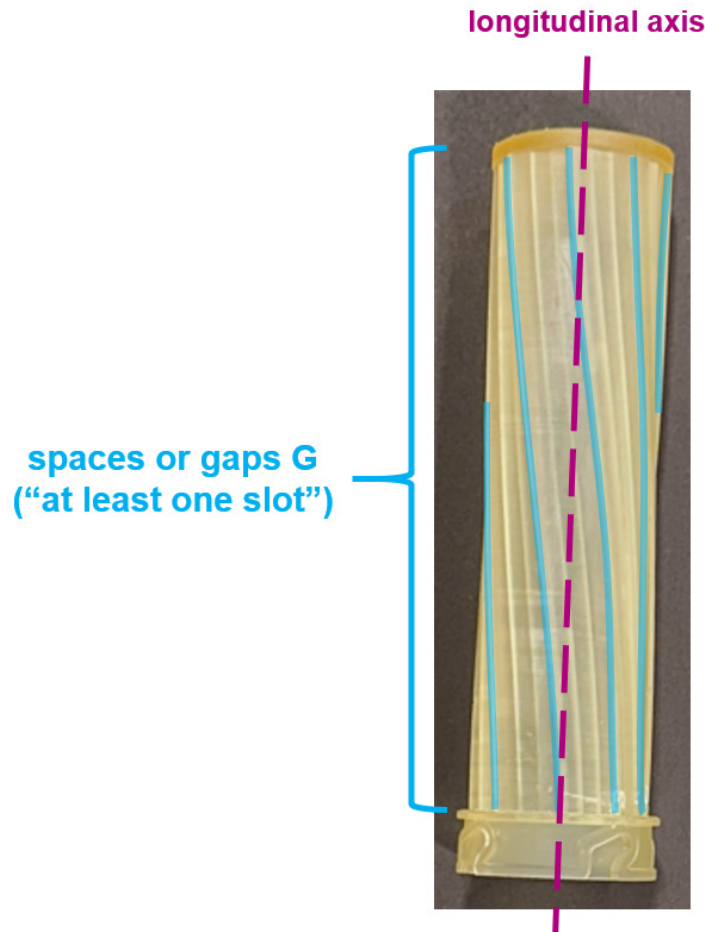
example in which the slots are helical and thus, non-parallel to the longitudinal axis of the attachment.



EX1005, Figs. 11, 5.

172. Accordingly, the gaps G (*i.e.*, “the at least one slot”) formed between each pair of adjacent vanes are “helical” with respect to the longitudinal axis LCA of Lindsey’s attachment, as required by claim 7.

173. Moreover, as demonstrated by the model that approximates a fully-extended, cylindrical Saito attachment that uses an array of vanes as taught by Lindsey, the modified Saito/Lindsey attachment would have likewise resulted in slots that are “helical” as required by claim 7:

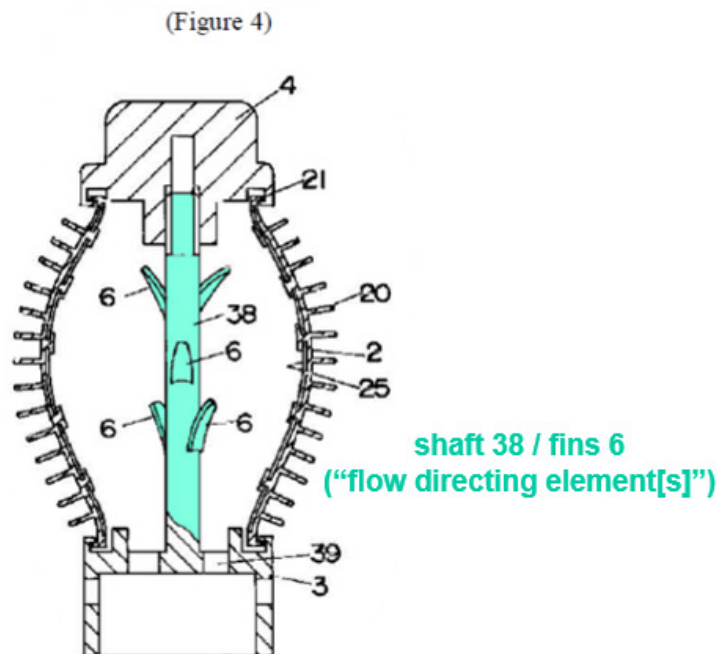


174. Therefore, in my opinion claim 7 is obvious over the modification of Saito in view of the teachings of Lindsey.

8. Claim 8: “The attachment of claim 1, further comprising a flow directing element between the inlet and the outlet.”

175. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use the vanes from Lindsey.

176. Saito teaches the use of “fins 6 for airflow direction adjustment [that] are provided on an outer peripheral surface of a shaft 38,” and explains that “the fins 6 change the direction of air or steam fed from the hair dryer that is heading toward the tip of the brush 1 so that the air or steam is discharged from the discharge ports 24 of the bristle base 2”:



EX1004 at ¶ (0014), Fig. 4. In my opinion, Saito teaches “a flow directing element between the inlet and the outlet.”

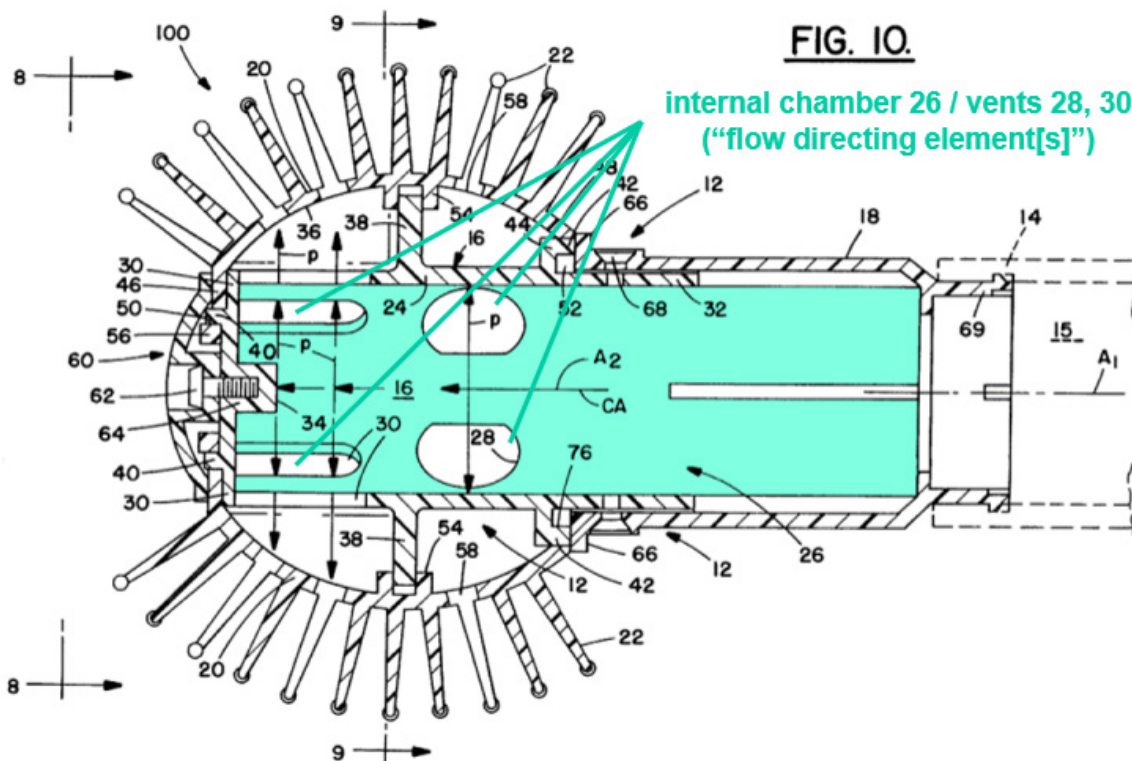
177. Therefore, in my opinion claim 8 is obvious over the modification of Saito in view of the teachings of Lindsey.

9. Claim 9: “The attachment of claim 8, wherein the flow directing element comprises a perforated layer.”

178. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

179. As I explained above, Saito teaches “a flow directing element between the inlet and the outlet” because the “fins 6 for airflow direction adjustment [that] are provided on an outer peripheral surface of a shaft 38” can “change the direction of air or steam fed from the hair dryer that is heading toward the tip of the brush.” EX1004 at ¶ (0014), Fig. 4. Saito’s shaft 38 and fins 6 appear to be solid; therefore, Saito’s “flow directing element” does not “comprise a perforated layer” as required by dependent claim 9.

180. However, Lindsey teaches an “internal chamber 26” (which is also a “flow directing element”) that “has a plurality of vents therethrough” that “allow air received from hair blower 15 to exit chamber 6.” EX1005 at 6:6-9. As shown in the annotated version of Lindsey’s Figure 10 below, the plurality of “vents 28, 30” are perforations in the “internal chamber 26”:



EX1005, Fig. 10 (annotations added).

181. Lindsey therefore teaches a “flow directing element” that “comprises a perforated layer.” In my opinion, it would have been obvious to a person of ordinary skill in the art to have modified Saito’s shaft 38 to be hollow and of a larger diameter, and to have “a plurality of vents therethrough” like the “internal chamber 26” that is taught by Lindsey.

