

Filed: February 1, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FOX Factory, Inc.,
Petitioner,

v.

SRAM, LLC,
Patent Owner.

IPR2024-00491
U.S. Patent No. 10,328,993

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT 10,328,993**

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Ex. 1001	U.S. Patent No. 10,328,993 to Watt et al. (“the ’993 patent”)
Ex. 1002	Prosecution History of the ’993 patent
Ex. 1003	Declaration of Dr. Alexander Slocum
Ex. 1004	Certified English translation of the reexamination decision upholding rejection of the claims of the counterpart Chinese application (CN 2015/11,009,996) by the CNIPA
Ex. 1005	German Patent Application Publication No. DE19629740A1 (German language document) to Denk, filed July 23, 1996; published January 29, 1998 (“Denk”) ¹
Ex. 1006	Certified English translation of German Patent Application Publication No. DE19629740A1
Ex. 1007	British Patent Application Publication No. GB287452A to Valat, filed March 13, 1928; published August 9, 1928 (“Valat”)
Ex. 1008	U.S. Patent Application Publication No. 2010/0259028A1 to Moechnig, filed April 9, 2009; published October 14, 2010 (“Moechnig”)
Ex. 1009	European Patent Application Publication No. EP0063719A1 to Campagnolo, filed April 5, 1982; published November 3, 1982 (“Campagnolo”)
Ex. 1010	U.S. Patent No. 7,503,576 B1 to Schroeder, filed August 7, 2006; published March 17, 2009 (“Schroeder”)
Ex. 1011	U.S. Patent Application Publication No. 2007/0257466A1 to Murphy et al., filed May 3, 2007; published November 8, 2007 (“Murphy”)

¹ All reference cites are based on the translation (Ex. 1006).

Exhibit	Description
Ex. 1012	U.S. Patent No. 6,145,862 to D’Aluisio et al., filed September 30, 1998; published November 14, 2000 (“D’Aluisio”)
Ex. 1013	U.S. Patent No. 8,366,130B2 to Galasso et al., filed November 23, 2009; published February 5, 2013 (“Galasso”)
Ex. 1014	Scheduling Order in the parallel district court case (<i>SRAM, LLC v. FOX Factory, Inc.</i> , No. 1:23-cv-00492 (N.D. Ga. May 31, 2023)) showing that discovery and all related deadlines are stayed pending the court’s ruling on defendant FOX Factory, Inc.’s motion to transfer.
Ex. 1015	Time to Milestones in patent cases in the United States District Court for the Northern District of Georgia, Docket Navigator (Jan. 15, 2024, 4:10 PM), https://search.docketnavigator.com/patent/court/17/14?print=true
Ex. 1016	<i>Steering_Tube_Strength.xls</i> (calculations performed by Petitioner’s expert Dr. Slocum)
Ex. 1017	Excerpts from Roark’s Formulas for Stress and Strain (7th ed. 2002)

CLAIM LISTING APPENDIX

Claim Number	Claim Elements
1	1[preamble] A steerer tube for a bicycle, the steerer tube comprising:
	1[a] an elongate hollow body arranged around a steering axis located in a vertical plane of travel of the bicycle,
	1[b] the body having upper and lower sections, a segment of the upper section adapted to be joined to a bicycle handlebar, a segment of the lower section adapted to be joined to a crown of a front wheel fork of the bicycle, the lower section joined to the upper section, and
	1[c] outer surfaces of the upper and lower sections of the body being circular in cross section, and
	1[d] the body formed by a wall, a thickness of the wall at any point in the lower section of the body varying as a function of the cross-sectional angle of the point relative to the plane of travel, the wall thickness being at a maximum in the plane of travel of the bicycle.
2	The steerer tube of claim 1, wherein an outer diameter of the lower section of the body is greater than an outer diameter of the upper section of the body.
3	The steerer tube of claim 2, wherein the lower section of the body has first and second portions, the first portion adjoining the upper section of the body, an outer diameter of the first

Claim Number	Claim Elements
	portion of the lower section being greater than an outer diameter of the upper section and less than an outer diameter of the second portion of the lower section.
4	The steerer tube of claim 3, wherein the outer diameter of the first portion of the lower section gradually tapers from the second portion of the lower section to the upper section of the body.
6	The steerer tube of claim 4, wherein an inner surface of the upper section is circular in cross section.
8	The steerer tube of claim 6, wherein a ratio of an inner diameter of the upper section of the body to an outer diameter of the upper section of the body is within the range of 0.75 to 0.95, inclusive.
10	The steerer tube of claim 1, wherein an inner surface of the upper section is circular in cross section.
12	The steerer tube of claim 10, wherein a ratio of an inner diameter of the upper section of the body to an outer diameter of the upper section of the body is within the range of 0.75 to 0.95, inclusive.
14	The steerer tube of claim 1, wherein the body is formed from a material selected from the group consisting of steel, carbon fiber reinforced composite, aluminum, titanium and magnesium.
15	The steerer tube of claim 1, wherein the wall thickness is at a minimum in a plane containing the steering axis and

Claim Number	Claim Elements
	orthogonal to the plane of travel of the bicycle.
16	The steerer tube of claim 15, wherein an outer diameter of the lower section of the body is greater than an outer diameter of the upper section of the body.
17	The steerer tube of claim 16, wherein the lower section of the body has first and second portions, the first portion adjoining the upper section of the body, an outer diameter of the first portion of the lower section being greater than an outer diameter of the upper section and less than an outer diameter of the second portion of the lower section.
18	The steerer tube of claim 17, wherein the outer diameter of the first portion of the lower section gradually tapers from the second portion of the lower section of the body to the upper section of the body.
20	The steerer tube of claim 18, wherein an inner surface of the upper section is circular in cross section.
22	The steerer tube of claim 20, wherein a ratio of an inner diameter of the upper section of the body to an outer diameter of the upper section of the body is within the range of 0.75 to 0.95, inclusive.
24	The steerer tube of claim 15, wherein an inner surface of the upper section is circular in cross section.
26	The steerer tube of claim 24, wherein a ratio of an inner diameter of the upper section of the body to an outer diameter of the upper section of the body is within the range of 0.75 to

Claim Number	Claim Elements
	0.95, inclusive.
27	The steerer tube of claim 15, wherein an outer diameter of the lower section of the body is greater than an outer diameter of the upper section of the body.
28	The steerer tube of claim 27, wherein the lower section of the body has first and second portions, the first portion adjoining the upper section of the body, an outer diameter of the first portion of the lower section being greater than an outer diameter of the upper section and less than an outer diameter of the second portion of the lower section.
29	The steerer tube of claim 28, wherein the outer diameter of the first portion of the lower section gradually tapers from the second portion of the lower section of the body to the upper section of the body.
31	The steerer tube of claim 15, wherein the segment of the lower section of the body is joined to the crown of the front wheel fork, the body formed of a material different from the crown of the front wheel fork.
33	The steerer tube of claim 15, wherein the body is formed from a material selected from the group consisting of steel, carbon fiber reinforced composite, aluminum, titanium and magnesium.
34	The steerer tube of claim 15, wherein an inner surface of the wall within the lower section of the body is formed as an ellipse in cross section, a major diameter of the ellipse formed

Claim Number	Claim Elements
	to be perpendicular to the plane of travel, a minor diameter of the ellipse formed to be in the plane of travel of the bicycle.
35	The steerer tube of claim 34, wherein outer surfaces of the upper and lower sections of the body are circular in cross section.
36	The steerer tube of claim 35, wherein an outer diameter of the lower section of the body is greater than an outer diameter of the upper section of the body.
37	The steerer tube of claim 36, wherein the lower section of the body has first and second portions, the first portion adjoining the upper section of the body, an outer diameter of the first portion of the lower section being greater than an outer diameter of the upper section and less than an outer diameter of the second portion of the lower section.
38	The steerer tube of claim 37, wherein the outer diameter of the first portion of the lower section gradually tapers from the second portion of the lower section of the body to the upper section of the body.
40	The steerer tube of claim 38, wherein an inner surface of the upper section is circular in cross section.
42	The steerer tube of claim 40, wherein a ratio of an inner diameter of the upper section of the body to an outer diameter of the upper section of the body is within the range of 0.75 to 0.95, inclusive.
44	The steerer tube of claim 34, wherein an inner surface of the

Claim Number	Claim Elements
	upper section is circular in cross section.
46	The steerer tube of claim 44, wherein a ratio of an inner diameter of the upper section of the body to an outer diameter of the upper section of the body is within the range of 0.75 to 0.95, inclusive.
47	The steerer tube of claim 34, wherein an outer diameter of the lower section of the body is greater than an outer diameter of the upper section of the body.
48	The steerer tube of claim 47, wherein the lower section of the body has first and second portions, the first portion adjoining the upper section of the body, an outer diameter of the first portion of the lower section being greater than an outer diameter of the upper section and less than an outer diameter of the second portion of the lower section.
49	The steerer tube of claim 48, wherein the outer diameter of the first portion of the lower section gradually tapers from the second portion of the lower section of the body to the upper section of the body.
51	The steerer tube of claim 34, wherein the segment of the lower section of the body is joined to the crown of the front wheel fork, the body formed of a material different from the crown of the front wheel fork.
53	The steerer tube of claim 34, wherein the body is formed from a material selected from the group consisting of steel, carbon fiber reinforced composite, aluminum, titanium and

Claim Number	Claim Elements
	magnesium.
56	The steerer tube of claim 34, wherein the minor diameter decreases as a function of proximity to the upper section of the body.
57	The steerer tube of claim 34, wherein a ratio of the major diameter to the minor diameter taken at a lower end of the lower section is within the range of 1.05 to 1.3, inclusive.
58	The steerer tube of claim 57, wherein the ratio is within the range of 1.10 to 1.25, inclusive.
59	The steerer tube of claim 34, wherein the major diameter of the lower section tapers from the second portion of the lower section to the first portion of the lower section.
60	The steerer tube of claim 34, wherein a ratio of the major diameter to the minor diameter decreases as a function of proximity to the upper section of the body.
61	61[preamble] A steerer tube for a bicycle, the steerer tube comprising:
	61[a] an elongate hollow body arranged around a steering axis located in a vertical plane of travel of the bicycle,
	61[b] the body having upper and lower sections, a segment of the upper section adapted to be joined to a bicycle handlebar, a segment of the lower section adapted to be joined to a crown of a front wheel fork of the bicycle, the lower section joined to the upper section,
	61[c] and an outer diameter of the lower section of the body is

Claim Number	Claim Elements
	greater than an outer diameter of the upper section of the body, and
	61[d] the body formed by a wall, a thickness of the wall at any point in the lower section of the body varying as a function of the cross-sectional angle of the point relative to the plane of travel, the wall thickness being at a maximum in the plane of travel of the bicycle.
62	The steerer tube of claim 61, wherein the lower section of the body has first and second portions, the first portion adjoining the upper section of the body, an outer diameter of the first portion of the lower section being greater than an outer diameter of the upper section and less than an outer diameter of the second portion of the lower section.
63	The steerer tube of claim 62, wherein the outer diameter of the first portion of the lower section gradually tapers from the second portion of the lower section to the upper section of the body.
64	64[preamble] A steerer tube for a bicycle, the steerer tube comprising:
	64[a] an elongate hollow body arranged around a steering axis located in a vertical plane of travel of the bicycle,
	64[b] the body having upper and lower sections, a segment of the upper section adapted to be joined to a bicycle handlebar, a segment of the lower section adapted to be joined to a crown of a front wheel fork of the bicycle, the lower section

Claim Number	Claim Elements
	joined to the upper section, and
	64[c] the segment of the lower section of the body is joined to the crown of the front wheel fork, the body formed of a material different from the crown of the front wheel fork, and
	64[d] the body formed by a wall, a thickness of the wall at any point in the lower section of the body varying as a function of the cross-sectional angle of the point relative to the plane of travel, the wall thickness being at a maximum in the plane of travel of the bicycle.

I. Introduction

Petitioner FOX Factory, Inc. requests *inter partes* review of U.S. Patent No. 10,328,993 (“the ’993 patent”) based on the following prior art and grounds:

Prior Art	
Ex. 1005	German Patent Application Publication No. DE19629740A1 to Denk, published January 29, 1998 (“Denk”); ² prior art under 35 U.S.C. § 102(a)(2)
Ex. 1007	U.S. Patent Application Publication No. 2010/0259028A1 to Moechnig, published October 14, 2010 (“Moechnig”); prior art under 35 U.S.C. § 102(a)(2)
Ex. 1008	British Patent Application Publication No. GB287452A to Valat, published August 9, 1928 (“Valat”); prior art under 35 U.S.C. § 102(a)(2)
Ex. 1010	U.S. Patent No. 7,503,576B1 to Schroeder, published March 17, 2009 (“Schroeder”); prior art under 35 U.S.C. § 102(a)(2)

Denk, Moechnig, Valat, and Schroeder are in the same field of bicycle frames and steerer tube configurations as the ’993 patent. These references are therefore analogous art to the ’993 patent. Ex. 1003, ¶54.

² All reference cites are based on the translation (Ex. 1006).

Ground	Claims ³	Basis Under 35 U.S.C. § 103
1	1-4, 6, 8, 10, 12, 14-18, 20, 22, 24, 26-29, 33-38, 40, 42, 44, 46-49, 53, 56-63 (“Group 1 Challenged Claims”)	Denk in view of Moechnig
2	31, 51, 64 (“Group 2 Challenged Claims”)	Denk in view of Moechnig and Schroeder
3	Group 1 Challenged Claims	Valat in view of Moechnig and Denk
4	Group 2 Challenged Claims	Valat in view of Moechnig, Denk, and Schroeder

The challenged claims are directed to a bicycle steerer tube with varying wall thickness over a cross-section of the tube, which is a concept that was well known long before the ’993 patent’s priority date. Thus, they are unpatentable.

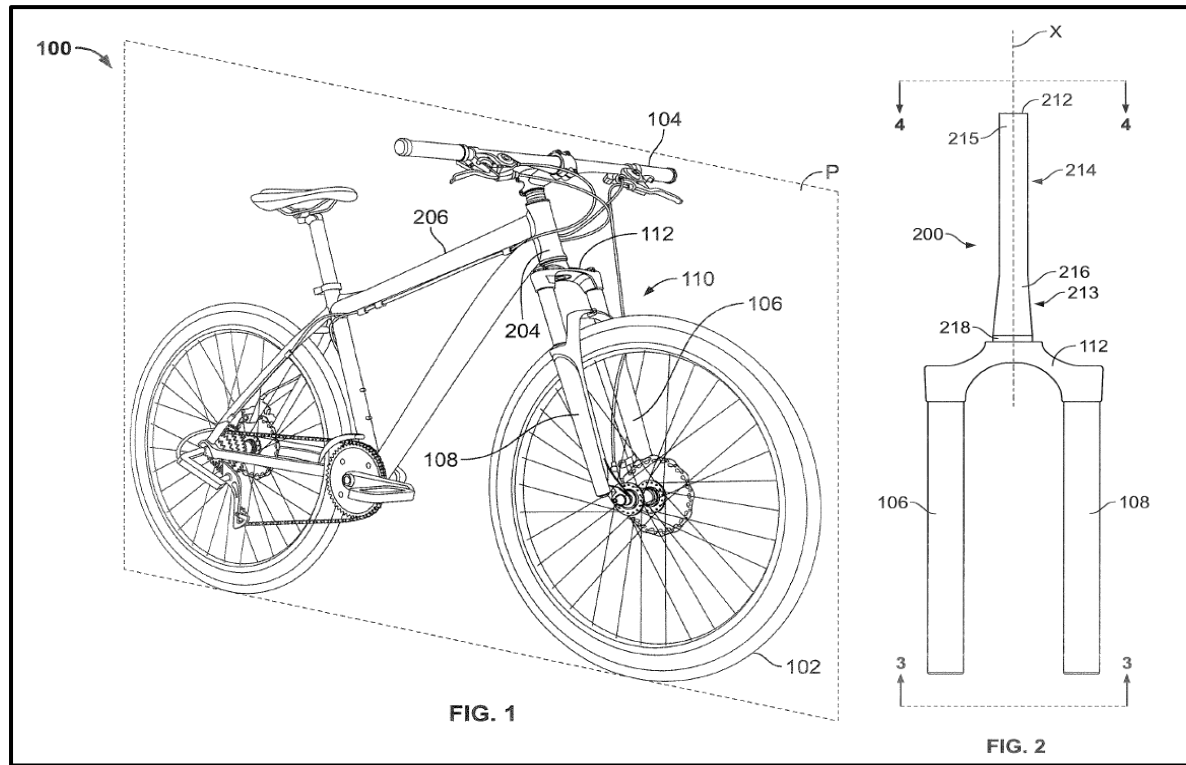
II. Applicant Admitted Prior Art (“AAPA”)

In the Background section of the ’993 patent specification, Patent Owner SRAM, LLC discloses a conventional bicycle 100 and how to steer it out of a plane

³ A listing of the challenged claims is provided at the beginning of the Petition, starting at page viii.

of travel P using a steerer tube 200, the steering tube being disposed along a steering axis X in the plane of travel P and having a lower end 202 affixed to the fork crown 112 and an upper end 212 affixed to the bicycle handlebar 104, as shown below.

Ex. 1001, 1:8-32; Ex. 1003, ¶38.



Ex. 1001, 1:8-32, FIGS. 1-2.

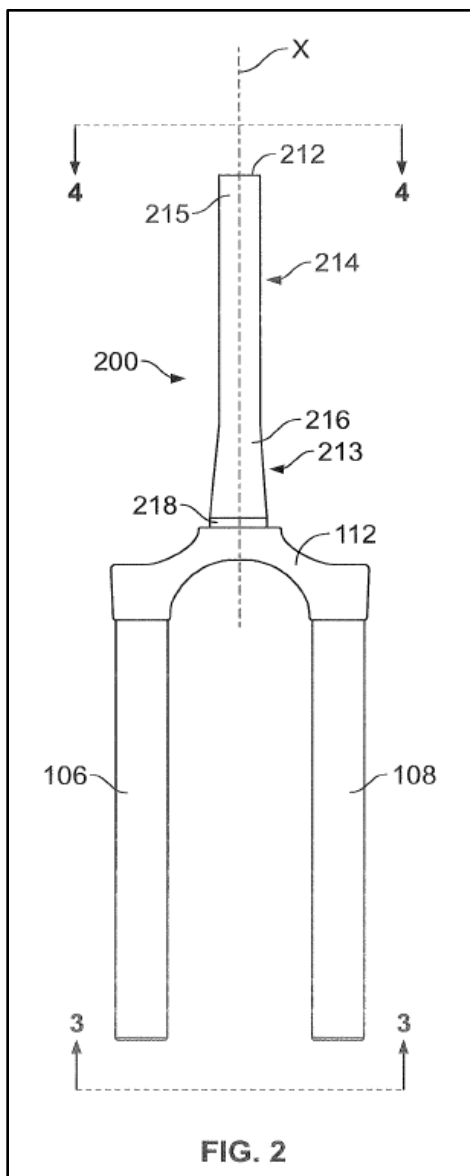
According to Petitioner's expert, Dr. Slocum, "the AAPA is evidence of at least the general knowledge at the time of the purported invention that: (1) a bicycle has a steerer tube; (2) a bicycle has a plane of travel aligned with the running direction of the bicycle; (3) a bicycle steerer tube has an elongate body disposed about a steering axis that lies within the plane of travel of the bicycle; and (4) the

lower end of a bicycle steerer tube is affixed to a crown of a front suspension fork of the bicycle and the upper end of the steerer tube is affixed to a handlebar of the bicycle.” Ex. 1003, ¶39.

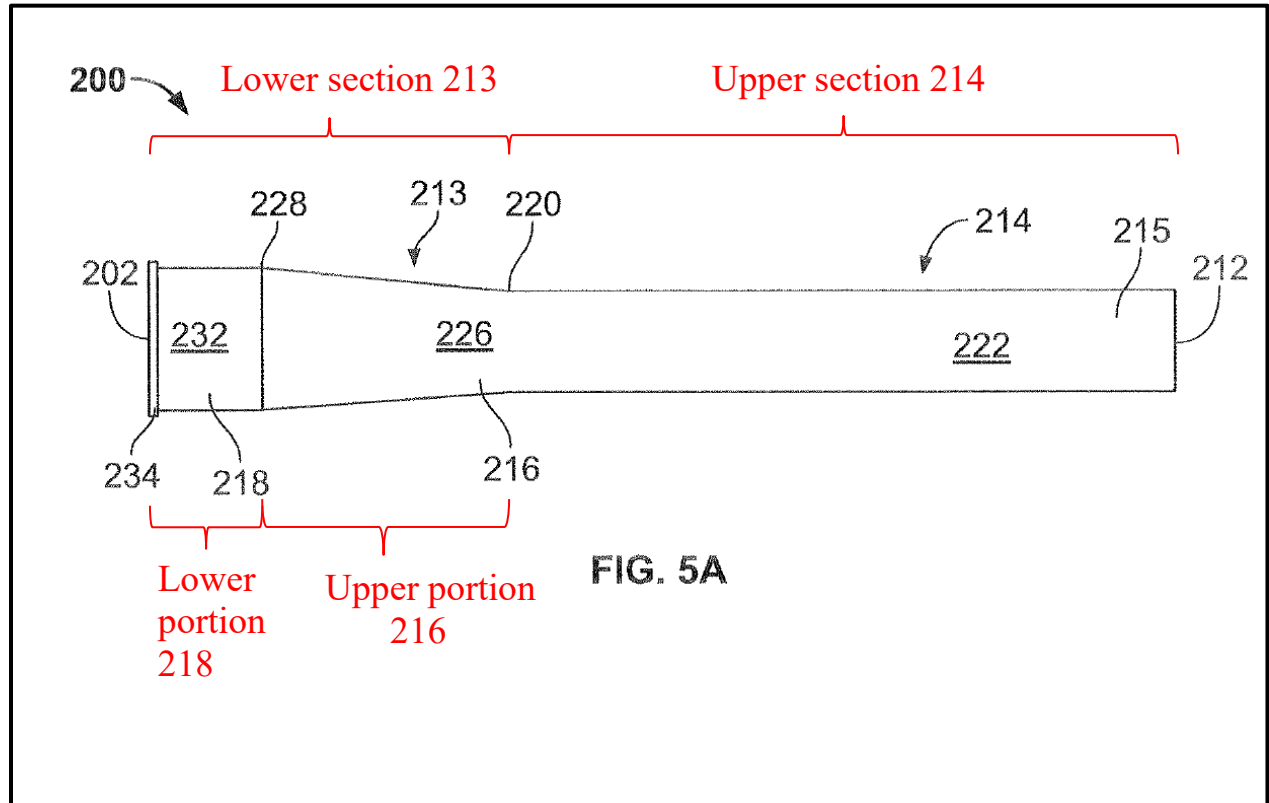
III. The '993 Patent's Bicycle Steerer Tube

The '993 patent discloses a bicycle steerer tube with varying wall thickness over a cross-section. Ex. 1001, 1:46-59, 3:26-32; Ex. 1002, 185-186. As shown below, like the conventional bicycle 100 described in the AAPA, steerer tube 200 includes an elongate hollow body arranged around steering axis X in a vertical plane of travel P of the bicycle. Ex. 1001, 1:19-32, FIGS. 1, 2, 5A; Ex. 1003, ¶25.

The body includes an upper section 214 and a lower section 213. Ex. 1001, 3:33-36. Lower section 213 is further divided into an upper portion 216 and a lower portion 218. Ex. 1001, 3:58-60, 4:23-26, FIGS. 5A-7. A segment of lower portion 218, adjacent to lower end 202, is joined to a crown 112 of a front fork of the bicycle. Ex. 1001, 4:26-29, FIGS. 2, 5A-7; Ex. 1003, ¶¶25-26.

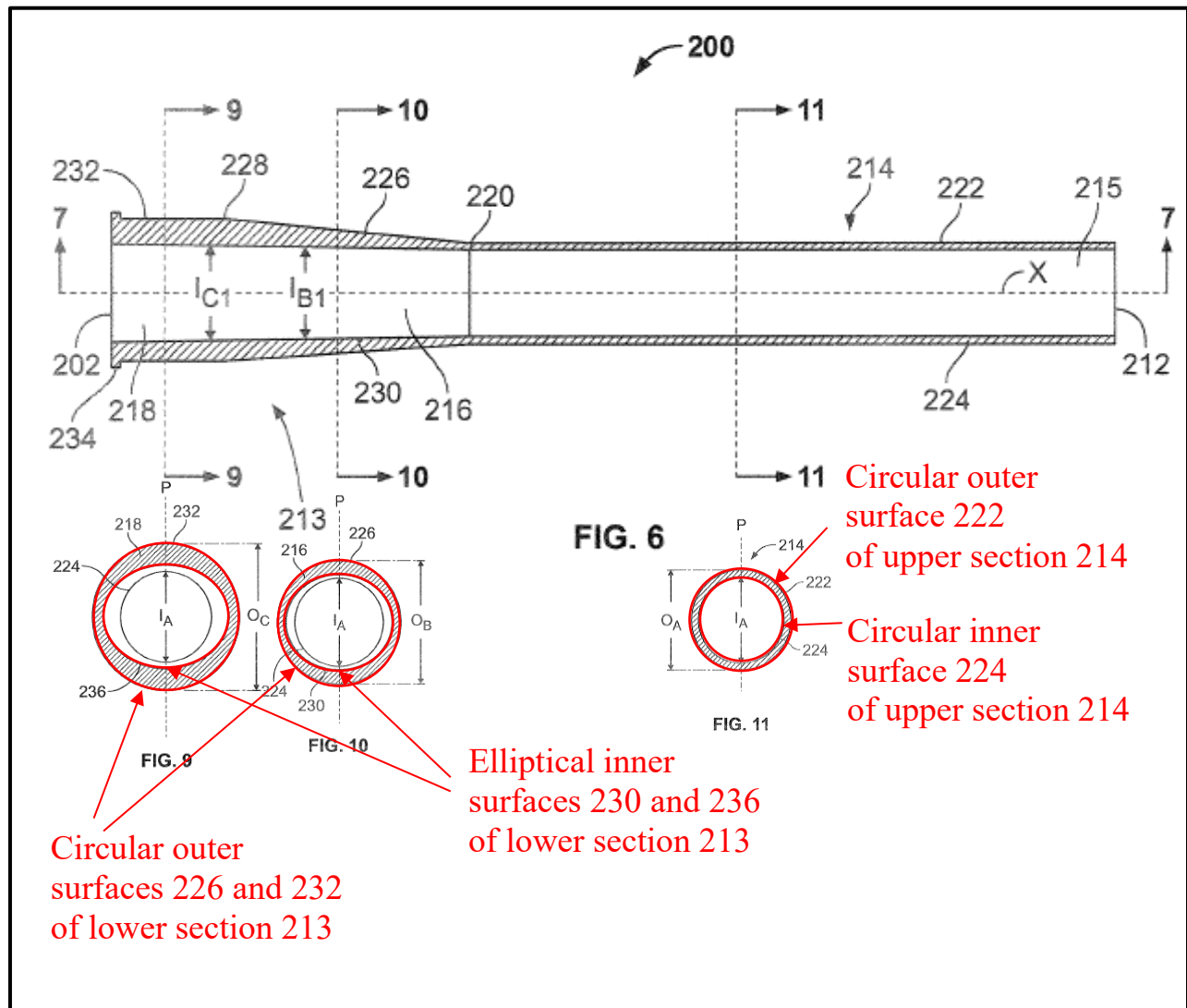


Ex. 1001, FIG. 2.



Id., FIG. 5A (annotations added).

As shown below, both the inner and the outer surfaces of upper section 214 are circular in cross-section. Ex. 1001, 3:39-43, FIGS. 5A-7; Ex. 1003, ¶27. In contrast, the cross-sectional shape of the inner surface of lower section 213 is elliptical, while the outer surface is circular in cross-section. Ex. 1001, 3:55-4:44, FIGS. 5A-7; Ex. 1003, ¶¶28-29.



Ex. 1001, FIGS. 6, 9, 10-11 (annotations added).

The elliptical cross-section of the inner surface results in varying wall thickness over a cross-section of the wall in lower section 213 of steerer tube 200, the wall thickness being at a maximum in the plane of travel P of the bicycle.

Ex. 1001, 4:7-26, FIGS. 5A-10; Ex. 1003, ¶29. This increase in wall thickness gives

the tube greater strength to bear higher loads and forces in the plane of travel P. Ex. 1001, 2:4-9, 3:29-32, 7:57-62; Ex. 1003, ¶29.

IV. Level of Ordinary Skill

At the effective filing date of the '993 patent, a person of ordinary skill in the art ("POSITA") would have had (1) a Bachelor's degree in Mechanical Engineering or an equivalent degree, and 1-2 years of experience in design work related to optimal mechanical and structural design (e.g., minimizing weight while maximizing strength and stiffness for a particular type of loading) such as practiced, for example, in aerospace, bicycle, or machinery (such as robotics) industries; or (2) at least a Master's degree in Mechanical Engineering or an equivalent degree with a focus on design of mechanical elements and structures, and a good understanding of mechanical and structural design principles. Ex. 1003, ¶23.

V. Claim Construction

Claims must be construed only to the extent necessary to resolve a controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d

1013, 1017 (Fed. Cir. 2017). No terms need construction to resolve the controversy in this forum.⁴ Ex. 1003, ¶30.

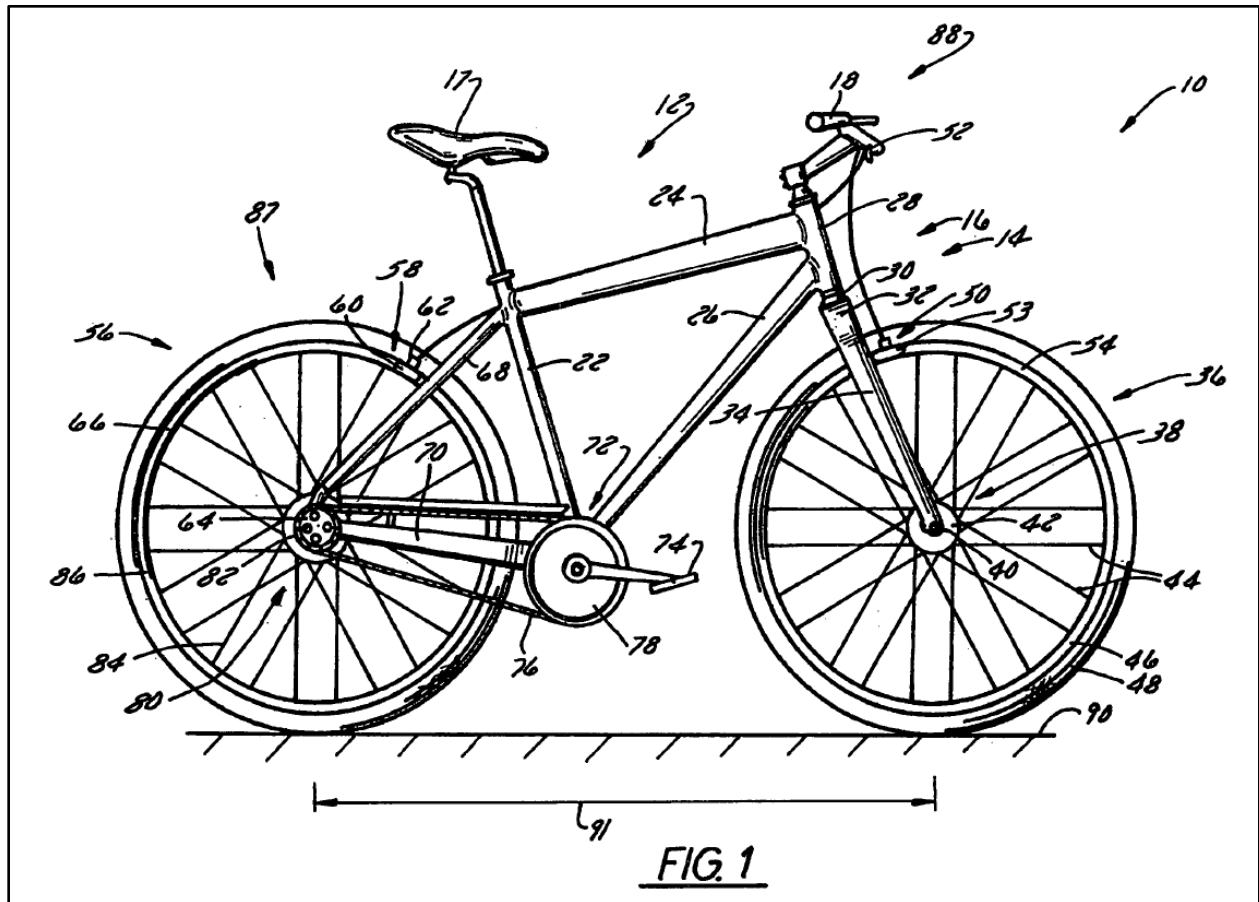
VI. Denk-Based Grounds

A. [Ground 1] The Group 1 Challenged Claims Are Rendered Obvious by Denk in View of Moechnig

1. Moechnig (Ex. 1008)

Moechnig discloses a steerer tube for a bicycle 10 that includes, among other things, a frame 12, a handlebar 18, a steerer tube 30, and a fork crown 32. Moechnig, Abstract, [0001]-[0003], [0025]-[0026], [0028], [0033]. Steerer tube 30 passes through a head tube 28 of frame 12 and connects to handlebar 18 at the upper end, and a fork crown 32 at the lower end, such that rotation of handlebar 18 rotates fork crown 32 and thereby rotates front wheel 36 about a longitudinal axis or direction of travel of the bicycle, which in turn steers the bicycle. *Id.*, [0005], [0026]-[0027], [0032], [0034]; Ex. 1003, ¶40. *See also* discussion of Moechnig in Ex. 1003, ¶¶41-43.

⁴ Petitioner reserves the right to argue in an appropriate forum that certain limitations in the challenged claims are indefinite.



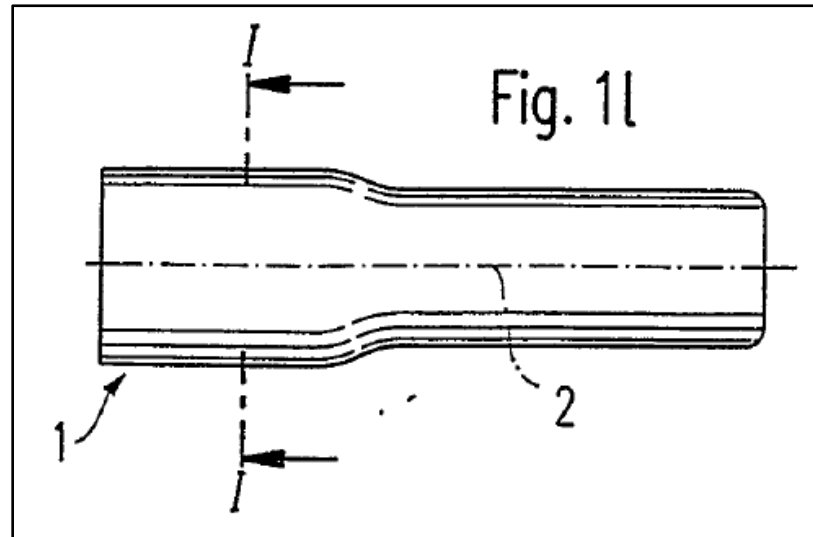
Moechnig, FIG. 1.

2. Denk (Ex. 1005)

Denk discloses a lightweight component suitable for all tubular components of a bicycle frame. Denk, Abstract, cols. 1, 4. A POSITA would have recognized that Denk's lightweight design would also have been suitable for a bicycle steerer tube to minimize the overall weight of the bicycle, while withstanding the loads on the steerer tube in the plane of travel of the bicycle. Ex. 1003, ¶44.

As shown below, the lightweight component has an elongate tubular body that extends symmetrically around a center line 2. Denk, col. 5. In one embodiment,

Denk discloses that the outer cross-sectional contour is cylindrical throughout the length of the tube. *Id.*, col. 8, Fig. 2a. In another embodiment, Denk discloses that the tube has two cylindrical sections joined by a tapering region, as shown in Figure 11, below. Ex. 1003, ¶44.

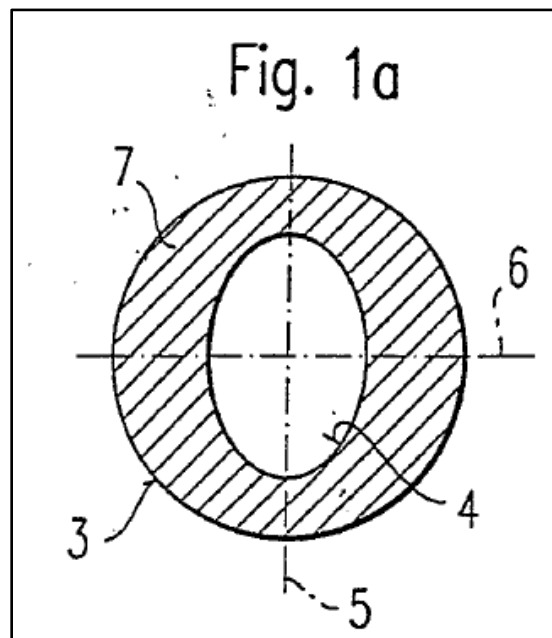


Denk, Fig. 11.

Denk discloses that the tubular body has a wall thickness that changes over its cross-section along the length of the tubular body to adapt to the loads that occur during use. *Id.*, Abstract, cols. 1-2 (“[T]he profile of the wall thickness over the cross section may be optimally adapted to the actual requirements with regard to strength and rigidity.”); Ex. 1003, ¶45. In one embodiment, as shown below, the tube has a circular outer cross-sectional contour 3 and an elliptical inner cross-sectional contour 4, thus providing maximum thickness and optimal load-bearing capacity along a plane 6 and minimum thickness along a plane 5 perpendicular to plane 6. Denk,

cols. 3, 6, 11-12, Figs. 1a, 4c; Ex. 1003, ¶45. Denk further discloses that the elliptical inner cross-sectional contour 4 can continually transition into a circular cross-sectional contour in a certain area of the tube. Denk, col. 8. Ex. 1003, ¶¶47-48.