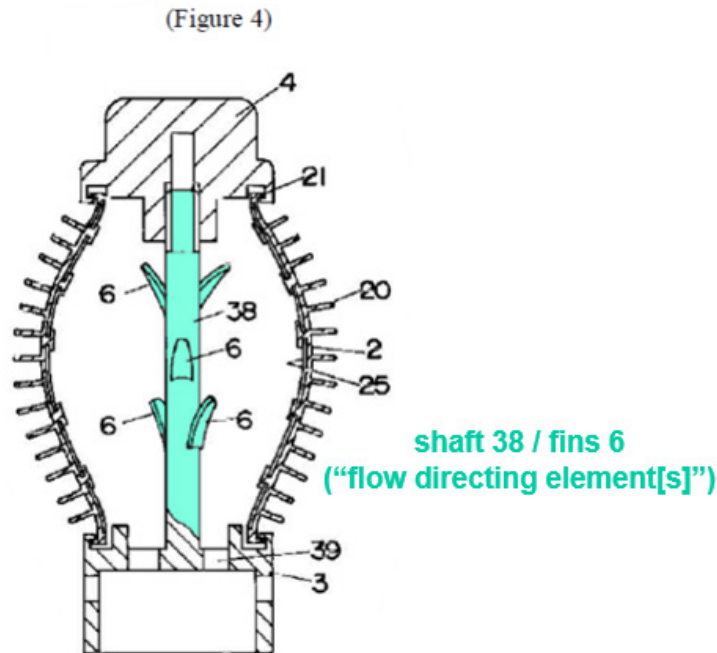
182. Lindsey explains that “wall 34” at the end of the “internal chamber 26” serves as means for changing the path of the received air and causing the air to flow in paths substantially transverse or perpendicular to central axis CA,” and that wall 34 “blocks the received air and builds up a back pressure of air in internal chamber

26, which accelerates the air out of vents 28, 30,” thus “deflect[ing] the air received from blower 15 out of core 16 through vents 28, 30 in paths p which are approximately transverse or perpendicular to central axis CA of internal chamber 26.” EX1005 at 6:16-22. In my opinion, a person of skill in the art would have been motivated to modify Saito’s shaft 38 to be hollow and include vents as taught by Lindsey in order to enhance the tangential airflow of the combined Saito/Lindsey attachment by building up back pressure of air, which would accelerate the air out of the vents. Therefore, in my opinion claim 9 is obvious over the modification of Saito in view of the teachings of Lindsey.

10.Claim 12: “The attachment of claim 9, wherein the flow directing element extends substantially along a length of the at least one slot.”

183. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

184. In my opinion, Saito teaches that “the flow directing element extends substantially along a length of the at least one slot” as required by dependent claim 12 because Saito’s “shaft 38” upon which the “fins 6” are provided extends the full length of the cutting grooves, which in the proposed modification of Saito would be the slots formed between adjacent vanes:



EX1004, (0014), Fig. 4.

185. The modification of Saito to use vanes as instructed by Lindsey would not change this aspect of Saito. Therefore, in my opinion claim 12 is obvious over the modification of Saito in view of the teachings of Lindsey.

**11.Claim 13: “The [attachment/appliance] of claim [9/24],
wherein the flow directing element extends substantially
around an inner circumference of the attachment.”**

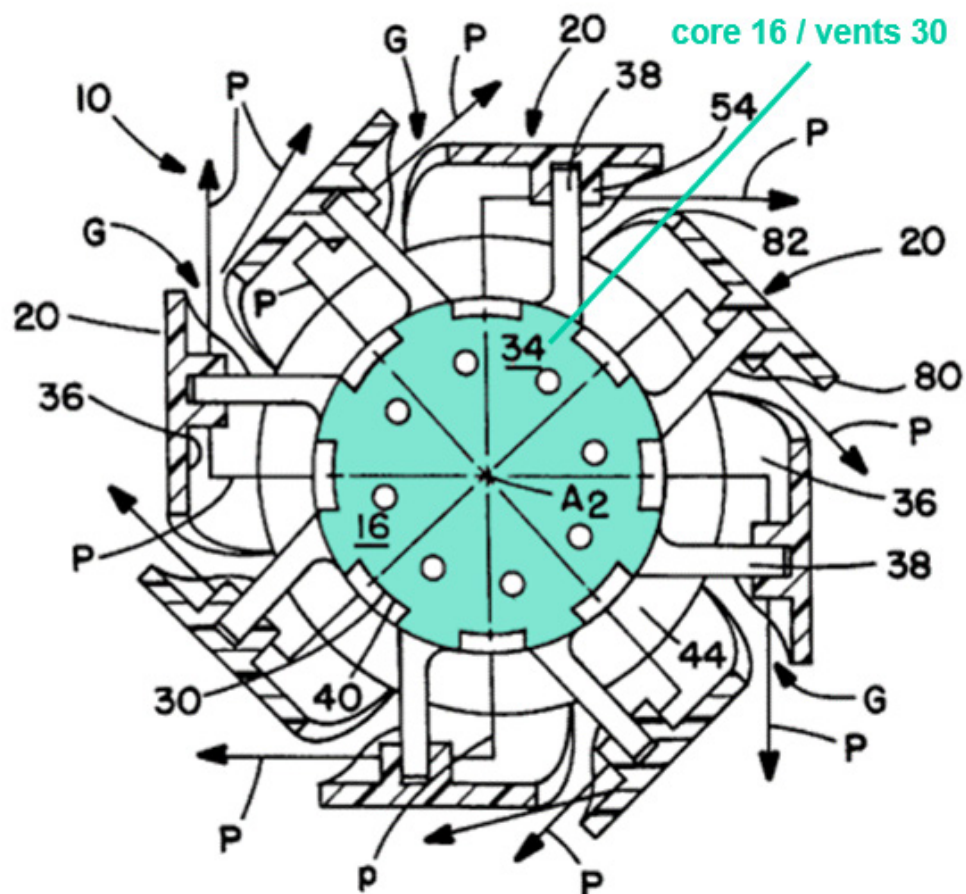
186. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use vanes as taught by Lindsey.

187. As I explained above regarding dependent claim 9, Lindsey discloses an “internal chamber 26” (*i.e.*, a “flow directing element”) that “has a plurality of vents therethrough” that “allow air received from hair blower 15 to exit chamber 6.”

EX1005 at 6:6-9. It would have been obvious to a person of ordinary skill in the art to have modified Saito's shaft 38 to be hollow and of a larger diameter, as well as to include "a plurality of vents therethrough" in the manner described with respect to the "internal chamber 26" in the Lindsey attachment.

188. As shown in the annotated version of Lindsey's Figure 9 below, the "core 16," which defines the "internal chamber 26," extends substantially around an inner circumference of the Lindsey attachment as required by dependent claim 13:

FIG. 9.



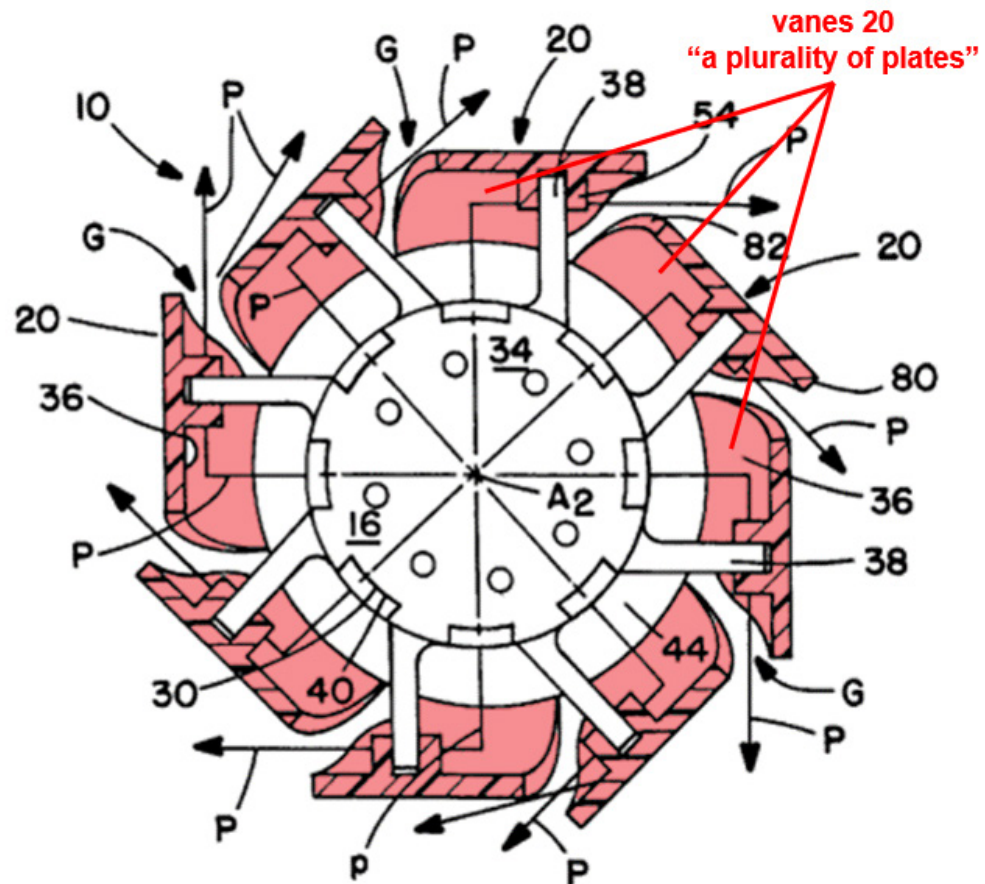
EX1005 at 6:6-9, Fig. 9. For this reason, Lindsey teaches that “the flow directing element extends substantially around an inner circumference of the attachment” as required by this dependent claim.

189. Therefore, in my opinion claim 13 is obvious over the modification of Saito in view of the teachings of Lindsey.

12.Claim 14: “The attachment of claim 1, wherein the wall comprises a plurality of plates.”