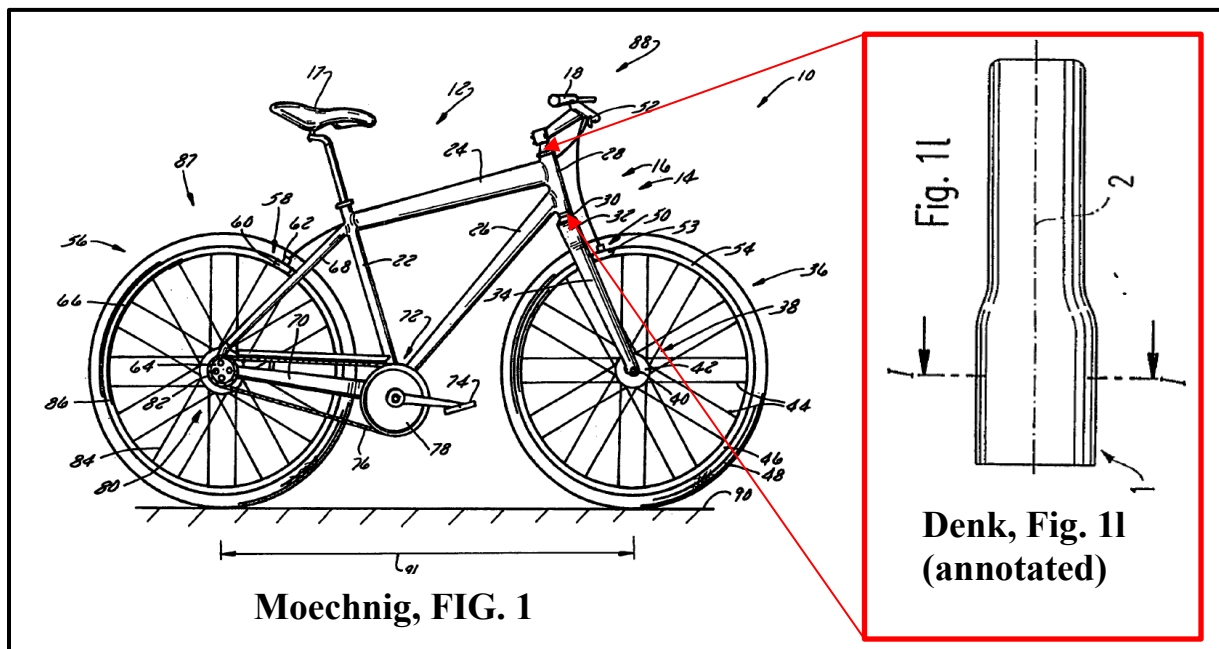
Denk discloses that high loads occur in the vertical plane of the bicycle frame and that the tube is configured to meet the requirements of strength and rigidity in the load direction. Denk, cols. 1-2. A POSITA would thus have understood that when implementing Denk's tube as a steerer tube, plane 6 would be aligned with the vertical plane of the bicycle frame (which is same as the vertical plane of travel of the bicycle), such that the areas of maximum thickness are in the plane that experiences most load. Ex. 1003, ¶¶45-46.



Denk, Fig. 1a.

3. A POSITA would have been motivated to combine Denk and Moechnig, and would have reasonably expected success in doing so

A POSITA would have found it obvious to use Denk's lightweight component as a bicycle steerer tube and would have implemented it in a conventional manner, i.e., connect it to the handlebar on the upper end and with the fork crown on the lower end, as disclosed in Moechnig and shown in the figure below. Ex. 1003, ¶55.



Specifically, a POSITA would have recognized Denk's lightweight tubular component as a suitable option for a bicycle steerer tube because Denk discloses that its lightweight component is suitable for all tubular components of a bicycle frame. Denk, Abstract, cols. 1, 4; Ex. 1003, ¶56. Moreover, a POSITA would have been motivated to use Denk's lightweight component as a bicycle steerer tube to have the advantages of improved mechanical strength and reduced weight as disclosed in

Denk and known in the prior art. Denk, cols. 1-2; *see also* Valat, 1:10-14; Schroeder, 6:22-26. A POSITA would have known that for most bicycles, from road bikes to mountain bikes, lower weight of the bicycle frame is desirable to improve performance. Ex. 1003, ¶57. Denk further discloses that bicycle frames, such as those of mountain bikes, also need to have high strength and rigidity, particularly in the vertical plane of the frame where high loads occur during use to prevent undesirable bending or fracturing of the steerer tube during rides. *Id.*; *see* Denk, cols. 1-2. A significant advantage of Denk's lightweight component is that the wall thickness over a cross-section is adapted to meet the requirements of strength and rigidity, such that "for the same overall strength and rigidity, the weight may be reduced, or for the same weight, the strength and rigidity may be significantly increased in the load direction specified by the design." *Id.*, col. 2; Ex. 1003, ¶57.

A POSITA would also have known how to use Denk's lightweight tubular component as a steerer tube. Mounting a steerer tube on a bicycle frame by connecting it to the handlebar and fork crown would have been well known for a POSITA. Ex. 1003, ¶58. Indeed, the AAPA admits that in a conventional bicycle, the steerer tube is affixed to the fork crown at its lower end and the handlebar at the upper end to permit the rider to steer the bicycle as desired. Ex. 1001, 1:19-33; Ex. 1003, ¶58.

A POSITA would have recognized that Denk's elongated tube as shown in Figure 11 would have been a suitable configuration for a bicycle steerer tube because it allows for added reinforcement, such as a thicker wall, in the lower section, which is generally subjected to more loads or stresses during a ride due to its connection to the fork crown. *See* Valat, 1:44-51; *see also* Denk, col. 3; Ex. 1003, ¶59.

A POSITA would have expected success in using Denk's lightweight tubular component as a steerer tube because mounting Denk's tube on a bicycle frame in a conventional manner, as disclosed in Moechnig and the AAPA, would have required nothing more than the application of ordinary skill and basic knowledge of bicycle hardware. Ex. 1003, ¶60. For instance, a POSITA would have known to (1) position the areas of maximum cross-sectional thickness of the steerer tube in the vertical plane of the bicycle frame—i.e., the plane of travel of the bicycle; and (2) affix the upper end of the tube to a handlebar or handlebar stem and affix the lower end of the tube to a fork crown using conventional methods and ordinary skill. *See* AAPA; Denk, col. 3; Schroeder, Title, Abstract; Moechnig, [0002]; Ex. 1003, ¶60. Indeed, using Denk's lightweight tubular component as a steerer tube in a bicycle frame, as disclosed in Moechnig, would have been a combination of known prior art elements according to their established functions, and the combination would have yielded the predictable result of a bicycle with a lightweight steerer tube that has improved

strength and rigidity properties in the plane of travel of the bicycle. Ex. 1003, ¶¶60-61.

4. Independent Claim 1

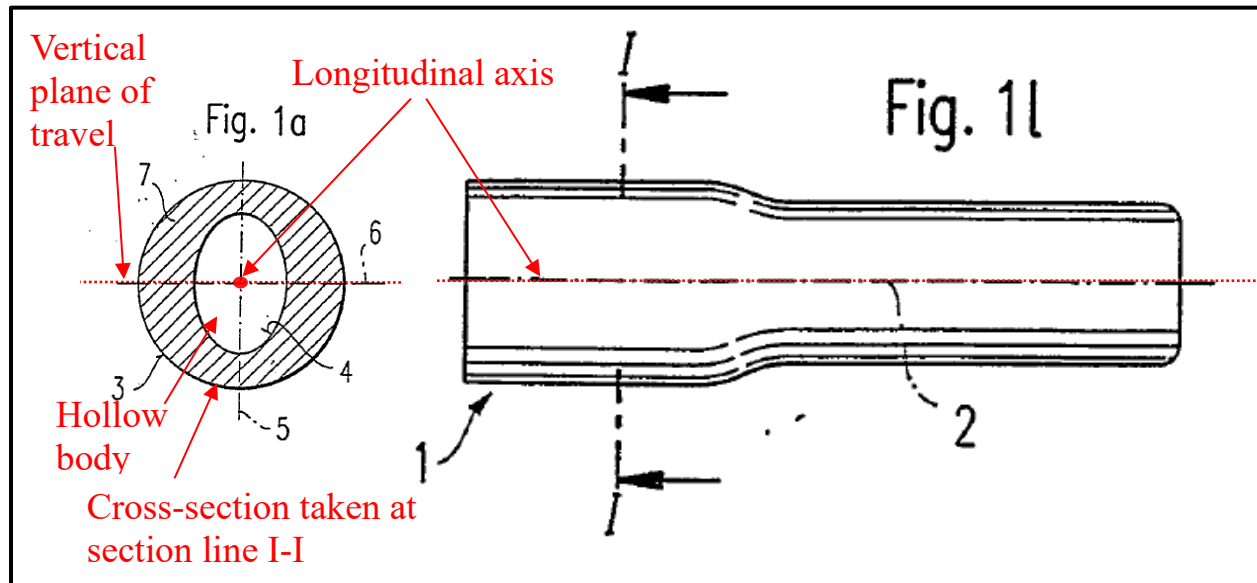
Denk in view of Moechnig renders claim 1 obvious. *Id.*, ¶¶62-92.

a. 1[preamble]

Denk discloses that its lightweight tubular component is suitable for all tubular components of a bicycle frame. Denk, cols. 1, 4. It would have been obvious to a POSITA to use Denk's lightweight tubular component as a bicycle steerer tube because it would have the known advantages of reduced weight and improved mechanical strength. Ex. 1003, ¶¶57, 63; *see also* Moechnig, [0001], [0009], [0049] (disclosing a lightweight steerer tube for a bicycle).

b. Claim term 1[a]

As shown below, Denk discloses that the lightweight component has “an essentially tubular body with a defined outer cross-sectional contour and a defined inner cross-sectional contour.” Denk, Abstract. The lightweight component is an elongated tube 1 extending symmetrically with respect to a straight center line 2. *Id.*, col. 5, Fig. 11. A cross-section of the tube has a circular outer cross-sectional contour 3 and an elliptical inner cross-sectional contour 4 arranged symmetrically with respect to a center line or center plane 5. *Id.*, col. 6, Fig. 1a; Ex. 1003, ¶65.



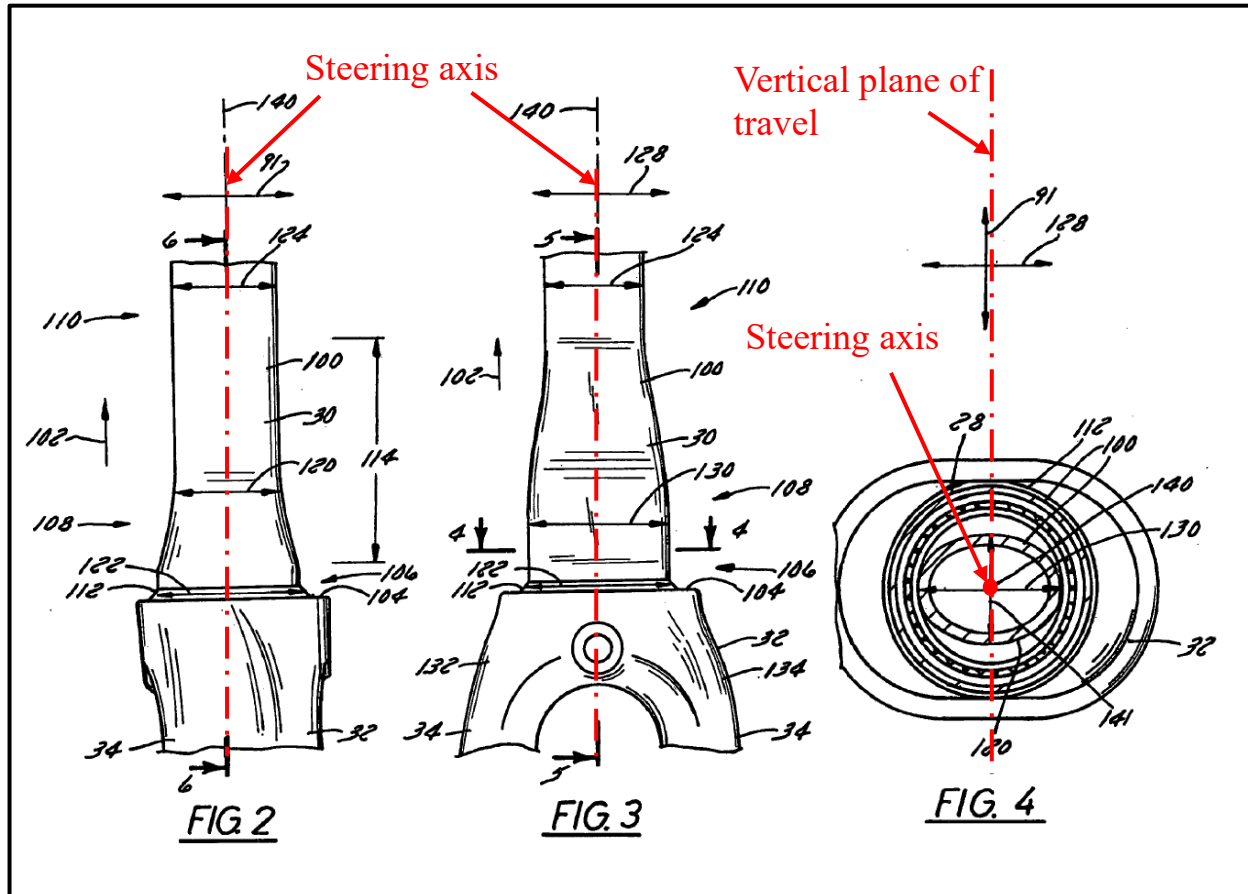
Denk, Figs. 1a, 1l (annotations added).

A POSITA would have understood that Denk's tubular component has "an elongate hollow body" because it is "an elongated tube" and the tube structure has a hollow core. *Id.*, col. 5, Figs. 1a, 1l; Ex. 1003, ¶66. When Denk's tubular component is mounted on a bicycle as a steerer tube as taught by Moechnig, its longitudinal axis ("center line 2") would be "a steering axis" because the longitudinal axis of a steerer tube is the axis about which the front wheel rotates to change travel direction and thereby steer the bicycle. Ex. 1003, ¶66.

A POSITA would have understood that the steering axis would have been "in a vertical plane of travel of the bicycle" because the vertical plane of travel of the bicycle is aligned with the fore-aft travel direction of the bicycle, and pivoting the

front wheel about the steering axis in the vertical plane of travel would steer the front wheel out of the vertical plane of travel. *Id.*, ¶67; *see also* AAPA.

Further, a POSITA would have found it obvious to arrange the “elongate hollow body” of Denk’s tube “around a steering axis located in a vertical plane of travel of the bicycle,” as disclosed in Moechnig. Ex. 1003, ¶¶68-72. Specifically, Moechnig discloses a steerer tube having an elongate hollow body arranged around a steering axis (longitudinal axis 140). Moechnig, FIGS. 2-3 (showing steerer tube 30 having an elongate body 110 arranged around longitudinal axis 140), FIG. 4 (showing body 100 being hollow), [0035], [0045]; Ex. 1003, ¶¶68-69. A POSITA would have further understood that Moechnig’s longitudinal axis 140 is “a steering axis” because the steerer tube rotates about it to enable turning, and that Moechnig’s longitudinal axis 140 is located in “a vertical plane of travel of the bicycle,” similar to the plane of travel disclosed in the ’993 patent. Moechnig, FIG. 1; Ex. 1003, ¶¶70-71; AAPA, FIG. 1.



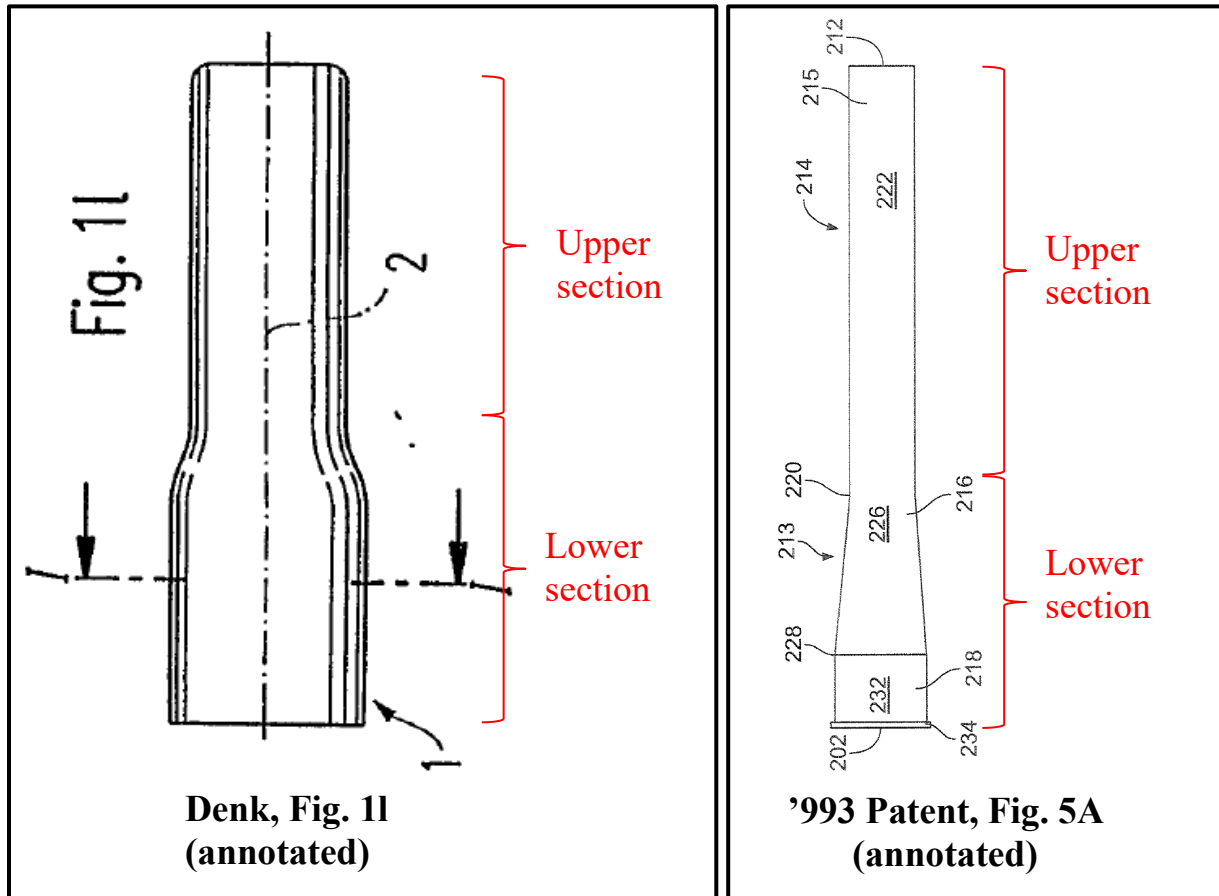
Moechnig, FIGS. 2-4 (annotations added).