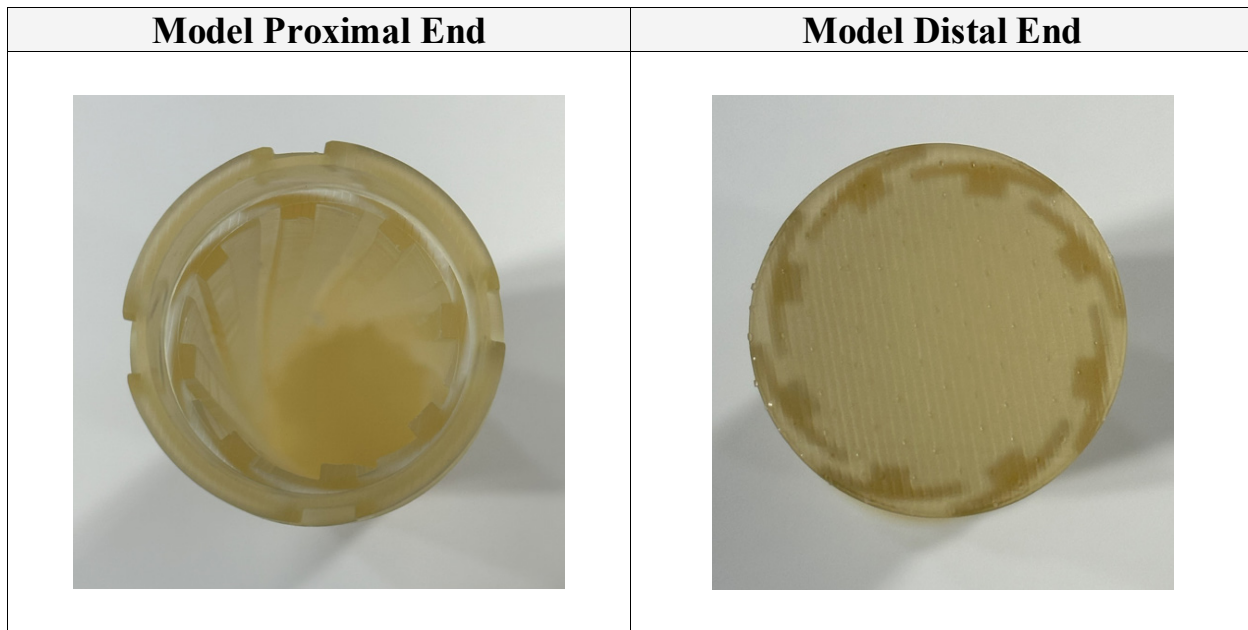
190. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use the vanes from Lindsey.

191. Lindsey’s “vanes,” which are the wall that comprises a plurality of plates, form the “exterior of a portion of the hair styler,” and “provide spaces or gaps G of varying widths and radial extents along and between side edges 80, 82 of mounted adjacent vanes.” EX1005 at 4:15-20, 8:47-49. As shown in the annotated version of Figure 9 below, the vanes are mounted using “a circular array of pins 40 extending axially forward from the front surface of front wall 34, and a circular array of pins 42 extending axially rearward from vertical annular flange 44 located adjacent entrance end 32 of core 16.” EX1005 at 6:32-40.

FIG. 9.

192. Accordingly, Lindsey discloses that “the wall comprises a plurality of plates.”

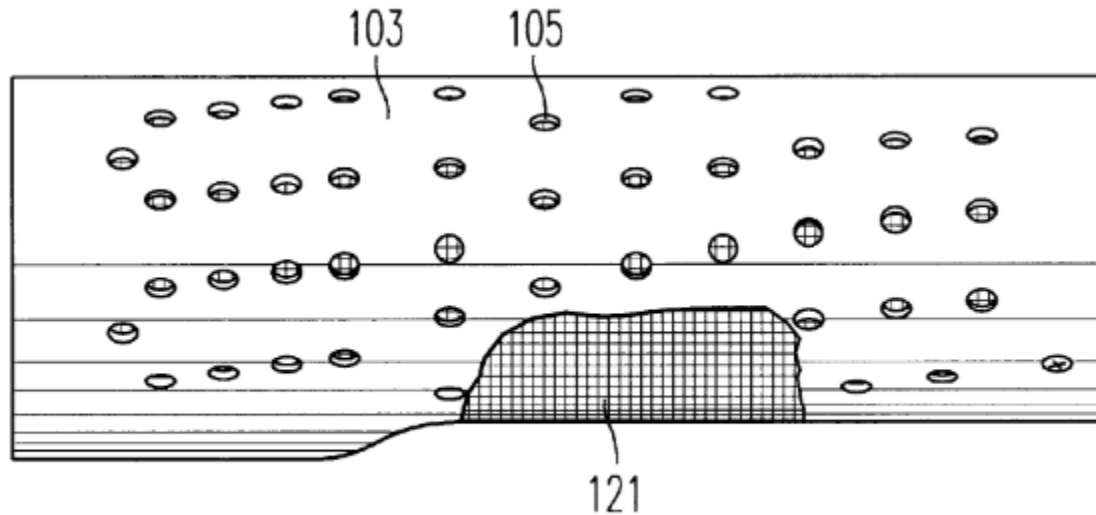
193. Moreover, as demonstrated by the model that approximates a fully-extended, cylindrical Saito attachment that uses an array of vanes as taught by Lindsey, the modified Saito/Lindsey attachment would have likewise resulted in a wall that “comprises a plurality of plates” in the combined attachment, as required by this dependent claim:



D. Ground 2: Claims 10 and 11 are Obvious Over the Combination of Saito, Lindsey, and Schepisi

194. I have analyzed claims 10 and 11 of the '979 patent, and it is my opinion that each claim is rendered obvious by Saito in view of Lindsey and Schepisi.

195. Schepisi teaches the use of a “mesh-type screen” that “can be positioned cylindrically within the barrel” that allows enough air “forced through the holes 105 to permit horizontal lifting/drying, etc.,” when the barrel is in the fully deflecting position.” The mesh is depicted in Figure 23:

*FIG. 23*

EX1006 at 11:12-30, Fig. 23. Further, Schepisi teaches that “the mesh-type screen 121 can be a frame grid of wire netting.” EX1006 at 12:10-11.

196. It would have been obvious to one of ordinary skill in the art to have formed the modified and enlarged hollow “shaft 38” with Schepisi’s mesh-type screen, and one of ordinary skill in the art would have had a reasonable expectation of success in doing so, because Schepisi’s mesh-type screen would have enhanced the tangential flow of the air exiting the vents into the “plural flow paths P” exiting through Lindsey’s “gaps G.” This is because the mesh would diffuse the airflow through the length of the attachment and slow down the longitudinal velocity. Moreover, Schepisi’s mesh-type screen is intended to be used with a hair dryer, and “can be positioned cylindrically within the barrel.” EX1006 at 11:26-30.

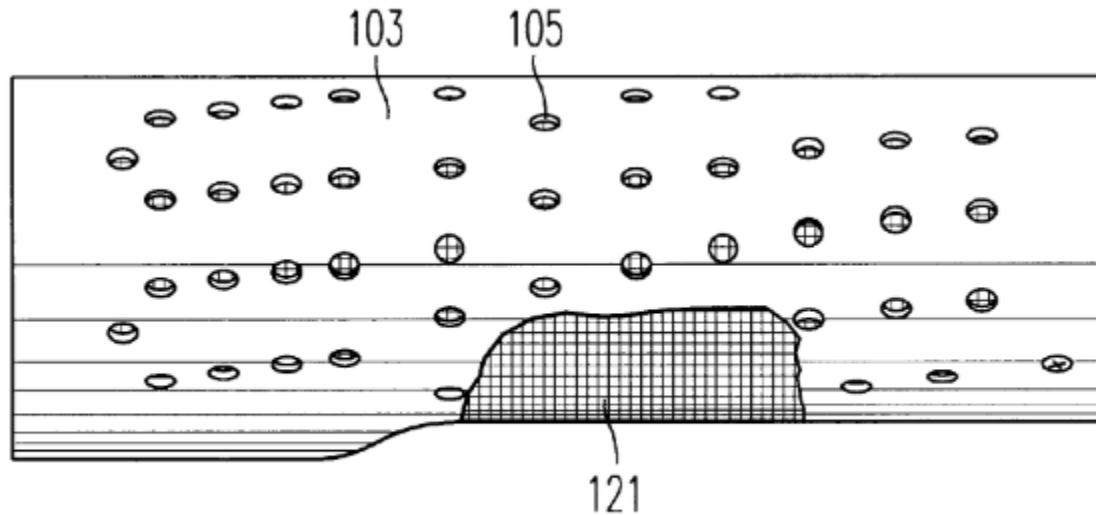
1. Claim 10: “The attachment of claim 9, wherein the perforated layer is formed from a mesh or weave of an elongate material.”

197. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use the vanes from Lindsey and Schepisi’s mesh-type screen.

198. As I have explained above with respect to claim 9, Lindsey discloses that “the flow directing element comprises a perforated layer” by reason of the plurality of “vents 28, 30” located in the “internal chamber 26.” EX1005 at 5:55-60. It would have been obvious to have modified Saito’s shaft 38 and to be hollow and have a larger diameter, and to include “a plurality of vents therethrough” as taught by Lindsey with respect to the “internal chamber 26.”

199. Lindsey does not teach that its “internal chamber 26” and “vents 28, 30” are “formed from a mesh or weave of elongate material” as required by claim 10. However, Schepisi discloses this feature.

200. As I have also explained above, Schepisi teaches the use of a “mesh-type screen” that “can be positioned cylindrically within the barrel” and serves to block or obstruct some of the air travelling through holes 105,” but permits “enough air [to be] forced through the holes 105 to permit horizontal lifting/drying, etc.” when the barrel is in the fully deflecting position. The mesh is shown in Figure 23:

*FIG. 23*

EX1006 at 11:12-30, Fig. 23. Further, Schepisi teaches that “the mesh-type screen 121 can be a frame grid of wire netting.” EX1006 at 12:10-11. Accordingly, Schepisi discloses a “perforated layer” that “is formed from a mesh or weave of an elongate material,” as required by claim 10.

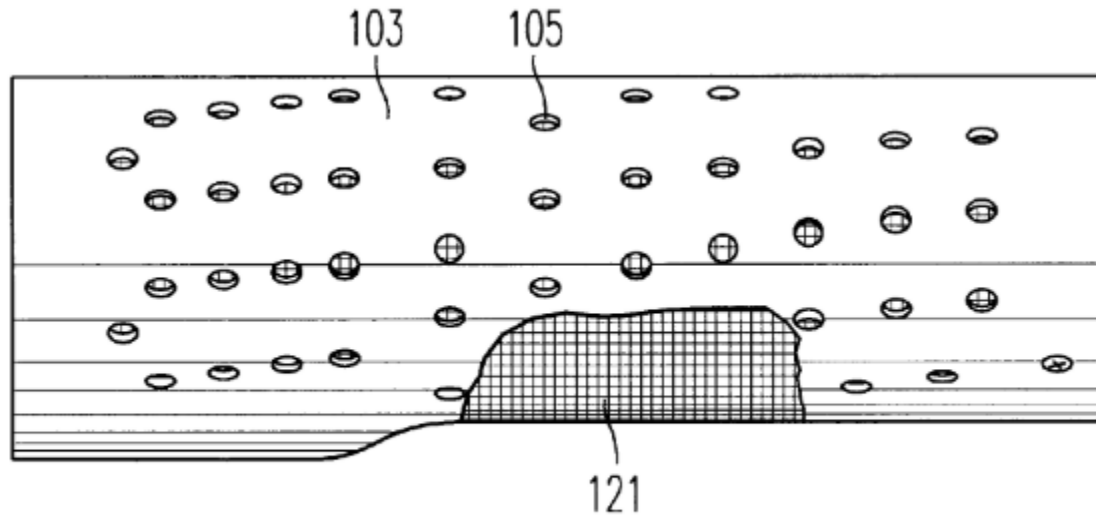
201. In my opinion, it would have been obvious to one of ordinary skill in the art that a modified Saito cylindrical attachment which used vanes in the manner taught by Lindsey would have been further improved by forming the modified hollow shaft of the Saito/Lindsey combined attachment in order to improve the deflection of the air exiting the shaft through the mesh. Therefore, in my opinion claim 10 is obvious over the modification of Saito in view of the teachings of Lindsey and in further view of the teachings of Schepisi.

2. Claim 11: “The attachment of claim 9, wherein the perforated layer is formed from a mesh or a weave of elongate wire.”

202. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use the vanes from Lindsey and Schepisi’s mesh-type screen.

203. As I have explained above with respect to claims 9 and 10, Lindsey discloses that “the flow directing element comprises a perforated layer” by reason of the plurality of “vents 28, 30” located in the “internal chamber 26.” EX1005 at 5:55-60. Lindsey does not disclose that its “internal chamber 26” and “vents 28, 30” are formed from “a mesh or a weave of elongate wire,” as required by claim 11. However, Schepisi discloses this feature.

As I have discussed above, Schepisi teaches the use of a “mesh-type screen” that “can be positioned cylindrically within the barrel” and serves to block or obstruct some of the air travelling through holes 105,” as shown in Figure 23:

*FIG. 23*

EX1006 at 11:12-30, Fig. 23. Further, Schepisi teaches that “the mesh-type screen 121 can be a frame grid of wire netting.” EX1006 at 12:10-11. Accordingly, Schepisi discloses a “perforated layer” that “is formed from a mesh or a weave of elongate wire,” as required by claim 11.

204. As I have explained above, it is my opinion that it would have been obvious to one of ordinary skill in the art to have formed the modified hollow shaft of the of the Saito/Lindsey combined attachment in order to improve the deflection of the air exiting the shaft through the mesh. Therefore, in my opinion claim 11 is obvious over the modification of Saito in view of the teachings of Lindsey and in further view of the teachings of Schepisi.

E. Ground 3: Claims 15 and 16 are Obvious Over the Combination of Saito, Lindsey, and Nicolas

205. I have analyzed claims 15 and 16 of the '979 patent, and it is my opinion that each claim is rendered obvious by Saito in view of Lindsey and Nicolas.

206. In my opinion, it would have been obvious to one of ordinary skill in the art to combine Nicolas's spacers with the slots formed by the vanes in the combined Saito/Lindsey attachment, and one of ordinary skill in the art would have had a reasonable expectation of success in doing so. For example, Nicolas indicates that its spacers "are mounted on" and "preferably integral with, one of the facing surfaces of the nozzle." EX1007 at 3:31-38. Accordingly, it would have been obvious to one of ordinary skill in the art to have modified the array of vanes in the modified Saito/Lindsey combined attachment to include integral spacers on each vane that contact the adjacent vane when the attachment is in the fully extended cylindrical position. Because the spacers are integral with each vane, this modification would not affect the ability of the modified Saito/Lindsey attachment to be adjusted to a bulbous shape.

207. A person of ordinary skill in the art would have recognized the advantages of maintaining a set minimum distance between the gaps G formed between the adjacent vanes of the modified Saito/Lindsey attachment when fully extended in the cylindrical shape, because Nicolas teaches that "the use of spacers spacing apart the facing surfaces of the nozzle enables a smooth, even output of air

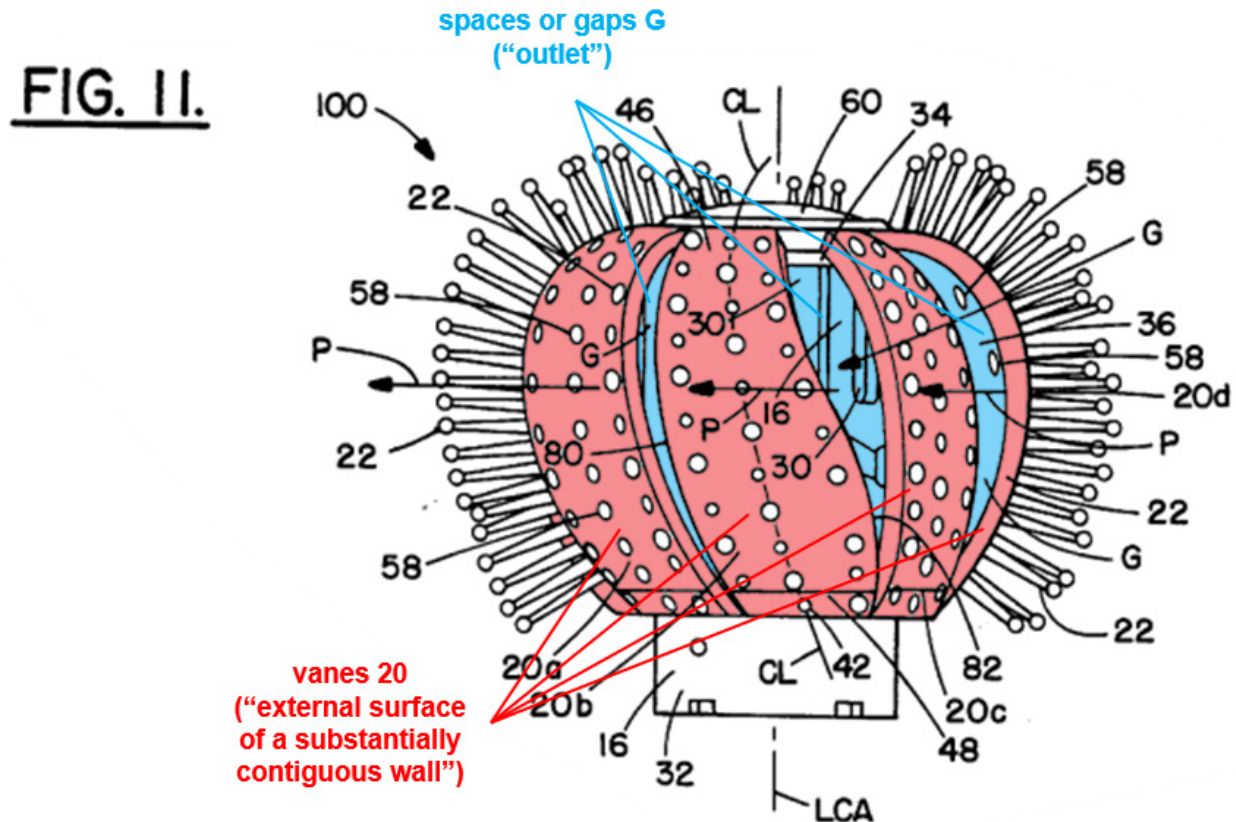
flow to be delivered to a user's location without the user feeling a ‘choppy’ flow.” EX1007 at 2:38-41. A person of ordinary skill in the art would have also recognized that Nicolas’s spacers advantageously “provide for reliable, reproducible manufacture of the nozzle of the fan assembly,” which “means that a user should not experience a variation in the intensity of the air flow over time due to product aging or a variation from one fan assembly to another fan assembly due to variations in manufacture.” EX1007 at 2:41-46. Moreover, a person of ordinary skill in the art would have recognized the direct applicability of Nicolas’s spacers to the modified Saito/Lindsey combined attachment, because each of Saito, Lindsey, and Nicholas describes the discharge of airflow from slot-shaped outlets using a fan.

1. Claim 15: “The attachment of claim 1, wherein the at least one slot is formed by a gap between adjacent sections of the wall that are joined by at least one spacer disposed between the beginning of the at least one slot and the end of the at least one slot to maintain the gap.”

208. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use the vanes from Lindsey and Nicolas’s spacers.

209. As I have discussed above with respect to element [1e] in Ground 1, Lindsey explains that its “vanes” form the “exterior of a portion of the hair styler,” and “provide spaces or gaps G of varying widths and radial extents along and between side edges 80, 82 of mounted adjacent vanes.” EX1005 at 4:15-20, 8:47-

49. As shown in Figure 11, Lindsey’s “gaps G” (*i.e.*, “the at least one slot”) is “formed by a gap between adjacent sections of the wall,” *i.e.*, the vanes:



EX1005 at 5:65-67, Fig. 11 (annotations added).

210. Lindsey does not disclose that the adjacent vanes “are joined by at least one spacer disposed between the beginning of the at least one slot and the end of the at least one slot to maintain the gap,” as required by claim 15. However, in my opinion, Nicolas discloses these features.

211. Nicolas teaches the use of “spacers for spacing apart the facing surfaces of the nozzle,” which “[a]dvantageously . . . enables a smooth, even output of air flow to be delivered to a user’s location without the user feeling a ‘choppy’ flow.”



212. As I explained above, it would have been obvious to one of skill in the art to have incorporated Nicolas's spacers in the vanes of the modified Saito/Lindsey attachment. Therefore, in my opinion claim 15 is obvious over the modification of Saito in view of the teachings of Lindsey and in further view of the teachings of Nicolas.