Based on Moechnig’s teaching, it would have been obvious to a POSITA that the elongated hollow body of Denk’s tube, when mounted on a bicycle frame as a steerer tube, would have been arranged around a steering axis in “a vertical plane of travel of the bicycle,” which was conventional and known at the time of the purported invention. *See* AAPA; Ex. 1003, ¶72.

c. Claim term 1[b]

The body of Denk’s tubular component 1, when implemented as a steerer tube in view of Moechnig, has two sections joined to each other over a tapering region,

similar to the body of the steerer tube disclosed in the '993 patent, as shown below (Ex. 1003, ¶73):



A POSITA would have understood that when Denk's tube is mounted on a bicycle as a steerer tube in view of Moechnig, the elongate tubular body would extend in a substantially vertical direction such that one of the two sections would be an upper section and the other would be a lower section. *See* Moechnig, FIG. 3; AAPA; Ex. 1003, ¶74. Further, it would have been obvious to a POSITA that the section of Denk's tube having the larger outer contour would have been suitable for the lower section because the larger outer contour allows for additional

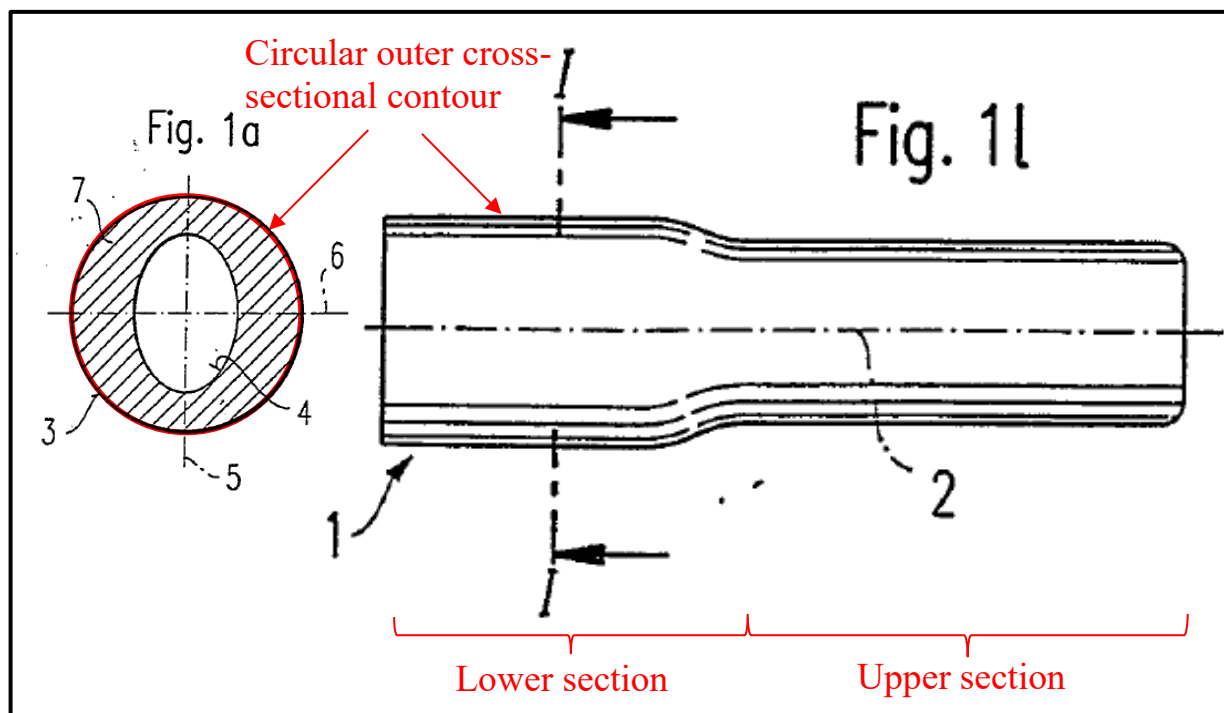
reinforcement, such as a thicker wall, in the lower section, which is subjected to more loads or stresses. *See* Denk, col. 3; Valat, 1:44-51; Ex. 1003, ¶75.

A POSITA would have understood that when Denk's tube is implemented as a steerer tube in view of Moechnig, the top end of the upper section of Denk's tube would have been joined to a handlebar, and a lower end of the lower section of the tube would have been joined to the crown of a fork, such that manipulation of the handlebar would allow for steering of the front wheel of the bicycle. *See* AAPA; Ex. 1003, ¶76. Indeed, Moechnig discloses that the stem of Moechnig's handlebar 18 engages with steerer tube 30, thus disclosing that "a segment of the upper section" of steerer tube body 100 is adapted to be joined to a bicycle handlebar. Moechnig, [0001], [0026], FIG. 1. Moechnig further discloses that steerer tube 30 may be secured to or formed integrally with fork crown 32, thus disclosing that "a segment of the lower section" of steerer tube body 100 is adapted to be joined to the crown of a front wheel fork of the bicycle. *Id.*, [0002], [0027], FIGS. 1-3.

Based on Moechnig's teaching, it would have been obvious to a POSITA that Denk's tube body, when mounted on a bicycle frame as a steerer tube, would have "a segment of the upper section adapted to be joined to a bicycle handlebar" and "a segment of the lower section adapted to be joined to a crown of a front wheel fork of the bicycle," which was conventional and known at the time of the purported invention. *See* AAPA; Ex. 1003, ¶¶77-80.

d. Claim term 1[c]

Denk discloses that its tubular component has a circular outer cross-sectional contour 3 and an elliptical inner cross-sectional contour 4 in the lower section, as shown below, such that the wall thickness distribution of the tubular body over a cross-section taken in the lower section is defined by the inner elliptical cross-sectional contour. Denk, Abstract, cols. 3, 6, Figs. 1a, 1l; Ex. 1003, ¶81.



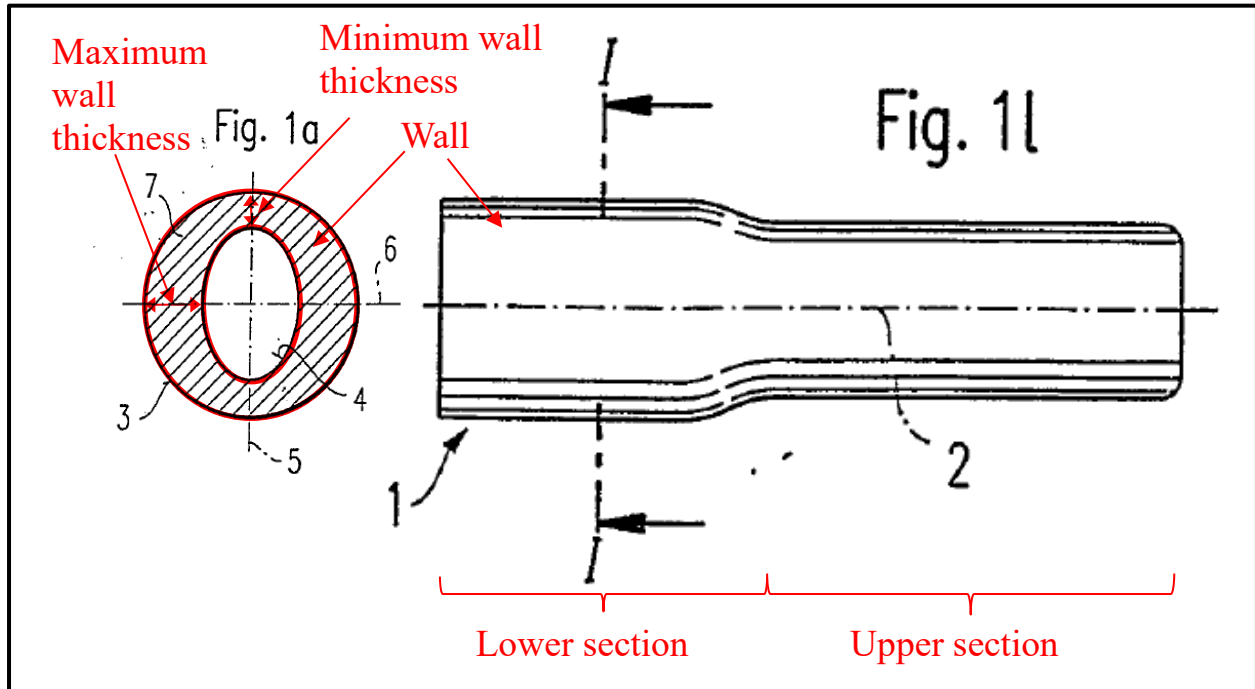
Denk, Figs. 1a, 1l (annotations added).

It would have been obvious to a POSITA that the outer surfaces of both the upper and the lower sections would have been circular in cross-section because Denk expressly discloses that a circular outer cross-sectional contour is preferred for visual and technical reasons. *Id.*, col. 3 (“A circular ring-shaped outer cross-sectional

contour is to be preferred for visual and possibly also technical reasons, resulting in a lightweight component in which the different wall thickness distribution is defined by the inner cross-sectional contour.”); Ex. 1003, ¶¶81-82. Furthermore, a POSITA would have known how to shape a circular outer cross-sectional contour throughout the tube length based on teachings in Denk. Ex. 1003, ¶¶83-86.

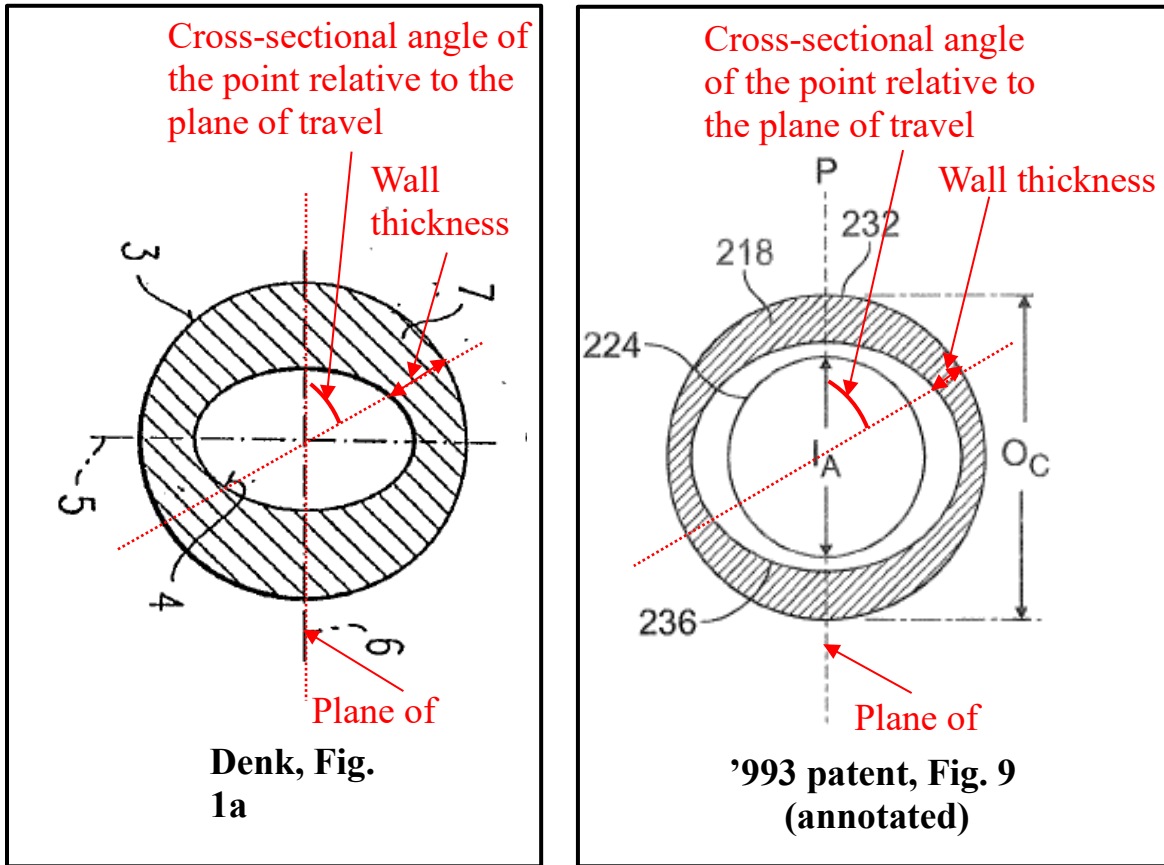
e. Claim term 1[d]

Denk’s tubular body includes a wall formed between the elliptical inner cross-sectional contour 4 and the circular outer cross-sectional contour 3, such that the wall thickness of the tubular body varies over a cross-section taken in the lower section, such as at section line I-I in Figure 11, with the maximum thickness being in plane 6 and minimum thickness being in a plane 5 perpendicular to plane 6, as shown below. *See* Denk, col. 6, Figs. 1a, 11; Ex. 1003, ¶¶87-88.



Denk, Figs. 1a, 1l (annotations added).

More specifically, the wall thickness of Denk's tube at any point on the wall, e.g., a point on the inner elliptical contour, changes as a function of the cross-sectional angle of the point relative to plane 6, the maximum thickness being in plane 6. Ex. 1003, ¶87.



Denk further discloses that high loads occur in the vertical plane of a bicycle frame, which is the same as the plane of travel of the bicycle, and so force absorption capability of bicycle components should be greater in vertical plane 6. Denk, col. 2; Ex. 1003. ¶46. Accordingly, a POSITA would have found it obvious to align plane 6 of Denk's tube 1, which has the maximum wall thickness, with the plane of travel. Ex. 1003, ¶¶89-92. That is, a POSITA would have found it obvious based on the disclosure of Denk to put the areas of maximum wall thickness (resulting from the elliptical inner contour and circular outer contour) in the plane of travel of the bicycle because the loads on the steerer tube are maximum in the plane of travel. *Id.*

Likewise, a POSITA would have found it obvious to have the areas of minimum thickness orthogonal to the plane of travel to improve lightness of the steerer tube in areas of lesser loads. *Id.*

5. Independent Claim 61

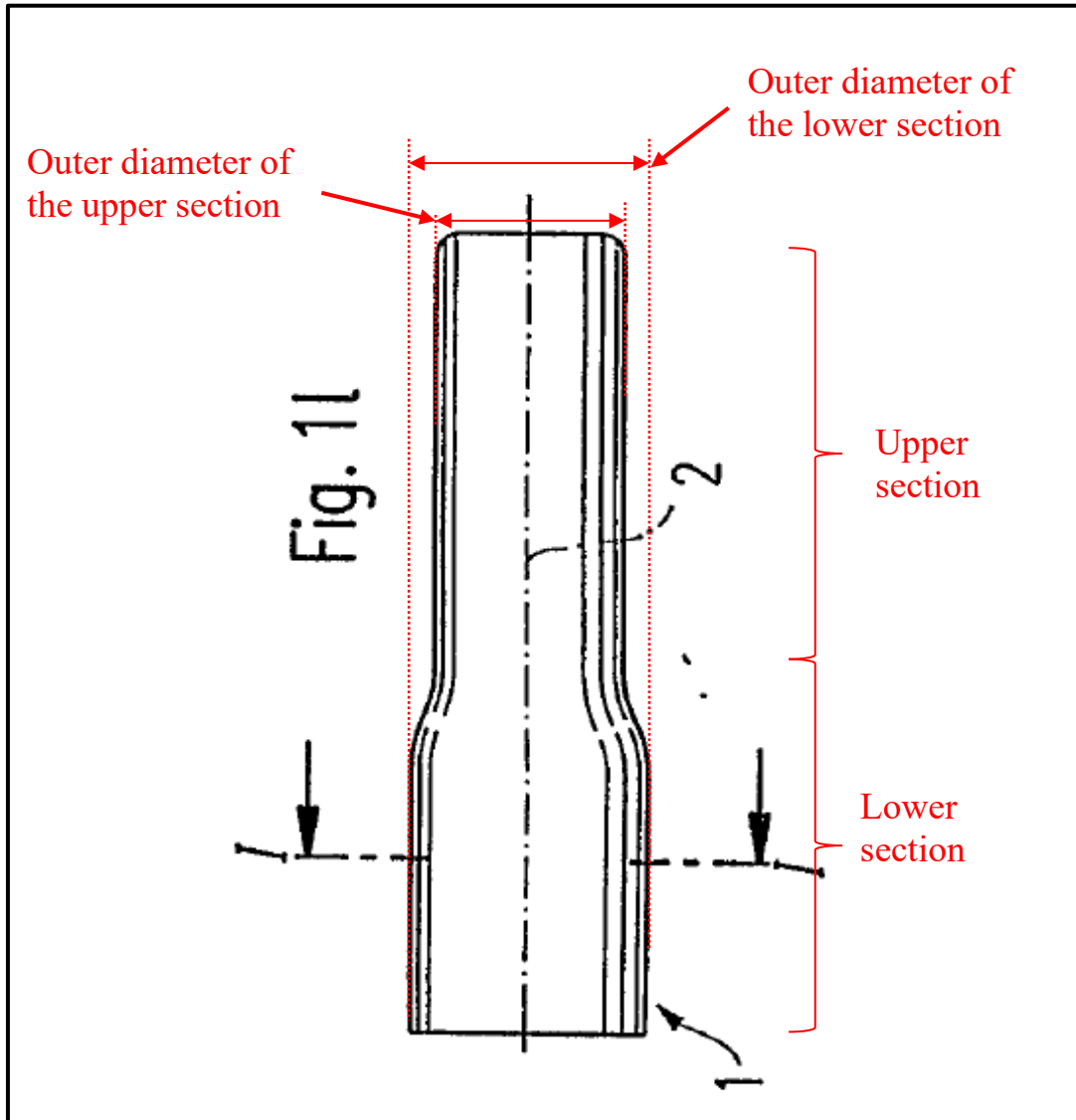
Denk in view of Moechnig renders claim 61 obvious. *Id.*, ¶¶93-99.

a. 61[preamble]-61[b] and 61[d]

61[preamble]-61[b] and 61[d] are identical to 1[preamble]-1[b] and 1[d], respectively. Denk in view of Moechnig render obvious 61[preamble]-61[b] and 61[d] for the reasons discussed in Sections VI.A.4.a-VI.A.4.c and VI.A.4.e; Ex. 1003, ¶¶94-96, 99.

b. Claim term 61[c]

As shown below, Denk's tube has an upper section and a lower section. Ex. 1003, ¶97.



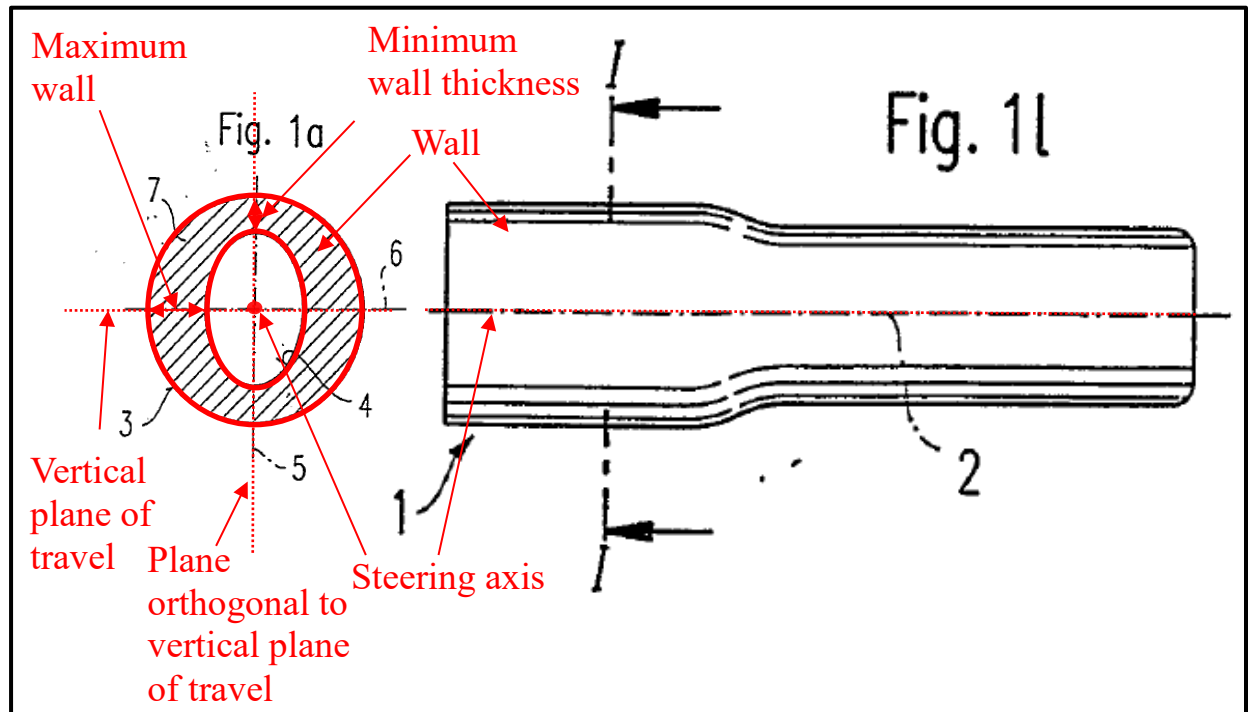
Denk, Fig. 11 (annotations added).