2. Claim 16: “The attachment of claim 15, wherein the at least one spacer extends from an edge of a first section of the adjacent sections of the wall to an edge of a second section of the adjacent sections of the wall.”

213. In my opinion, this additional limitation would have been obvious to one of ordinary skill in the art in light of the proposed modification of Saito to use the vanes from Lindsey and Nicolas’s spacers.

214. As I have discussed above with respect to element [1e] in Ground 1 and claim 15, Lindsey explains that its “vanes” form the “exterior of a portion of the hair styler,” and “provide spaces or gaps G of varying widths and radial extents along and between side edges 80, 82 of mounted adjacent vanes” and Lindsey’s “gaps G” (*i.e.*, “the at least one slot”) are “formed by a gap between adjacent sections of the wall,” *i.e.*, the vanes:

spaces or gaps G
("outlet")

vanes 20
("external surface
of a substantially
contiguous wall")

Diagram illustrating a spherical device 100, possibly a catheter or probe, showing its internal structure and various components.

The device features a central longitudinal axis CL and a proximal end connected to a handle assembly LCA. The main body is divided into sections by vanes 20, which are labeled as having an external surface 20a and an internal surface 20b. The outer wall is covered with numerous small protrusions 22 and larger openings 58. A blue shaded region indicates a space or gap G. Various other components are labeled with numbers: 16, 30, 32, 34, 36, 42, 46, 48, 58, 60, 80, 82.

215. Nicolas teaches the use of “spacers for spacing apart the facing surfaces of the nozzle,” which “[a]dvantageously . . . enables a smooth, even output of air flow to be delivered to a user’s location without the user feeling a ‘choppy’ flow.” EX1007 at 2:38-41. As shown in Figures 4 and 5, “the[] facing portions of the inner surface 39 and the outer surface 40 are held apart by spacers”:

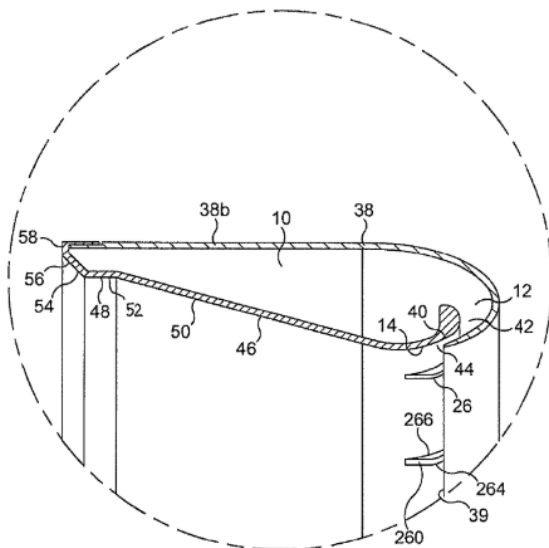


FIG. 4

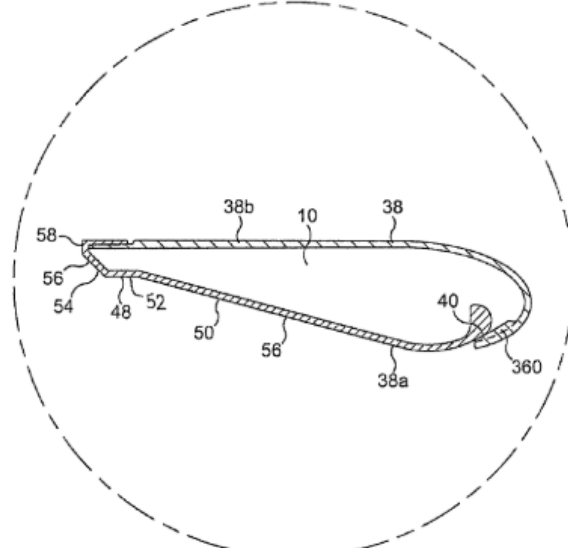


FIG. 5

EX1007 at 6:50-52, Figs. 3, 4. Accordingly, Nicolas discloses that “the at least one spacer extends from an edge of a first section of the adjacent sections of the wall to an edge of a second section of the adjacent sections of the wall,” as required by dependent claim 16.

216. As I explained above, it would have been obvious to one of skill in the art to have incorporated Nicolas’s spacers in the vanes of the modified Saito/Lindsey attachment. Therefore, in my opinion claim 16 is obvious over the modification of Saito in view of the teachings of Lindsey and in further view of the teachings of Nicolas.

F. Ground 4: Claims 17-25, 27, and 29-32 are Obvious Over the Combination of Saito, Lindsey, and Shoemaker

217. I have analyzed claims 17-25, 27, and 29-32 of the '979 patent, and it is my opinion that each claim is rendered obvious by Saito in view of Lindsey and Shoemaker.

218. It would have been obvious to a person of ordinary skill to have combined the modified Saito/Lindsey attachment with Shoemaker's hand-held hair styling appliance, and one of ordinary skill in the art would have had a reasonable expectation of success in doing so, because Shoemaker's hair styling appliance is expressly intended to be used with "styling attachments." Shoemaker states that its hair styler provides ergonomic benefits, as Shoemaker notes that "lightweight axial flow fans have been incorporated in hair styling appliances," but that "[u]nless the outer diameter of the axial flow fan can be reduced to a size which can be easily and comfortably grasped for relatively long periods of time (5 to 10 minutes or more) by the hand of a user, an external handle, or a longer appliance is necessary for consumer acceptance." EX1009 at 1:63-69. Thus, Shoemaker provides a hair styler with an axial-flow fan "having an outer diameter of sufficiently small dimension to allow a maximum diameter of said tubular body which is suitable for being grasped by a user during use so that the appliance may be used without any additional handle." EX1009 at 1:101-117.

219. A person of ordinary skill in the art would have been motivated to combine the modified Saito/Lindsey attachment described in Ground 1 above with Shoemaker's hand-held styling appliance to take advantage of the ergonomic benefits provided by Shoemaker's axial-flow fan type design. I note that while both Saito and Lindsey describe hair styling attachments for hair dryers, neither provide detail on any particular hair dryer. In my opinion, a person of ordinary skill in the art reading Saito and/or Lindsey would have looked at preexisting hair dryer designs, such as the hair dryer described in Shoemaker, to teach the particular design of a hair dryer to be used with the Saito or Lindsey attachments. The hair dryer described in Shoemaker would have been preferential, as Shoemaker indicates that "[t]he short length of an axial flow fan eliminates the necessity of a separate handle," and that its "hand-held hair drying or styling appliance" includes an axial-flow fan "having an outer diameter of sufficiently small dimension to allow a maximum diameter of said tubular body which is suitable for being grasped by a user during use so that the appliance may be used without any additional handle." EX1009 at 1:101-117. Thus, it would have been obvious to a person of ordinary skill in the art to have used Shoemaker's hair dryer with the modified Saito/Lindsey attachment in order to take advantage of the benefits of Shoemaker's ergonomic design.

1. Claim 17

220. It is my opinion that the combination of Saito, Lindsey, and Shoemaker renders obvious claim 17, for the reasons discussed below.

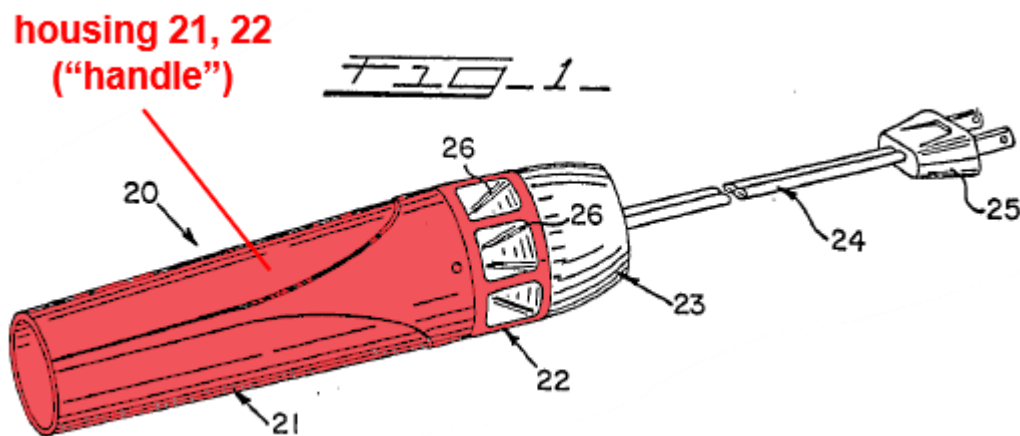
221. I note that the only differences between claims 1 and 17 are in their preambles. Claim 1 recites “An attachment for a hand held appliance,” whereas claim 17 recites “A hand held appliance” that comprises “an attachment” having the same elements as the attachment of claim 1. Thus, in my opinion, the limitations relating to the “attachment” are rendered obvious by the modification of Saito in view of the teachings of Lindsey, as I explained above. As discussed below, the limitations of [17pre] are obvious over the modification of Saito in view of the teachings of Lindsey and in further view of the teachings of Shoemaker.

- a) **[17pre]: “A hand held appliance comprising a handle having a fluid flow path from a handle inlet to a handle outlet, a fan unit for drawing fluid into the handle inlet, and an attachment for attaching to the handle, the attachment comprising”**

222. I understand that a preamble typically does not limit a claim. Regardless of whether the preamble of claim 1 is limiting, it is my opinion that the modification of Saito in view of the teachings of Lindsey and in further view of the teachings of Shoemaker renders this limitation obvious to one of ordinary skill in the art.

“A hand held appliance comprising a handle.”