As discussed with regard to claim term 1[c] (Section VI.A.4.d), it would have been obvious to a POSITA that the outer surfaces of the upper and lower sections of the tube body have circular cross-sections. A POSITA would also have understood that an outer diameter of the cross-section of the lower section of the body is greater than an outer diameter of the cross-section of the upper section of the body, as shown

above. Denk, Fig. 11; Ex. 1003, ¶¶97-98. A POSITA would have understood that such a shape allows for additional reinforcement, such as a thicker wall, in the lower section, which is subject to more loads or stresses during use compared to the upper section. *See* Denk, col. 3; Valat, 1:44-51; *see also* Section VI.A.4.c; Ex. 1003, ¶¶97-98.

6. Claim 15

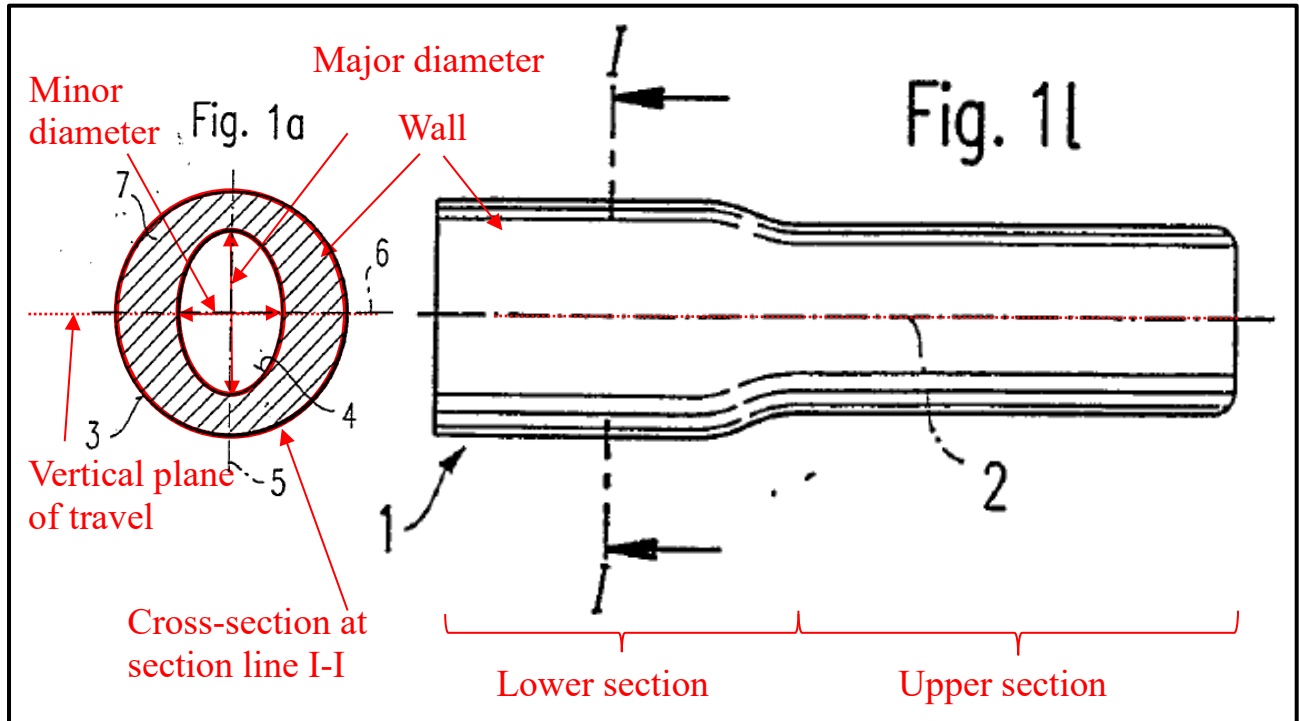
As discussed above in 1[d] (Section VI.A.4.e) and shown below, Denk in view of Moechnig teaches that the steerer tube body has maximum thickness along plane 6, i.e., “the plane of travel of the bicycle,” and minimum thickness along center plane 5 perpendicular to plane 6, i.e., “a plane ... orthogonal to the plane of travel of the bicycle.” *See also* Ex. 1002, ¶102. As discussed above in 1[a] (Section VI.A.4.b), the steering axis lies in the plane of travel of the bicycle (plane 6). Plane 5 also contains the steering axis because planes 5 and 6 intersect orthogonally at the steering axis, as shown below. Ex. 1003, ¶102. A POSITA would also have known that the steering axis of Denk’s tube would align with the center plane 5. *Id.*; *see* Moechnig, [0035], FIGS. 2-3. That is, when Denk’s tube is implemented as a steerer tube in view of Moechnig, the wall thickness is at a minimum in center plane 5, which contains the steering axis and is orthogonal to the plane of travel of the bicycle (plane 6).



Denk, Figs. 1a, 1l (annotations added).

7. Claim 34

As discussed above in 1[b] and 1[d] (Sections VI.A.4.c, VI.A.4.e) and shown below, Denk's tube, when implemented as a steerer tube in view of Moechnig, includes an upper section, a lower section, and a wall with varying thickness formed between inner elliptical cross-sectional contour 4 and outer circular cross-sectional contour 3 in the lower section (as evident from the cross-section taken at a section line I-I in the lower section of Denk's tube body). Ex. 1003, ¶105.



Denk, Figs. 1a, 1l (annotations added).

Because of the inner elliptical cross-sectional contour 4, an inner surface of the wall in the lower section of the Denk tube body is formed as “an ellipse in cross section.” Denk, Fig. 1a; Ex. 1003, ¶106. As shown above, the ellipse formed by contour 4 has “a major diameter” positioned to be perpendicular to the plane of travel (i.e., in center plane 5) and “a minor diameter” positioned to be in the plane of travel of the bicycle (i.e., in plane 6), such that the tube has maximum wall thickness in the plane of travel where the loads are higher compared to the plane that is orthogonal to the plane of travel. Denk, col. 2; Ex. 1003, ¶106; *see* Section VI.A.4.e.

8. Claim 35

Claim 35 depends from claim 34 and is identical to claim term 1[c]. Denk in view of Moechnig renders claim 35 obvious for the reasons discussed in 1[c]. Sections VI.A.4.d; Ex. 1003, ¶107.

9. Claims 14, 33, and 53

Denk discloses that lightweight components for bicycle tubes may be made of steel, aluminum or titanium alloy, or plastic material reinforced with carbon fibers. Denk, cols. 1, 5. It would have been obvious to a POSITA that when Denk's lightweight component is used as a steerer tube, it would have been made of any of these materials because Denk teaches that such a lightweight component is "suitable for practically all tubular components" of a bicycle frame. Ex. 1003, ¶110.

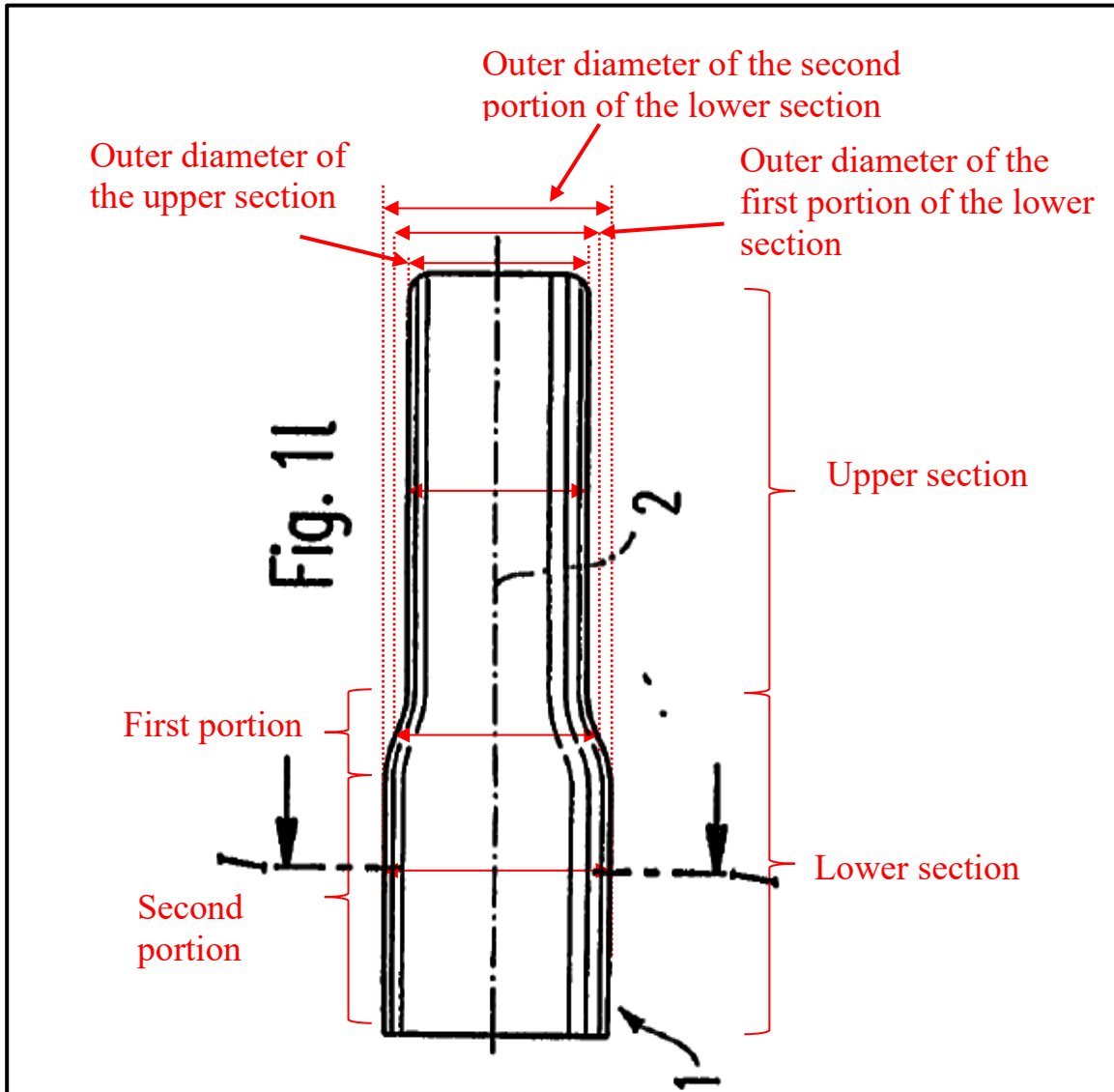
Moechnig also discloses that a steerer tube is made of aluminum or carbon fiber materials. Moechnig, [0003], [0014]. It would have been obvious to a POSITA that these materials would have been suitable for Denk's steerer tube. Ex. 1003, ¶111. Indeed, it was well known and conventional to use aluminum or titanium alloy, or carbon fiber reinforced materials, for tubular components of bicycles. *Id.*

10. Claims 2, 16, 27, 36, and 47

The limitation in each of these claims is identical to claim term 61[c]. Denk in view of Moechnig render them obvious for the same reason as discussed above for claim term 61[c]. Section VI.A.5.b; Ex. 1003, ¶112.

11. Claims 3, 17, 28, 37, 48, and 62

As discussed with regard to claim term 1[b] (Section VI.A.4.c) and as shown below, Denk discloses that the elongated tubular body has a lower section joined to an upper section. *See also* Ex. 1003, ¶115. The tapering region of the lower section forms a “first portion” of the lower section adjoining the upper section, and the rest of the lower section forms the “second portion.” *Id.* While the outer diameters of the upper section and the “second portion” of the lower section remain constant, the outer diameter of the “first portion” of the tubular body tapers gradually from the “second portion” of the lower section to the upper section, as shown below. *Id.*; Denk, Fig. 11. This results in an outer diameter of the “first portion” of the lower section that is greater than an outer diameter of the upper section and less than an outer diameter of the “second portion” of the lower section. Ex. 1003, ¶115.



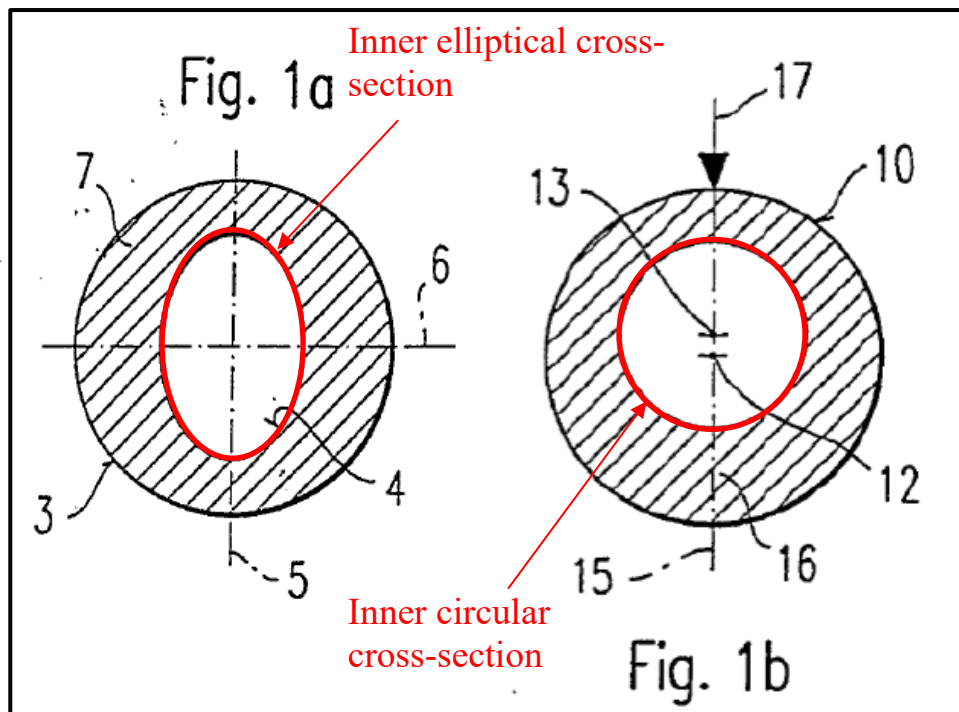
Denk, Fig. 11 (annotations added).

12. Claims 4, 18, 29, 38, 49, and 63

Denk in view of Moechnig render these claims obvious for the reasons discussed above in Section VI.A.11. Ex. 1003, ¶¶115, 116.

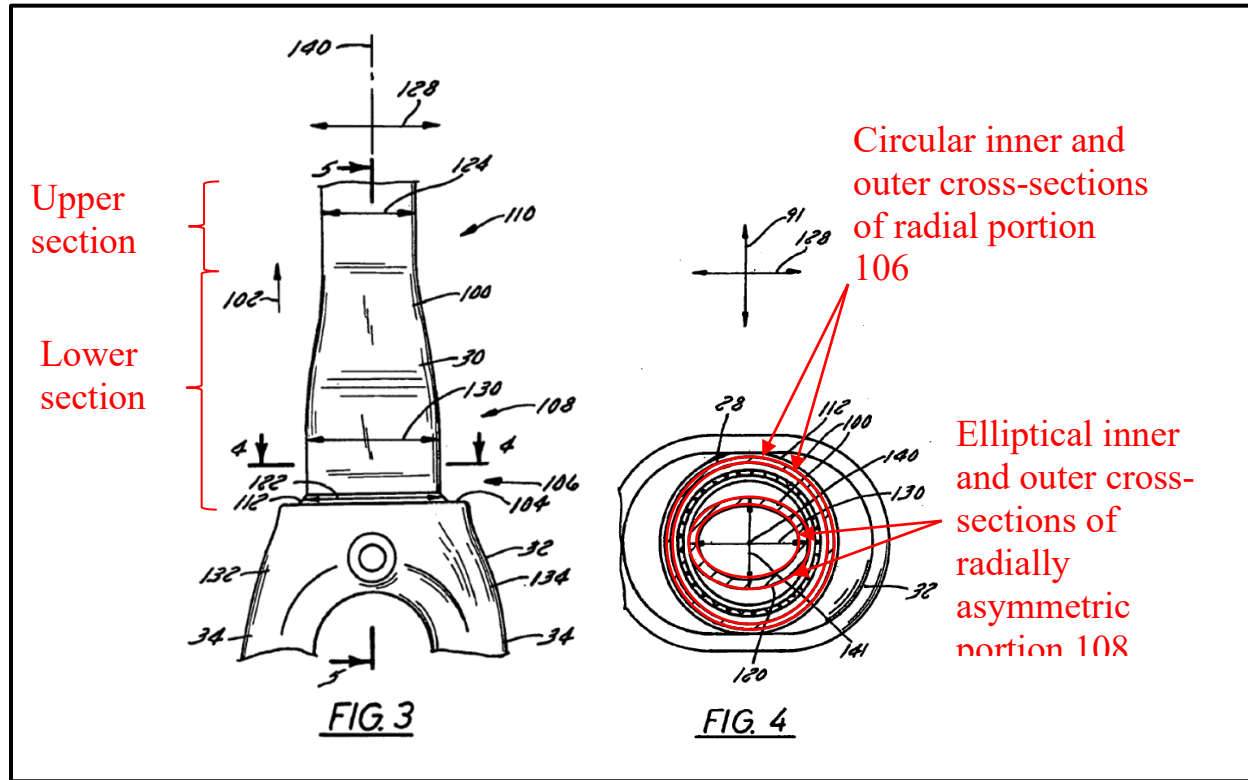
13. Claims 6, 10, 20, 24, 40, and 44

Denk discloses that the cross-sectional shape of the tube can change along the tube length, and that the inner cross-sectional shape in one region of the tube may be elliptical as shown in Figure 1a, and may be circular in another region as shown in Figure 1b. Denk, cols. 6, 8, Figs. 1a, 1b; Ex. 1003, ¶118. Denk further discloses that in the Figure 1a embodiment, “it is possible for the elliptical inner cross-sectional contour to continually transition into a circular inner cross-sectional contour in a certain area of the tube.” Denk, col. 8; Ex. 1003, ¶118. Denk thus suggests that an inner surface of the upper section of Denk’s tube is circular in cross-section. Ex. 1003, ¶118.



Denk, Figs. 1a-1b (annotations added).

As discussed with regard to claim term 1[b] (Section VI.A.4.c) and as shown below, Moechnig discloses a steerer tube that has an upper radial portion 110 that forms an “upper section,” and a radial portion 106 and a radially asymmetric portion 108 that collectively form a “lower section.” Moechnig, [0035], FIGS. 2-3. Moechnig discloses that the cross-section of radial portion 106 is associated with a diameter 124 and has circular inner and outer cross-sections. *Id.*, FIGS. 1, 2, 4, [0035]-[0036], [0038]. Moechnig further shows that the inner and outer cross-sections of radial portion 106 are circular in the cross-sectional view of Figure 4. Ex. 1003, ¶119. A POSITA would have understood that upper radial portion 110 (“upper section”) would also have circular inner and outer cross-sections, like lower radial portion 106, because Moechnig discloses that both portions are “radial.” *Id.*



Moechnig, FIGS. 3-4 (annotations added).

Based on the teachings of Denk and Moechnig, it would have been obvious to a POSITA that the inner surface of the upper section in Denk's tube is circular in cross-section, the inner surface of the lower section is elliptical in cross-section, and the elliptical inner cross-section of the lower section to "continually transition" into the circular inner cross-section of the upper section as taught by Moechnig and suggested by Denk. Denk, col. 8; Moechnig, [0038]; Ex. 1003, ¶120. A POSITA would have found such a design desirable because it allows for added reinforcement, such as greater wall thickness, in the lower section where loads are greater, but reduces weight by having thinner wall with circular inner and outer cross-sections

in the upper section. Ex. 1003, ¶120; Valat, 1:35-51, 1:70-78; Schroeder, 6:16-26. Indeed, steerer tubes having circular inner cross-sections in the upper section were conventional and well known in the art at the time of the purported invention. *See* Valat, Figs. 1-2; Schroeder, FIGS. 1A-2; Ex. 1003, ¶¶120-121.

14. Claims 8, 12, 22, 26, 42, and 46

As explained above in Sections VI.A.4.d and VI.A.13, Denk in view of Moechnig discloses that the inner and the outer surfaces of the upper section are circular in cross-section. A POSITA would have known that a ratio of an inner diameter to an outer diameter of the upper section of the steerer tube body being in the range of 0.75 to 0.95 is an obvious design choice and obvious-to-try based on multiple considerations, as explained by Petitioner's expert Dr. Slocum and as discussed below. Ex. 1003, ¶¶122-124.

A POSITA would have known that strength, rigidity, and the weight of the upper section of the steerer tube would be affected by the wall thickness, i.e., a ratio of the inner diameter to the outer diameter. *Id.*, ¶123. That is, the ratio of the inner diameter to the outer diameter of the upper section of the steerer tube body is a result-effective variable that affects strength, rigidity, and weight of the steerer tube. *See id.* And the law is clear that the determination of the optimum range of a result-effective variable is within the grasp of one skilled in the art. *In re Boesch*, 617 F.2d 272, 276 (C.C.P.A. 1980) (“[D]iscovery of an optimum value of a result effective

variable . . . is ordinarily within the skill of the art.”). Moreover, the ’993 patent does not show that “the claimed ranges [of ratio] are ‘critical’ or ‘produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art.’” *In re Applied Materials, Inc.*, 692 F.3d 1289, 1295, 1297 (Fed. Cir. 2012) (quoting *In re Aller*, 220 F.2d 454, 456 (C.C.P.A. 1955); *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1322 (Fed. Cir. 2004). Therefore, optimization of the ratio of the inner diameter to the outer diameter was nothing other than the exercise of ordinary skill in the art. *In re Huang*, 100 F.3d 135, 139 (Fed. Cir. 1996); *Iron Grip*, 392 F.3d at 1322.

Indeed, a POSITA would have known to design a steerer tube with a thinner wall in the upper section (compared to the lower section) of the steerer tube to have a lightweight steerer tube and thereby a lighter bicycle. *See* Moechnig, [0045]; Denk (discussing “lightweight component” in Title, Abstract, and throughout the specification); Schroeder, 6:16-26; Ex. 1003, ¶123. Given a certain outer diameter of the upper section, a POSITA would have known to select a suitable wall thickness, i.e., a ratio of the inner diameter to the outer diameter, in the upper section through routine experimentation and design considerations to optimize strength and rigidity of the steerer tube while maintaining light weight. Ex. 1003, ¶123.

For example, it was known that a typical 1-inch steerer tube would have an inner diameter of 22.2 mm and an outer diameter of 25.4 mm, resulting in a ratio of

0.874, which is within the claimed range of 0.75 to 0.95. *Id.*, ¶124. A POSITA would have known that this ratio would result in a wall thickness of 1.6 mm, which would be suitable for a steerer tube made of a certain material such as a high strength low alloy (HSLA) steel with a yield strength 2-3 times that of mild steel. *Id.* A POSITA would have known how to adjust this ratio or thickness for other materials and/or the actual strength and rigidity requirements of a certain type of bicycle (e.g., a road bike has lower strength and rigidity requirements than a mountain bike) using basic calculations, which would be within the ordinary skills of a POSITA. *Id.*; *see also* Ex. 1016 (basic calculations a POSITA would perform to identify the optimum tube wall thickness for a steerer tube of a certain material and/or the strength and rigidity requirements of the tube).

15. Claims 57 and 58

Denk in view of Moechnig renders claims 57 and 58 obvious because a POSITA would have known that a ratio of the major diameter to the minor diameter taken at a lower end of the lower section being within the range of 1.05 to 1.3 (or the range of 1.10 to 1.25, inclusive) is an obvious design choice and obvious-to-try based on multiple considerations, as explained by Dr. Slocum and as discussed below. Ex. 1003, ¶¶125-133.

As discussed with regard to claim term 1[d] and claim 34 (Sections VI.A.4.e, VI.A.7), the wall thickness of the lower section of Denk's tube is defined between

the outer circular cross-section and the inner elliptical cross-section, and the inner elliptical cross-section has a major diameter in the plane perpendicular to the plane of travel and a minor diameter in the plane of travel. Ex. 1003, ¶127. Specifically, based on Denk's teaching, a POSITA would have been motivated to have an elliptical cross-sectional contour in a lower end of the lower section of the steerer tube body, such as adjacent to section line I-I in Denk's Figure 11 where it is connected to the fork bridge—i.e., an end area—to be capable of absorbing the additional stress as compared to other portions of the lower section. *See* Denk, Fig. 11; Ex. 1003, ¶130. A POSITA would have then designed the wall thickness of the lower end of the lower section, which would vary over a cross-section, based on multiple factors (e.g., the particular outer diameter, the tube material, type of connection to the fork crown, type of bicycle, etc.) through routine experimentation to optimize strength and rigidity of the lower end of the lower section while keeping the tube light, as suggested by Denk. Denk, cols. 3, 8; Ex. 1003, ¶127.

Indeed, a POSITA would have understood that changing the ratio of the major diameter to the minor diameter of the inner elliptical cross-sectional contour in the lower end of the lower section of the steerer tube would change the wall thickness distribution over a cross-section in that portion of the tube, which in turn would affect the weight of the tube as well as the strength and rigidity properties of the tube. Ex. 1003, ¶¶128-130. Accordingly, the ratio of the major to the minor

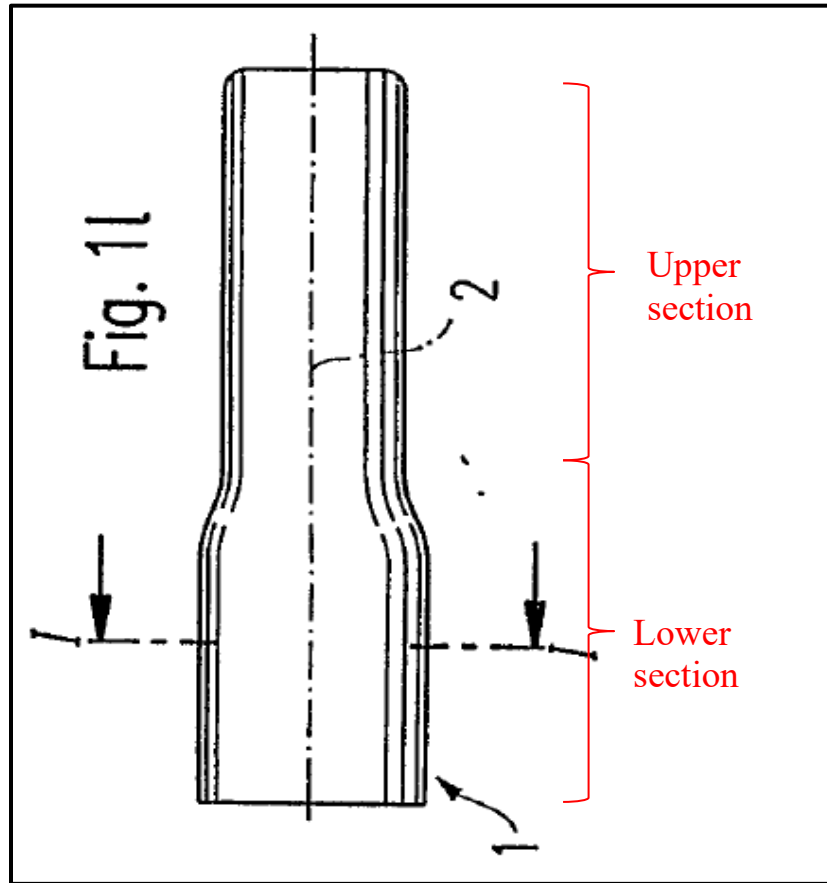
diameters in the lower end of the lower section of the steerer tube is a result-effective variable that affects strength, rigidity, and weight of the steerer tube, and determination of the optimum range of that variable is within the grasp of one skilled in the art. *Boesch*, 617 F.2d at 276. A POSITA would have optimized the ratio of the major diameter to the minor diameter taken at a lower end of the lower section through routine optimization and experimentation to identify an optimum ratio that meets the strength and rigidity requirements in the lower end of the steerer tube, particularly the greater bending moments or loads near the fork crown, while keeping the weight of the tube low. Ex. 1003, ¶¶130, 132; *see also* Ex. 1016.

Moreover, Moechnig further teaches that the widest major diameter (lateral diameter 130), i.e., the major diameter in the lower end of the lower section (106, 108), is 1.559 inches, and that the smallest minor diameter (longitudinal diameter 120), which is not less than radial diameter 124 of the upper portion 110, is 1.125 inches. Moechnig, [0040]. A POSITA would have known that the widest minor diameter (longitudinal diameter 120) in the lower end of the lower section (106, 108) is greater than 1.125 inches but less than 1.559 inches. Ex. 1003, ¶133. A POSITA optimizing the ratio of the major and minor diameters in a lower end of the steerer tube would have considered the ratio of the major and minor diameters taught by Moechnig because it is in the same field of art, and would have used the ratio taught by Moechnig as a starting point for further optimization. *Id.* Accordingly, a POSITA

would have recognized that a ratio of the major diameter to the minor diameter in Denk's steerer tube would have been in the range of 1.05 and 1.3. *Id.* A POSITA would also have been able to arrive at a ratio within the range of 1.10 to 1.25 through routine experimentation to optimize the strength and rigidity of the steerer tube while minimizing weight. *Id.*

16. Claims 56 and 59

Denk discloses that the tube body has an upper section and a lower section, which are joined by a gradually tapering region, as shown in Denk's Figure 11. Ex. 1003, ¶135. Denk teaches that the elliptical inner cross-sectional contour of the lower section of the steerer tube "continually transition[s]" into a circular inner cross-sectional contour. Denk, col. 8. Moechnig further teaches that such transition occurs over a tapering region in its steerer tube. *See* Moechnig, [0035], [0038]-[0039], FIGS. 2-3. It would have been obvious to a POSITA that in Denk's tube, the major and the minor diameters in the tapering region of the tube body decrease over the tapering region as a function of proximity to the upper section of the body. Denk, Fig. 11; Ex. 1003, ¶¶135-136.



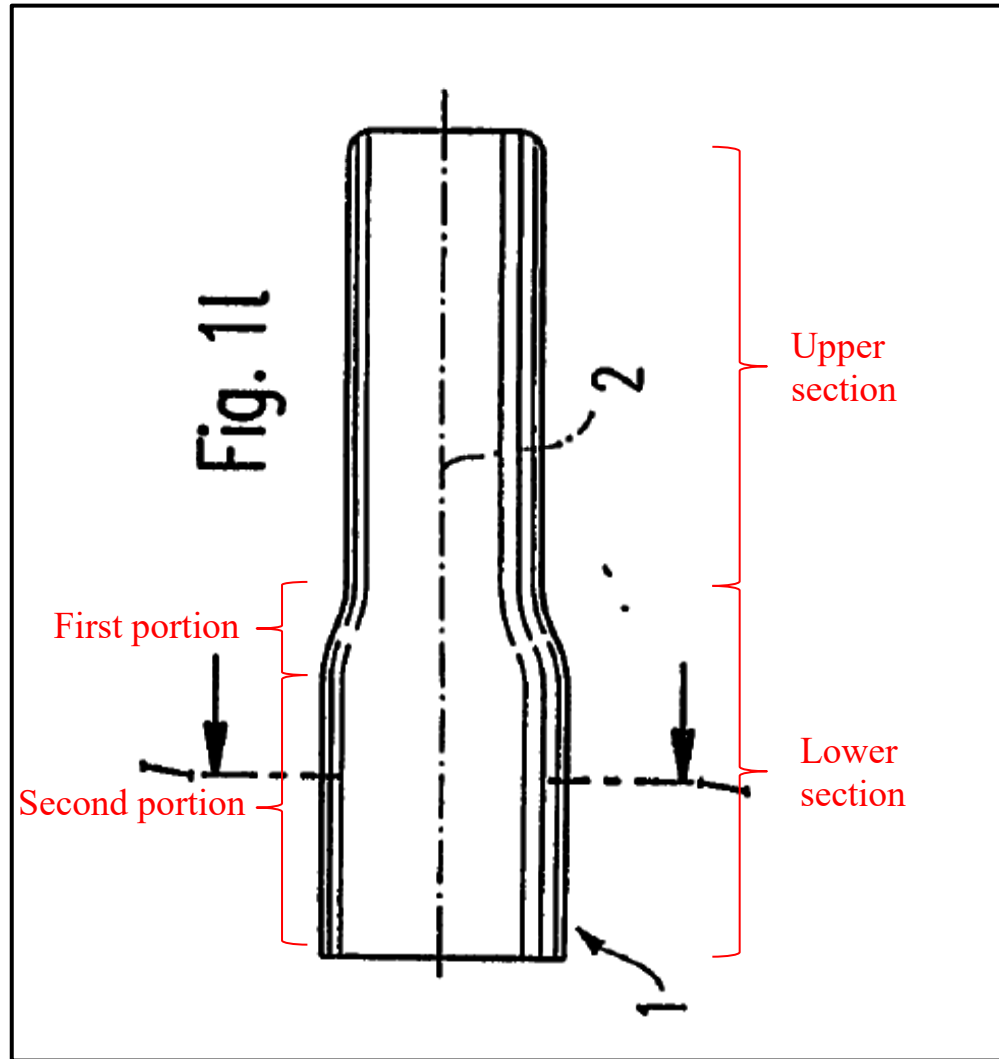
Denk, Fig. 11 (annotations added).

Specifically, Moechnig explicitly discloses that the major and minor diameters of its lower section decrease (i.e., taper) as a function of proximity to the upper section of the body. Moechnig, [0038] (“Both longitudinal and lateral diameters 120, 130 transition from lower radial portion 106 to upper radial portion 110.”). Accordingly, based on the teachings of Moechnig, it would have been obvious to a POSITA that Denk’s tube, which has a tapering neck region as in Moechnig’s steerer tube, would also have a minor diameter of the lower section of the tube decrease as a function of proximity to the upper section of the tube, and

have a major diameter of the lower section taper from the second portion of the lower section to an end region of the first portion of the lower section. Ex. 1003, ¶¶137-138.

17. Claim 60

As discussed with regard to claims 56 and 59, Section VI.A.16, Denk teaches that the elliptical inner cross-sectional contour of the lower section of the steerer tube “continually transition[s]” into a circular inner cross-sectional contour over a tapering region. *See* Denk, cols. 6, 8; Moechnig, [0035], [0038]-[0039], FIGS. 2-3 (disclosing same for Moechnig’s steerer tube). As the inner cross-sectional contour of the tapering portion of the tube’s lower section (as shown in the annotated Figure 11 of Denk) transitions gradually from an ellipse to a circle, the ratio of the major diameter to the minor diameter gradually decreases over the taper. Ex. 1003, ¶141. It would have been obvious to a POSITA that the decrease of the ratio of the major diameter to the minor diameter in the tapering region of the tube would have resulted in the ratio to “decrease[] as a function of proximity to the upper section of the body” and that the ratio at the upper end of the tapering region (where the elliptical inner contour transitions into the circular inner contour) would be approximately 1. *Id.*



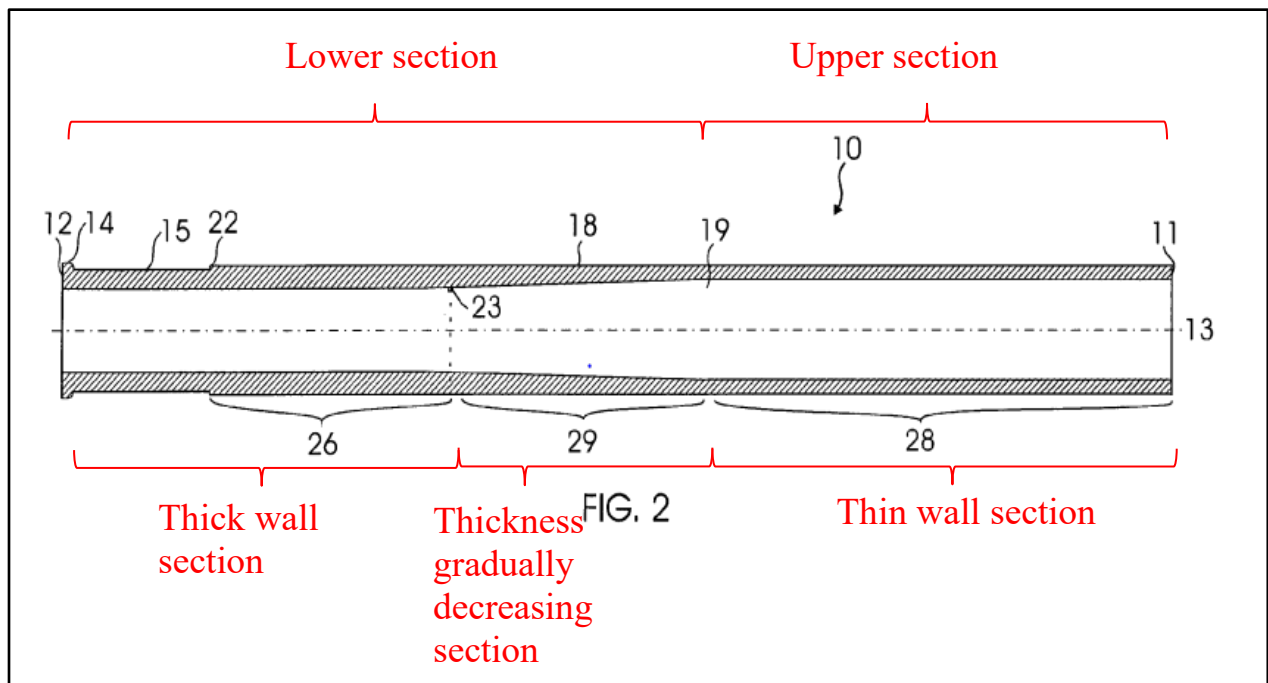
Denk, Fig. 11 (annotations added).

B. [Ground 2] The Group 2 Challenged Claims Are Rendered Obvious by Denk in View of Moechnig and Further in View of Schroeder

1. Schroeder (Ex. 1010)

Like Denk, Moechnig, and the '993 patent, Schroeder discloses a steerer tube 10 connected to a crown 30 of a bicycle fork. Schroeder, 4:8-12, 6:1-4, FIGS. 1A-2. As shown below, steerer tube 10 has a thick tube wall section 26, a thin tube wall

section 28, and a section 29 where the thickness of the tube wall gradually decreases from section 26 to section 28. *Id.*, 6:15-21, FIG. 2. A POSITA would have understood that thin wall section 28 would form an “upper section,” and thick wall section 26 and section 29 would collectively form a “lower section,” when the steerer tube is mounted on a bicycle frame in a conventional manner, as taught by Moechnig and the AAPA. Ex. 1003, ¶53. Schroeder further teaches that a steerer tube of the disclosed configuration has the advantage of reduced weight and improved mechanical strength. Schroeder, 6:16-26; Ex. 1003, ¶¶53, 143.