223. Saito discloses a “hair dryer,” which is a “hand held appliance,” but Saito does not explicitly disclose that its “hair dryer” has a handle. However, Shoemaker discloses a “hand-held hair drying or styling appliance” that includes a “tubular body which is suitable for being grasped by a user during use so that the appliance may be used without any additional handle.” EX1009 at 1:101-117. As shown in the annotated version of Figure 1 below, the Shoemaker hair styler “is of tubular shape,” and “the housing 21, 22 of the dryer or styler [is] small enough to be comfortably held in the hand”:

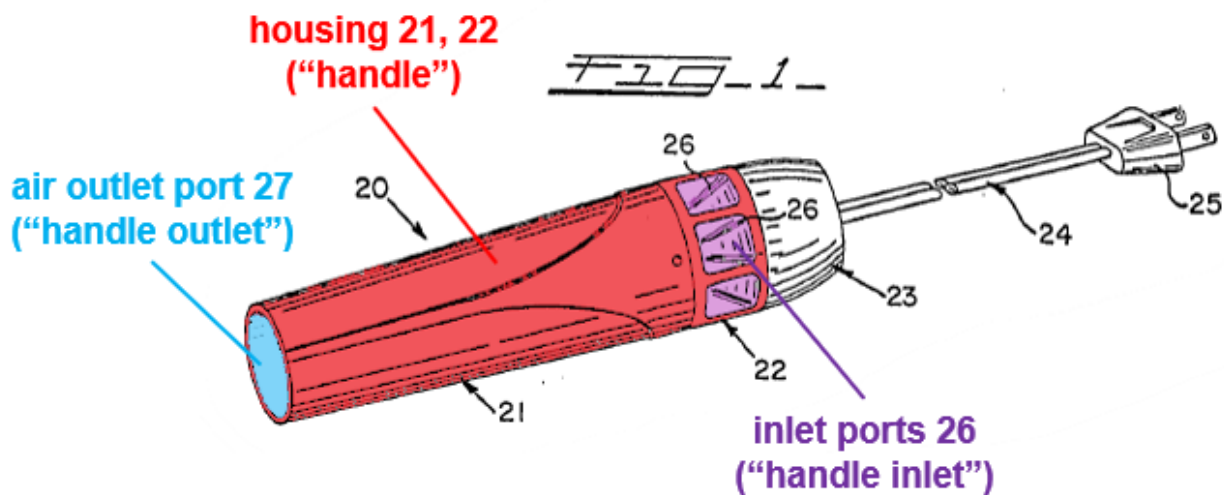


EX1009 at Abstract, Fig. 1. Thus, in my opinion, the “housing 21, 22” of the Shoemaker hair styler is a “handle” as required by [17pre].

“A fluid flow path from a handle inlet to a handle outlet.”

224. Shoemaker’s hair styler includes “inlet ports 26” that are “positioned around the tubular outline of the air inlet and switching housing 22,” (*i.e.*, “a handle

inlet”), as well as a “circular air outlet port 27,” (*i.e.*, “a handle outlet”) at the end of the housing 21, as shown in the annotated version of Figure 1 below:



EX1009, Fig. 1.

225. Shoemaker also describes “a fluid flow path” from its inlet ports 26 to its air outlet port 27. Shoemaker explains that “air passing through the styler 20 enters same through a plurality of air inlet ports 26-26,” and the “air flows through the fan and heater housing 21 from right to left.” EX1009 at 2:53-58. Subsequently, “[t]he warm and rapid flowing air exits the styler 20 through a circular air outlet port 27 defining the left end of the appliance as shown.” EX1009 at 2:62-64. Thus, in my opinion, Shoemaker teaches “a fluid flow path from a handle inlet to a handle outlet.”

“A fan unit for drawing fluid into the handle inlet.”

226. Shoemaker’s hair styler includes an “axial flow fan 42” within its housing 21. EX1009 at 2:110-12. Shoemaker explains that “the air is driven through the housing 21 by the fan.” EX1009 at 2:58-62. In my opinion, therefore, Shoemaker teaches “a fan unit for drawing fluid into the handle inlet.”

An attachment for attaching to the handle.

227. Shoemaker explains that “styling attachments ... may be releasably connected to the air outlet housing 27 to adapt the appliance for various combing and brushing operations in connection with the styling and drying of a user’s hair.” EX1009 at 2:64-69. In my opinion, therefore, Shoemaker teaches “an attachment for attaching to the handle.”

b) [17a]: “an inlet in a proximal first portion of the attachment;”

228. As I have discussed above with respect to element [1a], the modification of Saito in view of the teachings of Lindsey renders “an inlet in a proximal first portion of the attachment” obvious to one of ordinary skill in the art. *See* Section VIII.C.1.b. Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17a] obvious.

c) **[17b]: “an outlet in a cylindrical second portion of the attachment; and”**

229. As I have discussed above with respect to element [1b], the modification of Saito in view of the teachings of Lindsey renders “an outlet in a cylindrical second portion of the attachment” obvious to one of ordinary skill in the art. *See* Section VIII.C.1.c. Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17b] obvious.

d) **[17c]: “a fluid flow path between the inlet and the outlet,”**

230. As I have discussed above with respect to element [1c], the modification of Saito in view of the teachings of Lindsey renders “a fluid flow path between the inlet and the outlet” obvious to one of ordinary skill in the art. *See* Section VIII.C.1.d. Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17c] obvious.

e) **[17d]: “wherein the outlet in the cylindrical second portion of the attachment comprises at least one slot extending continuously from the proximal first portion to a distal end of the attachment,”**

231. As I have discussed above with respect to element [1d], the modification of Saito in view of the teachings of Lindsey renders “wherein the outlet in the cylindrical second portion of the attachment comprises at least one slot extending continuously from the proximal first portion to a distal end of the attachment” obvious to one of ordinary skill in the art. *See* Section VIII.C.1.e.

Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17d] obvious.

- f) **[17e]: “wherein the outlet is at least partially defined by an external surface of a substantially contiguous wall of the attachment and”**

232. As I have discussed above with respect to element [1e], the modification of Saito in view of the teachings of Lindsey renders “wherein the outlet is at least partially defined by an external surface of a substantially contiguous wall of the attachment” obvious to one of ordinary skill in the art. *See* Section VIII.C.1.f. Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17e] obvious.

- g) **[17f]: “is configured to direct fluid flow emitted from the outlet tangentially along and around the external surface of the substantially contiguous wall to form a circumferential fluid flow around the cylindrical second portion of the attachment that encourages hair to automatically wrap around the cylindrical second portion,”**

233. As I have discussed above with respect to element [1f], the modification of Saito in view of the teachings of Lindsey renders “the outlet...is configured to direct fluid flow emitted from the outlet tangentially along and around the external surface of the substantially contiguous wall to form a circumferential fluid flow around the cylindrical second portion of the attachment that encourages hair to automatically wrap around the cylindrical second portion” obvious to one of

ordinary skill in the art. *See* Section VIII.C.1.g. Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17f] obvious.

- h) [17g]: “wherein the external surface of the substantially contiguous wall is an outermost surface of the attachment along an entire length of the attachment from a beginning of the at least one slot to an end of the at least one slot, and”**

234. As I have discussed above with respect to element [1g], the modification of Saito in view of the teachings of Lindsey renders “wherein the external surface of the substantially contiguous wall is an outermost surface of the attachment along an entire length of the attachment from a beginning of the at least one slot to an end of the at least one slot” obvious to one of ordinary skill in the art. *See* Section VIII.C.1.h. Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17g] obvious.

- i) [17h]: “wherein the distal end of the attachment is closed.”**

235. As I have discussed above with respect to element [1h], the modification of Saito in view of the teachings of Lindsey renders “wherein the distal end of the attachment is closed” obvious to one of ordinary skill in the art. *See* Section VIII.C.1.i. Therefore, the combination of Saito, Lindsey, and Shoemaker renders element [17h] obvious.

2. Claim 18: “The appliance of claim 17, wherein the outlet comprises a plurality of slots radially spaced around the attachment.”

236. As I have discussed above with respect to claim 2, the modification of Saito in view of the teachings of Lindsey renders “wherein the outlet comprises a plurality of slots radially spaced around the attachment” obvious to one of ordinary skill in the art. *See* Section VIII.C.2. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 18 obvious.

3. Claim 19: “The appliance of claim 17, wherein the attachment is configured so that, in use, the fluid emitted from the outlet is attracted to the external surface of the attachment.”

237. As I have discussed above with respect to claim 3, the modification of Saito in view of the teachings of Lindsey renders “wherein the attachment is configured so that, in use, the fluid emitted from the outlet is attracted to the external surface of the attachment” obvious to one of ordinary skill in the art. *See* Section VIII.C.3. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 19 obvious.

4. Claim 20: “The appliance of claim 17, wherein the outlet comprises two slots.”

238. As I have discussed above with respect to claim 4, the modification of Saito in view of the teachings of Lindsey renders “wherein the outlet comprises two slots” obvious to one of ordinary skill in the art. *See* Section VIII.C.4. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 20 obvious.

5. Claim 21: “The appliance of claim 17, wherein the attachment has a longitudinal axis and the at least one slot is parallel to the longitudinal axis.”

239. As I have discussed above with respect to claim 5, the modification of Saito in view of the teachings of Lindsey renders “wherein the attachment has a longitudinal axis and the at least one slot is parallel to the longitudinal axis” obvious to one of ordinary skill in the art. *See* Section VIII.C.5. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 21 obvious.

6. Claim 22: “The appliance of claim 17, wherein the attachment has a longitudinal axis and the at least one slot is non-parallel to the longitudinal axis.”

240. As I have discussed above with respect to claim 6, the modification of Saito in view of the teachings of Lindsey renders “wherein the attachment has a longitudinal axis and the at least one slot is non-parallel to the longitudinal axis” obvious to one of ordinary skill in the art. *See* Section VIII.C.6. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 22 obvious.

7. Claim 23: “The appliance of claim 22, wherein the at least one slot is helical with respect to the longitudinal axis.”

241. As I have discussed above with respect to claim 7, the modification of Saito in view of the teachings of Lindsey renders “wherein the at least one slot is helical with respect to the longitudinal axis” obvious to one of ordinary skill in the art. *See* Section VIII.C.7. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 23 obvious.

8. Claim 24: “The appliance of claim 17, further comprising a flow directing element between the inlet and the outlet.”

242. As I have discussed above with respect to claim 8, the modification of Saito in view of the teachings of Lindsey renders “further comprising a flow directing element between the inlet and the outlet” obvious to one of ordinary skill in the art. *See* Section VIII.C.8. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 24 obvious.