Schroeder, FIG. 2 (annotations added).

Schroeder teaches molding together a steerer tube and a fork crown made of different materials. *See, e.g., id.*, Title, 4:22-26 (“It has been discovered, according

to the present invention, that **if a bicycle fork assembly is comprised of a steering tube made of resin having carbon fiber composites molded into a crown made of aluminum**, the bicycle fork will possess[] a better durability and shock absorbing capabilities.” (emphasis added)); Ex. 1003, ¶¶52, 144-145.

2. A POSITA would have been motivated to combine Denk, Moechnig, and Schroeder, and would have reasonably expected success in doing so

Claims 31, 51, and 64[c] require “the [steerer tube] body formed of a material different from the crown of the front wheel fork.” Based on the teachings of Schroeder, a POSITA would have been motivated to use different materials for the steerer tube body and the fork crown in the Denk and Moechnig steerer tube combination to improve durability and shock absorption capabilities of the steerer tube and fork. Ex. 1003, ¶¶142-144.

Schroeder explicitly teaches molding together a steerer tube and fork crown made of different materials. *See, e.g.*, Schroeder, Title, 4:22-26. A POSITA would have been motivated to use the generally preferred aluminum for the fork crown and a different material, such as the uncured resin blended with carbon fiber composites as disclosed in Schroeder, to improve durability and shock absorption capabilities of the steerer tube and fork. Ex. 1003, ¶144.

A POSITA would have known how to connect the steerer tube and the fork crown formed of different materials because it would have only required

conventional manufacturing techniques and ordinary skill, such as bonding or molding, as disclosed in Denk, Moechnig, and Schroeder. Denk, col. 3; Moechnig, [0002]; Schroeder, 7:31-42, 8:8-17, 9:66-10:9; Ex. 1003, ¶145.

3. Independent Claim 64

Denk in view of Moechnig and further in view of Schroeder renders claim 64 obvious. Ex. 1003, ¶¶146-149.

a. 64[preamble]-64[b] and 64[d]

The claim limitations in 64[preamble]-64[b] and 64[d] are identical to 1[preamble]-1[b] and 1[d], respectively. Denk in view of Moechnig renders obvious 64[preamble]-64[b] and 64[d] for the reasons discussed above in 1[preamble]-1[b] and 1[d]. *See* Sections VI.A.4.a-VI.A.4.c, VI.A.4.e; Ex. 1003, ¶147.

b. Claim term 64[c]

Denk in view of Moechnig and further in view Schroeder discloses claim 64[c]. Ex. 1003, ¶¶148-149.

As discussed with regard to claim term 1[b] (Section VI.A.4.c), Denk in view of Moechnig teaches that a segment of the lower section of the steerer tube body is joined to a fork crown. And as discussed above, Schroeder discloses that the body of the steerer tube is formed of a material different from that of the fork crown, and that a POSITA would have been motivated to modify Denk's tube—when mounted as a steerer tube on a fork crown in the conventional manner taught by Moechnig—

to be formed of a material different from the fork crown to improve durability and shock absorption capabilities. Schroeder, 4:19-26, 4:48-53, 5:21-25, 5:63-67, 7:20-44, 8:8-17, 9:39-49; Ex. 1003, ¶¶148-149.

4. Claims 31 and 51

Claims 31 and 51 depend from claims 15 and 34, respectively. Both claims are identical to claim term 64[c]. Denk in view of Moechnig and further in view Schroeder renders claims 31 and 51 obvious for the reasons discussed in claims 1, 15, 34, and 64[c] (Sections VI.A.4, VI.A.6, VI.A.7, VI.B.3.b). Ex. 1003, ¶¶150-151.

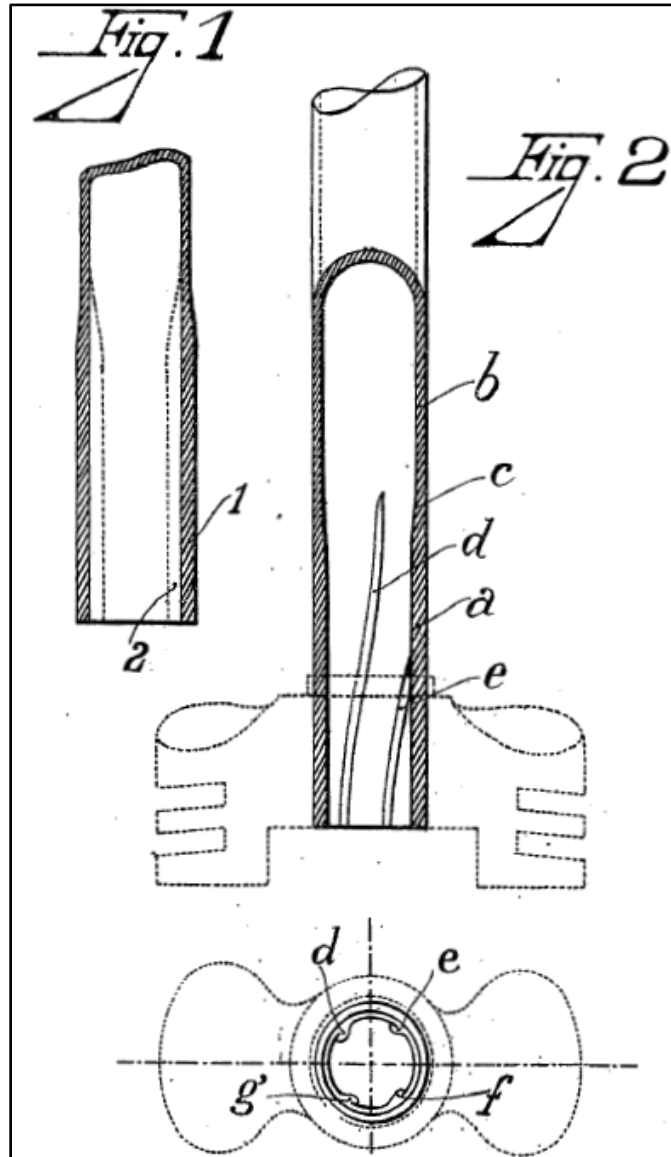
VII. Valat-Based Grounds

A. [Ground 3] The Group 1 Challenged Claims Are Rendered Obvious by Valat in View of Moechnig and Denk

1. Valat (Ex. 1007)

Valat discloses a steerer tube for a bicycle. Valat, 1:44-54. As shown below, the steerer tube can have two alternative configurations, 1 and 2. *Id.*, 1:58-63, Figs. 1-2. The steerer tube has a lower part *a* and an upper part *b*. *Id.*, 1:70-78, Fig. 2. Lower part *a*, where the loads are greatest, has a greater thickness than upper part *b*. *Id.*, 1:43-50, 1:70-78. In configuration 1, shown in Figure 1, the outer diameter of the steering tube wall in the lower part *a* is greater than the outer diameter in upper part *b*. Ex. 1003, ¶49. In configuration 2, depicted in Figures 1 and 2, the inner diameter of the steering tube wall in the lower part *a* is smaller than the inner diameter in upper part *b*. *Id.* Valat's steerer tube also includes interior

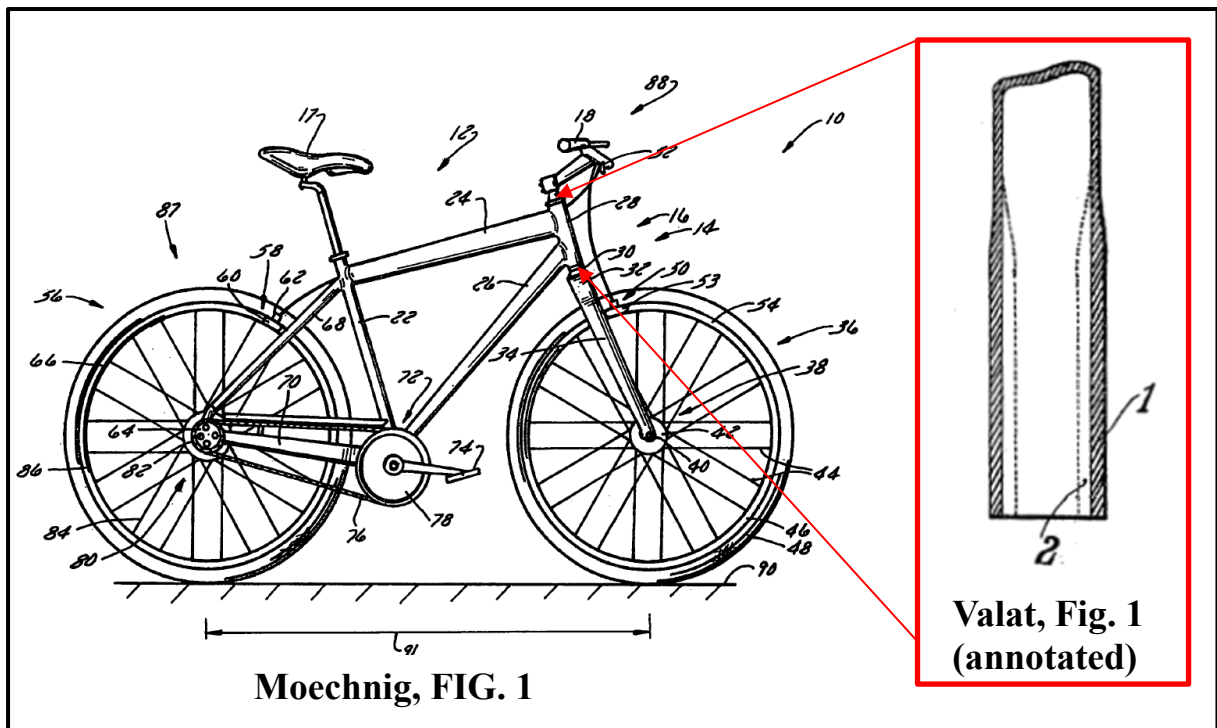
reinforcements, such as parallel or helical ribs, that taper towards the change in the internal or external diameter of the tube. Valat, 1:79-90, Figs. 2-5. This provides varying wall thickness over a cross-section in lower part *a*. *Id.*; Ex. 1003, ¶49.



Valat, Figs. 1-2.

2. A POSITA would have been motivated to combine Valat, Moechnig, and Denk, and would have reasonably expected success in doing so

A POSITA would have found it obvious to mount Valat's steerer tube on a bicycle frame in the conventional manner, as disclosed in Moechnig and as shown below. Ex. 1003, ¶¶152-153.



A POSITA would have understood that Valat's steerer tube would have been mounted on the bicycle frame to connect to the handlebar and the fork crown in a conventional manner to steer the bicycle, as disclosed in Moechnig and as admitted in the AAPA, and would have reasonably expected success. Ex. 1003, ¶153; *see also* Section VI.A.3.

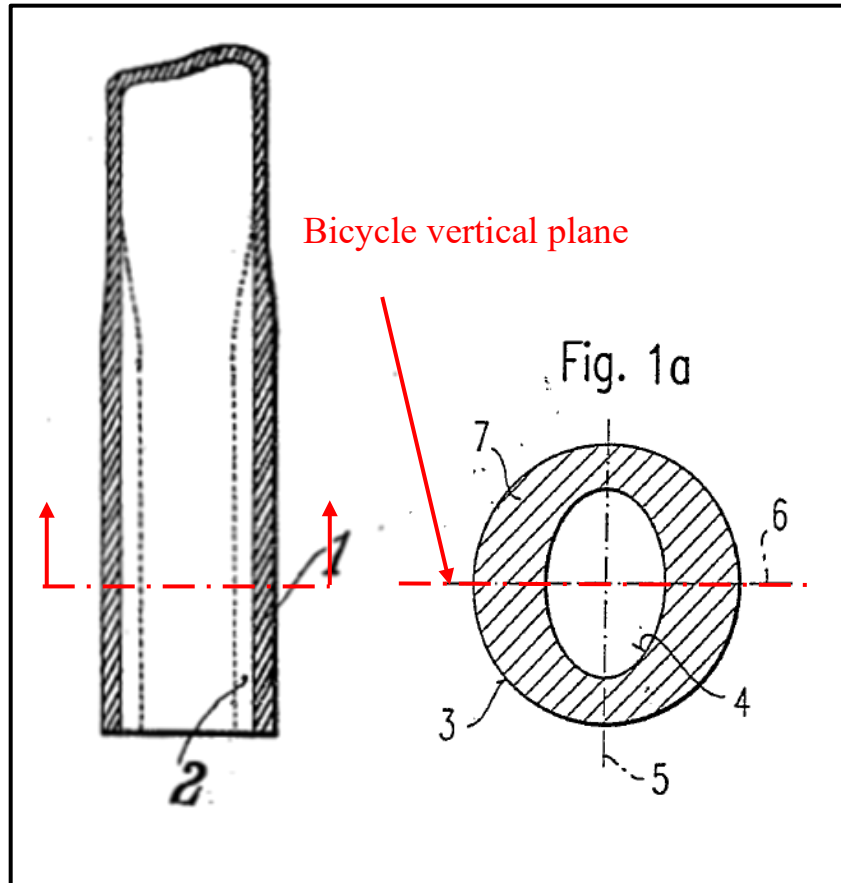
A POSITA would have been motivated to improve the Valat design by having the internal cross-sectional contour of the lower section of the tube be an ellipse as taught by Denk instead of Valat's reinforcement ribs. Ex. 1003, ¶¶154, 156. A POSITA would have understood that such modification would allow the wall thickness to transition around the internal perimeter smoothly and continuously, thereby reducing stress concentration or failure points. *Id.*; see Denk, col. 3. A POSITA would also have known that at the time of the alleged invention, it would have been easier to manufacture a steerer tube with an elliptical inner surface in a portion thereof as compared to a steerer tube with reinforcement ribs on the inner wall. Ex. 1003, ¶154.

A POSITA would have understood that modifying Valat's steerer tube to incorporate Denk's teaching of an elliptical inner cross-sectional contour in the lower part of the tube would have provided the following benefits expressly recognized by the references: (1) improving the strength and rigidity (or load-bearing) properties of Valat's steerer tube in the vertical plane of the bicycle frame where higher loads or stresses occur (Denk, cols. 1-2); and (2) reducing the weight of the steerer tube to provide "a lighter weight machine" (Valat, 1:10-14; Denk, Abstract, cols. 1-2, 9). Ex. 1003, ¶155.

It would have been obvious to a POSITA to incorporate Denk's varying wall thickness to the lower part *a* of Valat's steerer tube by positioning the maximum

thickness areas in the vertical plane of travel as disclosed in Denk. *Id.*; *see also* Campagnolo, 7:29-8:3; Ex. 1003, ¶157. A POSITA would have understood that the minimum wall thickness would be in the plane perpendicular to the plane of travel and would be designed to have a thickness that meets the lower requirements of strength and rigidity in that plane while minimizing weight of the steerer tube. Ex. 1003, ¶157. A POSITA would have understood that such modification would have allowed Valat's lightweight steerer tube to have "particularly favorable ratio of strength properties and rigidity properties with regard to the weight" by reinforcing at the areas of higher loads and reducing materials (and tube weight) at areas of lower loads at the lower part *a* of Valat where reinforcement is preferred. Denk, col. 1; Valat, 1:35-43, 1:79-90, 1:102-105; Ex. 1003, ¶157.

Incorporating Denk's elliptical inner contour to the lower part *a* of Valat's steerer tube would have required only conventional manufacturing techniques and ordinary skill in the art, such as machining, tube rolling, casting, or injection molding, as taught in Denk. Denk, cols. 4, 9-10, Figs. 4a-5d. A POSITA would have expected success in modifying Valat's steerer tube in view of Denk and achieving the structure as shown in the figure below (Ex. 1003, ¶158):



Valat, Fig. 1 (modified, annotated); Denk, Fig. 1a (annotations added).

A POSITA would have understood that the combination of Valat, Moechnig, and Denk would have meant mounting Valat's steerer tube—as modified with Denk's elliptical inner contour—on a bicycle frame in a conventional manner as disclosed in Moechnig. Ex. 1003, ¶159. A POSITA would have expected success in combining the teachings of Valat, Moechnig, and Denk because it would have simply required combining known prior art elements according to their established functions and would have yielded the predictable result of a lightweight steerer tube

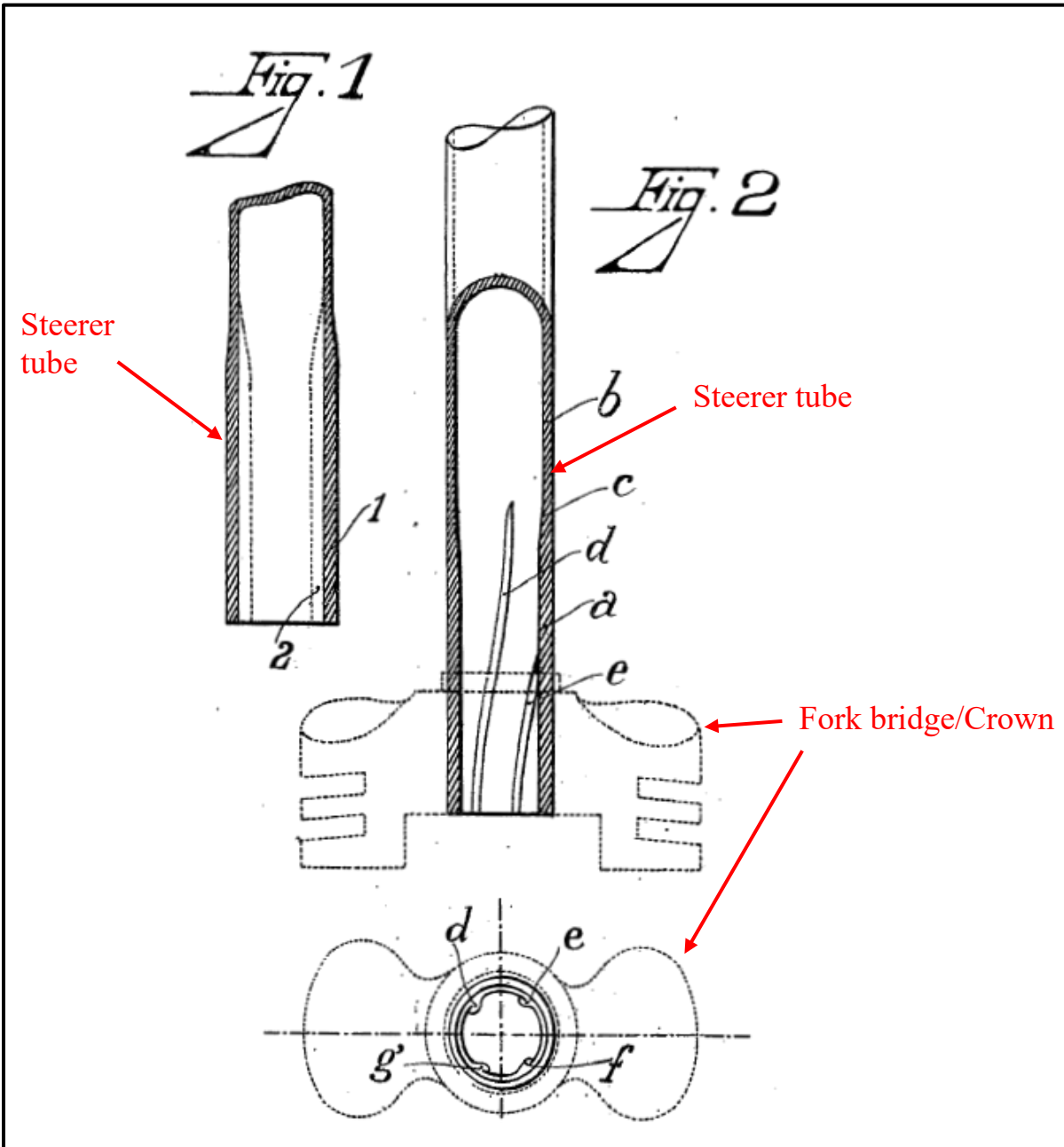
that meets the strength and rigidity requirements in the lower part of the steerer tube where reinforcement is beneficial. *Id.*

3. Independent Claim 1

Valat in view of Moechnig and Denk renders claim 1 obvious. *Id.*, ¶¶160-189.

a. 1[preamble]

As shown below, Valat discloses a steerer tube for a bicycle connected to a fork bridge/crown. Valat, 1:44-63, Figs. 1-2. Moechnig also discloses a steerer tube for a bicycle. Moechnig, Title, Abstract, [0001]; Ex. 1003, ¶¶161-162.