9. Claim 25: “The appliance of claim 24, wherein the flow directing element comprises a perforated layer.”

243. As I have discussed above with respect to claim 9 the modification of Saito in view of the teachings of Lindsey renders “wherein the flow directing element comprises a perforated layer” obvious to one of ordinary skill in the art. *See* Section VIII.C.9. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 25 obvious.

10. Claim 27: “The appliance of claim 24, wherein the flow directing element extends substantially along a length of the at least one slot.”

244. As I have discussed above with respect to claim 12, the modification of Saito in view of the teachings of Lindsey renders “wherein the flow directing element extends substantially along a length of the at least one slot” obvious to one of ordinary skill in the art. *See* Section VIII.C.10. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 27 obvious.

11.Claim 29: “The appliance of claim 24, wherein the flow directing element extends substantially around an inner circumference of the attachment.”

245. As I have discussed above with respect to claim 13, the modification of Saito in view of the teachings of Lindsey renders “wherein the flow directing element extends substantially around an inner circumference of the attachment” obvious to one of ordinary skill in the art. *See* Section VIII.C.11. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 29 obvious.

12.Claim 30: “The appliance of claim 17, wherein the appliance is a hair care appliance.”

246. Shoemaker teaches this additional element. Specifically, Shoemaker describes a “hand-held hair styling or drying appliance[] using axial-flow fans therein.” EX1009 at 1:5-6. Accordingly, the combination of Saito, Lindsey, and Shoemaker renders obvious “a hair care appliance.”

13.Claim 31: “The appliance of claim 17, wherein the appliance is a hot styling appliance.”

247. Shoemaker teaches this additional element. Specifically, Shoemaker describes a “hand-held hair styling appliance” that includes a “heater housing” and “heating element” that warms the air prior to exiting the styler. EX1009 at 2:24-29, 2:56-64. Accordingly, the combination of Saito, Lindsey, and Shoemaker renders obvious “a hot styling appliance.”

14.Claim 32: “The appliance of claim 17, wherein the appliance is a hot styling brush.”

248. Shoemaker teaches this additional element. As I have explained above with respect to claim 31, Shoemaker describes a “hand-held hair styling appliance” that includes a “heater housing” and “heating element” that warms the air prior to exiting the styler. EX1009 at 2:24-29, 2:56-64. Shoemaker further notes that “styling attachments (not shown) may be 130 releasably connected to the air outlet housing 27 to adapt the appliance for various combing and brushing operations in connection with the styling and drying of a user’s hair.” EX1009 at 2:64-69. Accordingly, the combination of Saito, Lindsey, and Shoemaker renders obvious “a hot styling brush.”

G. Ground 5: Claims 26 and 28 are Obvious Over the Combination of Saito, Lindsey, Schepisi, and Shoemaker

249. I have analyzed claims 26 and 28 of the ’979 patent, and it is my opinion that each claim is rendered obvious by Saito in view of Lindsey, Schepisi, and Shoemaker.

1. Claim 26: “The appliance of claim 25, wherein the perforated layer is formed from a mesh or weave of an elongate material.”

250. As I have discussed above with respect to claim 10, the modification of Saito in view of the teachings of Lindsey and Schepisi renders “wherein the perforated layer is formed from a mesh or weave of an elongate material” obvious

to one of ordinary skill in the art. *See* Section VIII.D.1. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 26 obvious.

2. Claim 28: “The appliance of claim 25, wherein the perforated layer is formed from a mesh or a weave of elongate wire.”

251. As I have discussed above with respect to claim 11, the modification of Saito in view of the teachings of Lindsey and Schepisi renders “wherein the perforated layer is formed from a mesh or a weave of elongate wire” obvious to one of ordinary skill in the art. *See* Section VIII.D.2. Therefore, the combination of Saito, Lindsey, and Shoemaker renders claim 28 obvious.

IX. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

252. As I explained above in Section V.C, I understand that an obviousness analysis includes consideration of “secondary” or “objective” evidence of non-obviousness, including things such as: (1) a long-felt but unmet need in the prior art that was satisfied by the claimed invention; (2) commercial success or the lack of commercial success of the claimed invention; (3) unexpected results achieved by the claimed invention; (4) praise of the claimed invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the claimed invention; and (7) contemporaneous and independent invention by others.

253. I am not aware of any secondary considerations of non-obviousness raised by Dyson with respect to the Challenged Claims of the '979 patent. As an

example, I am not aware of any showing of a long-felt but unmet need satisfied by the '979 patent. As supported by my analysis above, any alleged “need” that would have been satisfied by the '979 patent would have already been satisfied in light of the teachings of Saito, Lindsey, Schepisi, Nicolas, and Shoemaker, which together render each of the Challenged Claims obvious. As another example, I am not aware of any commercial success of any styling brush that is due to their practicing of the Challenged Claims of the '979 patent. Although it appears to me that the Dyson AirWrap has had some degree of commercial success, I have not quantified that success, nor have I performed an element-by-element analysis of the claims of the '979 patent against the Dyson AirWrap product such that I could conclude that any commercial success is due to the practicing of the Challenged Claims by the Dyson AirWrap. I likewise am not aware of any evidence relating to the other “secondary” or “objective” considerations listed above.

254. Accordingly, the consideration of “secondary” or “objective” evidence of nonobviousness does not change my opinion that claims 1-32 of the '979 patent would have been obvious to one of skill in the art.

X. CONCLUSION

255. Based on my review and above analysis of the prior art, it is my opinion that claims 1-32 of the '979 patent would have been obvious to one of skill in the art.

I hereby declare under penalty of perjury that the foregoing is true and correct, and that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: June 7, 2024

A handwritten signature in black ink, reading "Daniel M. Nosenchuck". The signature is written in a cursive style with a large initial 'D' and 'M'.

Dr. Daniel M. Nosenchuck

Appendix A

CV

Daniel M. Nosenchuck

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Education:

Ph.D.	California Institute of Technology, Pasadena, California <i>Aeronautics</i> , Thesis Advisor: H.W. Liepmann	June 1982
M.S.	California Institute of Technology, Pasadena, California <i>Aeronautics</i>	June 1977
B.S.	Syracuse University, Syracuse New York <i>Aerospace Engineering</i> <i>Mechanical Engineering</i>	May 1976

Experience:

July 1988 - Present	Princeton University, Princeton NJ: Associate Professor of Mechanical and Aerospace Engineering
August 1983 – June 1988	Princeton University, Princeton NJ: Assistant Professor

Recent Teaching (Graduate and Undergraduate): Thermodynamics, Heat Transfer, Fluid Dynamics, Viscous Flows, Energy Conversion and the Environment: Applications to Transportation, Mechanical Design, Entrepreneurial Engineering (Product Design and Marketing)

Research: Experimental fluid mechanics: Turbulence control; Drag reduction; Heat Transfer, Dynamic Three-Dimensional Flow Visualization
Computer Simulation: Special-purpose computer architecture design and fabrication

Honors and Awards:

- Boeing H.G. Welliver Fellow, 1995
- Excellence in Teaching Award, Princeton University Undergraduate Engineering Council, 1993
- Presidential Young Investigator Award (NSF), 1984-1989
- GTE Emerging Scholar, 1987
- Rheinstein Award, School of Engineering, Princeton University, 1986
- IBM Faculty Development Award 1984 - 1985
- EMMY Award from the Academy of Television Arts and Sciences *for Outstanding Individual Achievement - Special Visual Effects: The Day After*, 1984
- The William F. Ballhaus Prize for an *Outstanding Doctoral Dissertation in Aeronautics* California Institute of Technology, 1982
- Graduate Fellowships, California Institute of Technology, 1976

U.S.A. Department of Defense Activities (1994 - Present):

- Member of Navel Studies Board Panels on
 - Joint Strike Operations
 - Regional Conflict (Combat Power Panel)
 - Undersea Warfare
- Member of Defense Science Board Ballistic Missile Defense Task Force
- Member of Defense Science Study Group
- Reviewer of Various Research Programs for the Operational Forces

U.S. Patents - First or Sole Inventor (Provisional, Applications and Foreign Patents Not Listed):

1. Patent 6,393,208 (May 2002) *Compressor with integrated impeller and motor*
2. Patent 6,168,405 (January 2001) *Wankel type pump for transporting fluid with entrained particulate matter*
3. Patent 6,014,791 (January 2000) *Quiet vacuum cleaner using a vacuum pump with a lobed chamber*
4. Patent 6,011,903 (January 2000) *Reduced-noise ducted flow hair dryer with multiple impellers and ambient air inlets*
5. Patent 5,964,433 (October 1999) *Staggered actuation of electromagnetic tiles for boundary layer control*
6. Patent No. 5,841,943 (November 1998) *Ducted flow hair dryer with multiple impellers*
7. Design Patent No. D398,074 (September 1998) *Hair Dryer*
8. Patent No. 5,492,289 (February 1996) *Lifting Body with Reduced-Strength Trailing Vortices*
9. Patent No. 5,442,790 (August 1995) *A Parameterized Optimizing Compiler*
10. Patent No. 5,437,421 (August 1995) *Multiple Electromagnetic Devices for Boundary Layer Control*
11. Patent No. 5,320,309 (June 1994) *Electromagnetic Device and Method for Boundary Layer Control*
12. Patent No. 4,811,214 (March 1989): *Dynamic Reconfiguration System for Pipelined Computers*

Numerous foreign patents also awarded for many of the above patents; other patents pending.

Technology Development and Commercialization:

- Small- and Personal-Care Appliances
 - Extensive Involvement in IP Creation and Commercial Product Development and Manufacture of Small and Personal-Care Appliances
 - Typical Example of High-Volume and -Market-Share Product: Hairdryer
 - Numerous Utility and Design Patents
 - Models Introduced: Quiet Hairdryers (numerous brands)
 - Makeup Mirrors (numerous brands)
 - Follow-on Next-Generation Models Under Major Brand Names
 - Major U.S. National Chain Retail Outlets Include: Target, Wal-Mart and Kmart
 - Other Ongoing and New-Launch Products Include Hairdryers, Lighted Makeup-Mirrors, Hair Curlers, Portable Heater-Based Appliances, Humidifiers, Vacuum-Based Appliances
- Direct-Response TV Products
 - Involved in development, prototype and manufacture of DR TV products, including
 - Air-Press Massager, Roll-A-Hose, Doggy Steps, Ped Egg, Jupiter Jack, ...

Past Technology Development and Transfer:

- Navier-Stokes Computer Technology
 - Princeton University to Concurrent Computer Corporation, Tinton Falls, NJ - 1987
 - Supercomputer Solutions Inc., San Diego, CA - 1989
- Electromagnetic Flow-Control Technology
 - Princeton University to Nova Innovations, San Diego, CA - 1993

Consulting Experience:

- Avolio and Hanlon, P.C., Lawrenceville, NJ
- Boeing Company, Seattle, WA
- Cahn Litigation, Roslyn Heights, NY
- Defense Science Board, Washington DC
- DSV Partners, Princeton, NJ
- Greenberg Traurig, LLP, New York, NY
- General Atomics, San Diego, CA
- Helen of Troy, El Paso, TX
- Hultquist IP, Chapel Hill, NC
- Institute for Defense Analysis, Alexandria VA
- The Manica Group, Tokyo, Japan
- Matsushita Electric Works, Osaka, Japan
- Nova Innovations Corporation, San Diego, CA
- National Research Council (Naval Studies Board)
- Northwest Research Associates Inc., Bellevue WA
- Praxis Film Works, North Hollywood, CA
- Princeton Combustion Research Laboratories, Princeton, NJ
- Rubin/Anders Scientific Inc., Brookline, MA
- Security and Exchange Commission, Denver, CO
- Telebrands, Fairfield, NJ
- Union Camp Corporation, Lawrenceville, NJ
- Wiggin and Dana, Hartford, CT
- Wolf Popper Ross Wolf and Jones, New York City, NY

Reviewer for:

- AIAA Journal
- Journal of Fluid Mechanics
- Physics of Fluids
- Review of Scientific Instruments
- National Science Foundation (Proposals and NYI Selection Committee)

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Daniel Nosenchuck received his BS in both Mechanical and Aerospace Engineering (cum laude) from Syracuse University in 1976. He then received his Ph.D. in Aeronautics from the California Institute of Technology (Caltech) in 1982, for which he was the charter winner of the William Ballhaus Prize for an outstanding thesis. After a year as a post-doctoral fellow in Aeronautics at Caltech, he joined the faculty in Mechanical and Aerospace Engineering at Princeton University.

His interests include experimental and computational fluid mechanics, dynamic flow control and visualization, heat transfer, advanced parallel supercomputer and compiler architectures, and concurrent design, manufacture and test of complex aero-mechanical systems, and consumer product design, manufacture and marketing. His major scientific and engineering contributions include experimental active laminar-flow control, the first successful demonstration of active turbulence control, the development of electromagnetic turbulence control, and the creation of a parallel-processing supercomputer for complex flow simulations. He was a charter-year recipient of the five-year NSF Presidential Young Investigator Award (1984-89), a recipient of the IBM Faculty Development Award (1984-85) and the Princeton University School of Engineering Rhinestein Award (1986) for work related to the implementation of unique flow-control concepts, and the development of new flow visualization techniques. He was a Boeing Welliver Fellow (1995) and is active in industrial consulting and technology transfer. He also consults directly with the Department of Defense, has been a member of the DoD/IDA Defense Science Study Group and is frequently a member of various DoD Defense Science Board and Naval Studies Board Task Forces and Panels.

Daniel Nosenchuck has a dozen US Utility and Design Patents as primary inventor, along with foreign patents in areas ranging from supercomputers and aircraft drag reduction and safety, to commercial products. In the latter category, he developed and introduced a range of branded (e.g. Revlon, Helen-of-Troy) personal care appliances, including the Revlon Perfect Look Makeup Mirror and the first successfully mass-marketed quiet hairdryer: the Revlon 'Get Quiet.' In the direct-marketing category, he has been extensively involved in the development of well-received mass-market products, such as Roll-A-Hose, Doggy Steps, Ped Egg, Jupiter Jack and others. For the past several decades, he has spent considerable time in China, Thailand and Japan where he has been working with businesses and factories in direct support of the development of commercial prototypes and transition to large-scale manufacture. He has also consulted with a number of patent and intellectual property firms in a variety of matters, including IPR issues.

Among his other interests, he has worked in Hollywood as a consultant on special effects, and in 1984 he received the Academy of Television Arts and Sciences *Primetime Emmy Award* for 'Outstanding Individual Achievement in Special Visual Effects: The Day After.' Contemporaneous with the ABC's airing of *The Day After* (which was the most-watched TV-movie of all time), the mushroom clouds and missile launches he created for the film were prominently featured in numerous national and international print and media publications, including the cover of Newsweek.

Some of his further activities include flying (Commercial Pilot since 1973; former FAA Certified Flight Instructor in Airplanes and Gliders 1974-1982), and fine woodworking (furniture and cabinet making).

Appendix B

News from
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FOR IMMEDIATE RELEASE

Contact: Caroline Moseley 609/258-5729
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Princeton Students Design a Better Hair Dryer

Princeton, N.J.--An innovative hair dryer design won five of Princeton's nascent engineers a trip to Bangkok, Thailand, in March. After competing against six other teams of students in a course called Engineering Design, winners Lina Jin '97, Andy Johnson '98, Matt Nuffort '98, Meeko Oishi '98 and Eric Young '98 were invited by the electronics firm Manica Corp. to present their design to company executives at headquarters in Bangkok.

The students were accompanied by Associate Professor of Mechanical and Aerospace Engineering Daniel Nosenchuck, their instructor in the course, and graduate student teaching assistant Clay Gabler.

Nosenchuck, an expert in fluid mechanics who consults for Manica and several other electronics firms, set the class the task of "designing a quiet hair dryer" last fall. He asked them to make it "a little more powerful than current models--2000 watts instead of the typical 1800-1850 watts--and to aim for an acoustic level of about 60 decibels, which exists in an ordinary office with no machines clattering." (The average dryer at the present time, he says, is about 80 decibels.)

Manica's CEO and chief engineer visited campus to judge the competition in January.

Come spring break, the winning group set off for the Far East. Their first stop was Hong Kong, where they visited Manica's purchasing department and toured the city.

Manica's director of purchasing explained to the students how "it's more efficient to do purchasing in a free trade port, even if it's not where you do your manufacturing. That's why U.S. companies often can't compete with countries in East Asia that are purchasing through places like Hong Kong," Nosenchuck says.

In Bangkok, the Princetonians sat down with Manica's CEO, design engineers and top level management.

Recalls Nuffort, "They more or less turned to us and said, 'OK, what are we going to do now? How are we going to take your design and create something manufacturable?'" It took a moment for the students to realize "they were looking to us for expertise. It put a real significance on the education I've received at Princeton that, even as a junior, I could make a difference to this company."

"Their people knew more about the practical aspects of manufacture than we did," Jin points out. "For instance, one of our ideas was rejected because it involved a component being subjected to

extreme working stress, which would shorten the lifetime of the product--which wouldn't satisfy customers."

Still, says Johnson, "It was great to feel that we were of real value to a significant player in industry. Granted, we're only talking about hairdryers here, but I never thought I would be doing something like that at age 20."

Johnson's feeling that "I'll come out of Princeton knowing enough to make valuable contributions in industry" is one Nosenchuck aims to foster. Nosenchuck spent a summer as fellow at the Boeing Co. in Seattle that introduced him to "the workings of a very large company and its relation to what faculty and students here can do." He has made an effort to move the engineering curriculum toward courses that use modern engineering tools, such as computer aided design, engineering and manufacturing (CAD, CAE and CAM) and also "make students aware of the opportunities offered by global enterprise.

"Engineering is a profession," Nosenchuck asserts. "Engineers are meant to produce competitive goods and serve customers."

He himself dwells as comfortably in the academy as in the marketplace.

"What makes Princeton strong," he insists, "is the emphasis on fundamentals. Our students must know the principles of physics, math and chemistry to become engineers."

His design students start "with pencil and paper," he says. "Sometimes I let them use chalk on the board. But I ask them not to go to the computer until they think their design is going to work, a conviction that can only be based on first principles."

Team approach

Nosenchuck uses the team approach in his courses, because "no single individual could create a complex system in the time we have available," he says. "And team design is a regular procedure in industry. Why? Because the whole is greater than the sum of its parts; and you get the job done faster --which, in industry, translates to a competitive advantage."

According to Johnson, "Team dynamics were the key to our success in the hairdryer competition. On the design side, Eric and I were the dreamers and conceptualists; Matt, Meeko and Lina took care of the heavy analysis and theory. When things got bad, we all pulled together instead of going at each other's throats."

"A lot of advanced engineering went into designing the dryer shell, in terms of providing the right flow," Nosenchuck says. Air is a gas, he points out, that is treated like a fluid. The students performed simulations using computational fluid dynamics, and "they tried housings of various geometries, trying to ensure the flow didn't separate, which is very inefficient."

The students designed their dryers using ProEngineer, a CAD program that allows three-dimensional modeling.

"You can spin the design around, look at everything in 3-D, change the dimensions easily," says Nuffort. "Then you export those files to a manufacturing computer that starts with a block of plastic and cuts it according to ProEngineer's instructions."

So what's the secret of the Hair Dryer of the Future? Unwilling to spill too many beans about a design that may be patented, Nosenchuck says only that "it uses multiple blower fans within the housing and a minimal number of structural components. Also, it provides a very low acoustic

emission level with high flow rate."

Nosenchuck would like "all the design students to have the same experience Manica provided for those on the winning design team." He hopes to "institutionalize an appreciation of the connections between modern engineering design and global enterprise.

The unofficial University motto, he points out, "used to be 'Princeton in the nation's service.' Now, with the 250th Anniversary, the motto has been expanded to include 'the service of all nations.' What better way to honor that idea than to move students from the confines of the campus to the broader world beyond, to establish them in service throughout their professional careers?"