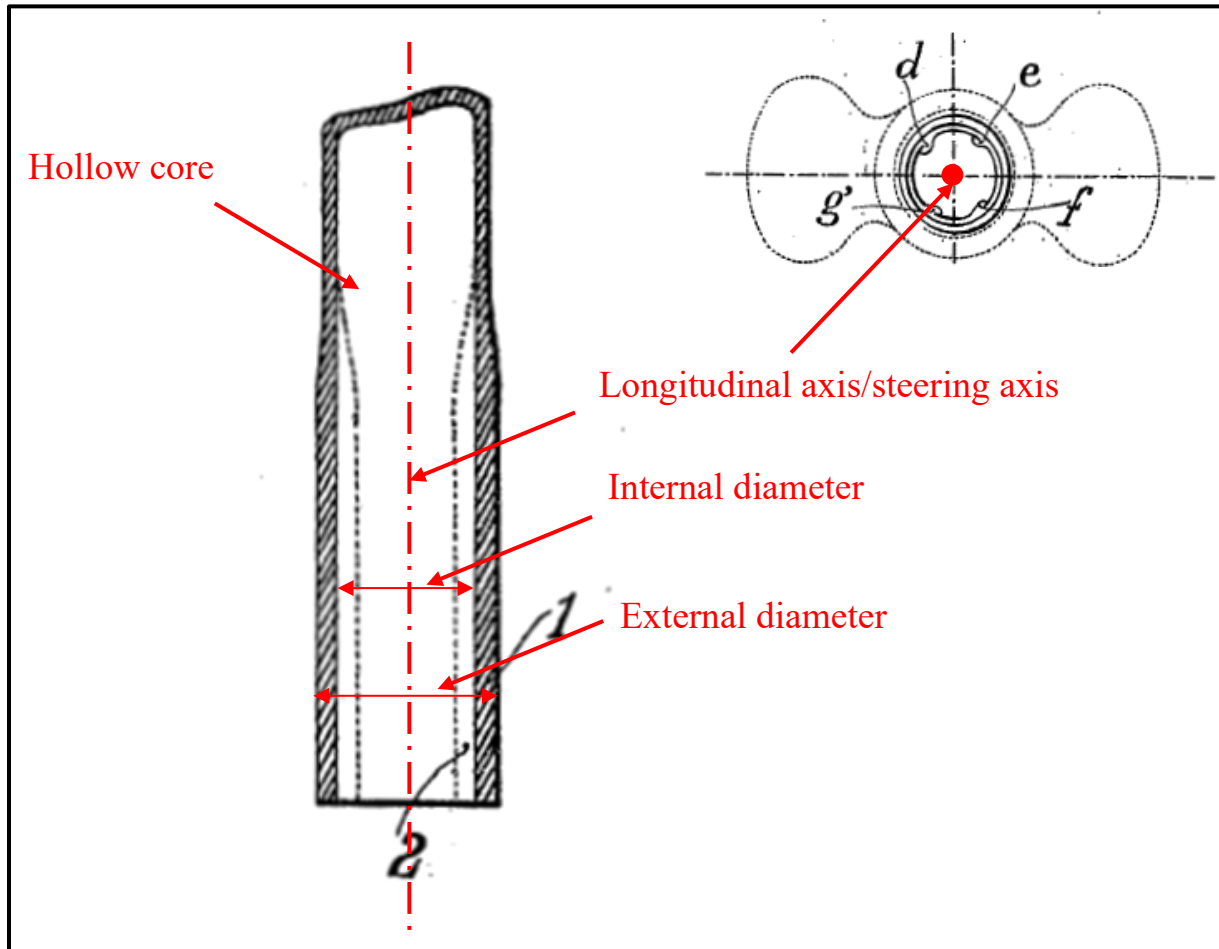


Valat, Figs. 1-2 (annotations added).

b. Claim term 1[a]

Valat discloses that the steerer tube has “an elongate hollow body” because Valat’s steerer tube is arranged around a longitudinal axis and has an internal

diameter and an external diameter forming a hollow core, as shown below. Valat, 1:22-26, 1:70-78, 1:86-90, 2:22-25; Ex. 1003, ¶164.



Valat, Figs. 1-2 (modified, annotations added).

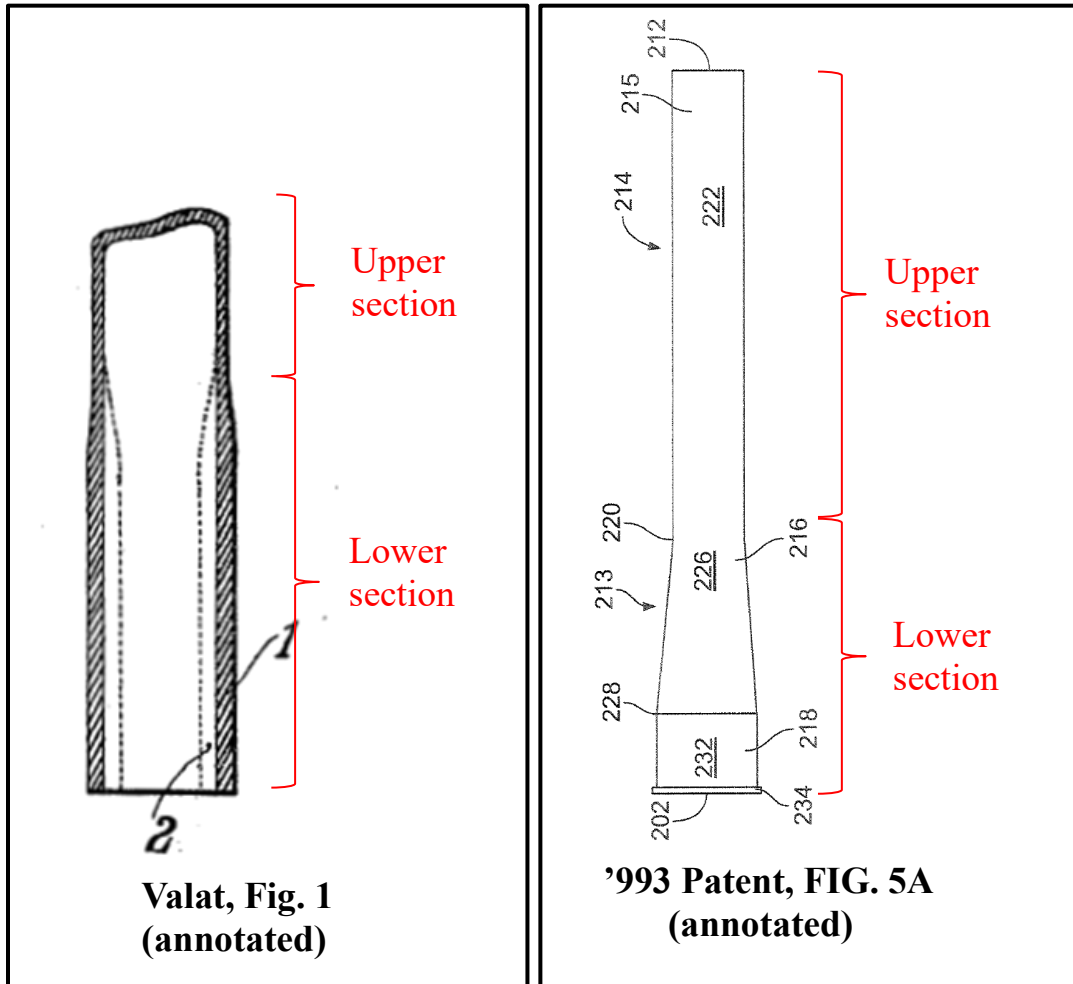
A POSITA would have understood that Valat's longitudinal axis is the "steering axis" when the steerer tube is mounted on a bicycle because the longitudinal axis of a steerer tube is the axis about which the front wheel rotates to change travel direction and steer the bicycle. Ex. 1003, ¶¶165-166. A POSITA would have understood the longitudinal axis to be located in a vertical plane of travel

of the bicycle as discussed in Ground 1, 1[a] (Section VI.A.4.b). *See* AAPA; Ex. 1003, ¶166.

Moechnig also discloses a steerer tube having “an elongate hollow body arranged around a steering axis located in a vertical plane of travel of the bicycle.” Ex. 1003, ¶¶167-171. Based on Moechnig’s teaching, it would have been obvious to a POSITA that the elongated hollow body of Valat’s steerer tube, when mounted on a bicycle frame, would have been arranged around a steering axis in a vertical plane of travel of the bicycle, which was conventional and known. *Id.*; *see also* AAPA.

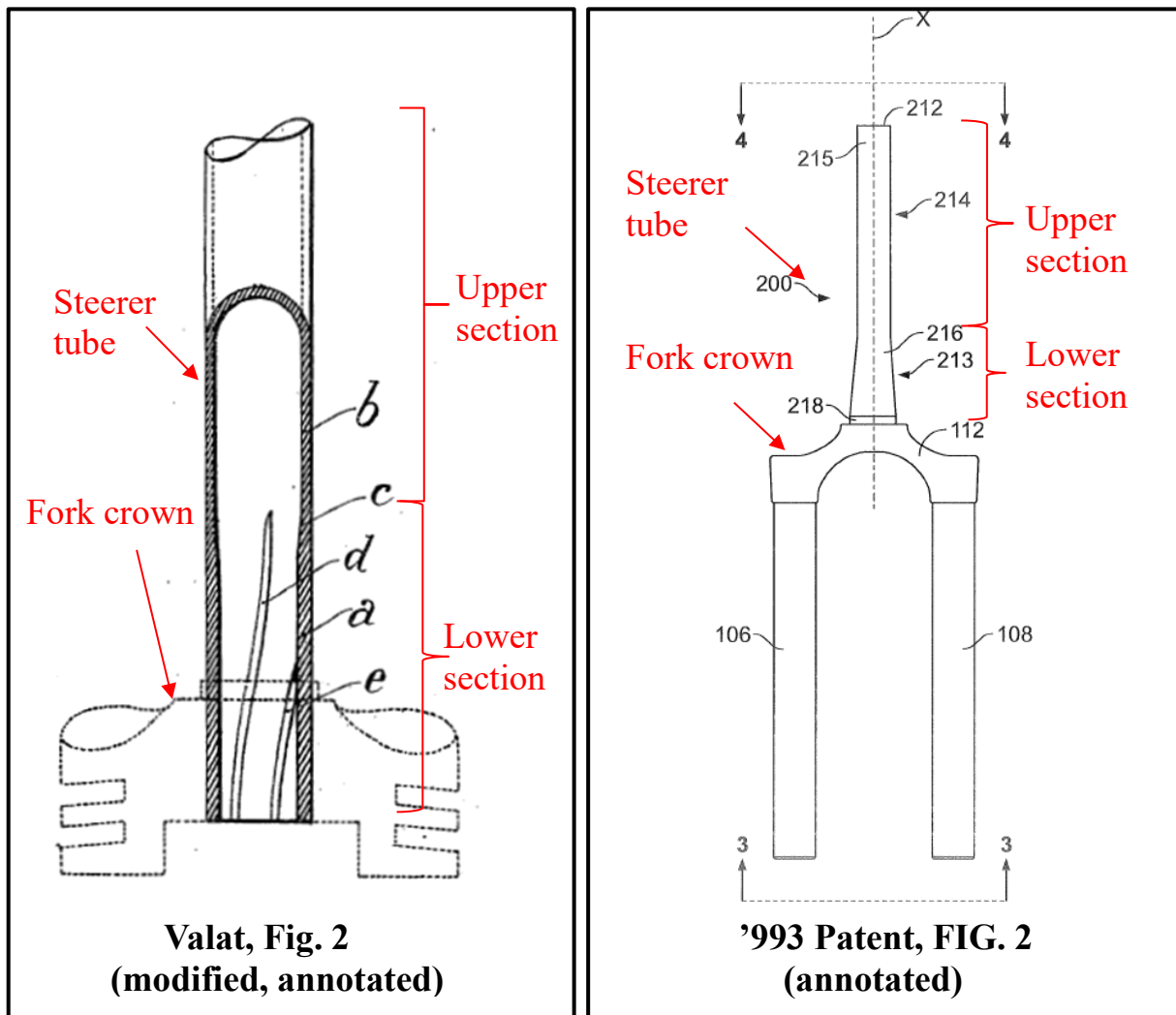
c. Claim term 1[b]

Valat discloses the elongate hollow body of the steerer tube has a lower part *a* and an upper part *b* joined to the lower part *a* via a tapering region *c*. Valat, 1:70-78, Figs. 1-2. Like the ’993 patent, lower part *a* and tapering region *c* collectively form the “lower section” and upper part *b* forms the “upper section” that is joined to the lower section, as shown below. Ex. 1003, ¶173.



Valat discloses that a segment of the lower part *a* is adapted to be joined to a fork bridge, which is equivalent to “a crown of a front wheel fork of the bicycle.”

Valat, 1:44-51, 1:61-63; Ex. 1003, ¶174.



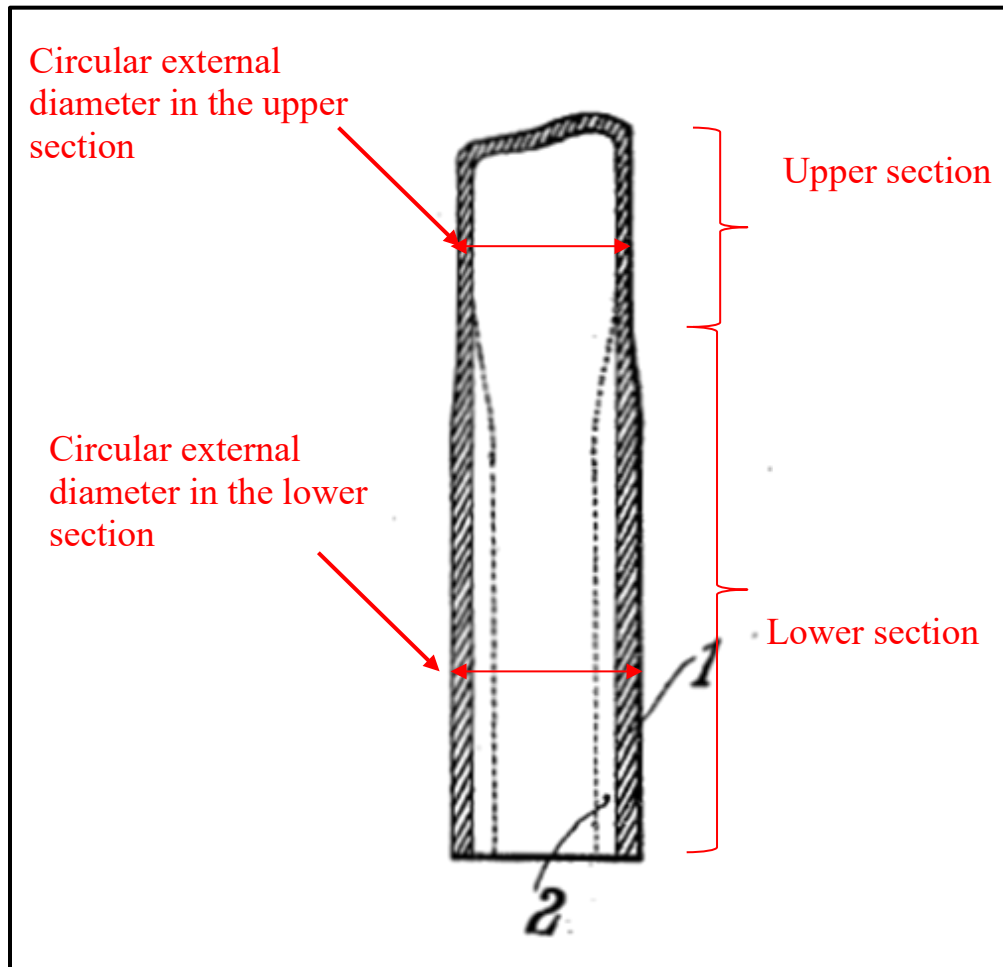
It would have been obvious to a POSITA that when Valat's steerer tube is mounted on a bicycle frame, the top end of the upper section of Valat's steerer tube would have been joined to a handlebar such that manipulation of the handlebar would allow for steering the front wheel, thereby changing the travel direction of the bicycle. *See* AAPA; Ex. 1003, ¶175.

As discussed in Ground 1, 1[b] (Section VI.A.4.c), Moechnig also discloses "a segment of the upper section" of the steerer tube body is adapted to be joined to

a bicycle handlebar and “a segment of the lower section” of the steerer tube body is adapted to be joined to a crown of a front fork of the bicycle. Moechnig, [0002], [0026]-[0027], FIGS. 1-3. Based on Moechnig’s teaching, it would have been obvious to a POSITA that Valat’s steerer tube would have “a segment of the upper section adapted to be joined to a bicycle handlebar” and “a segment of the lower section adapted to be joined to a crown of a front wheel fork of the bicycle,” which was conventional and known. Ex. 1003, ¶¶176-180.

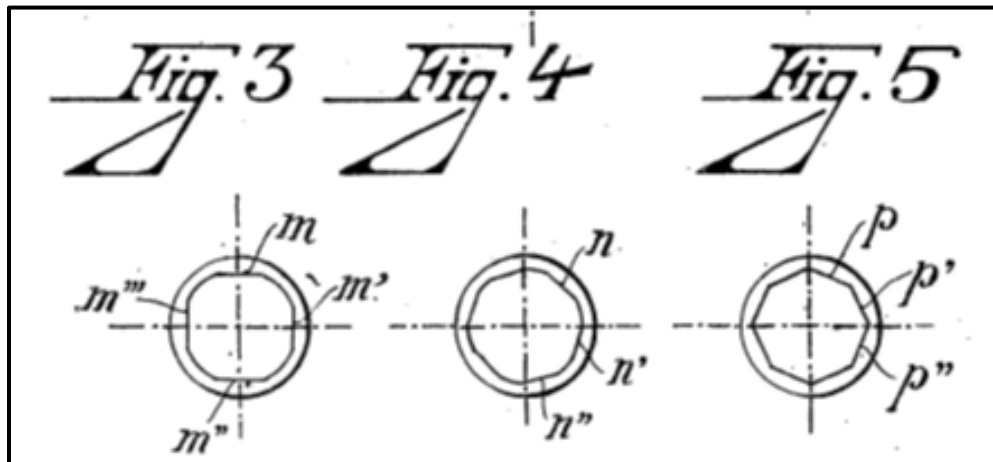
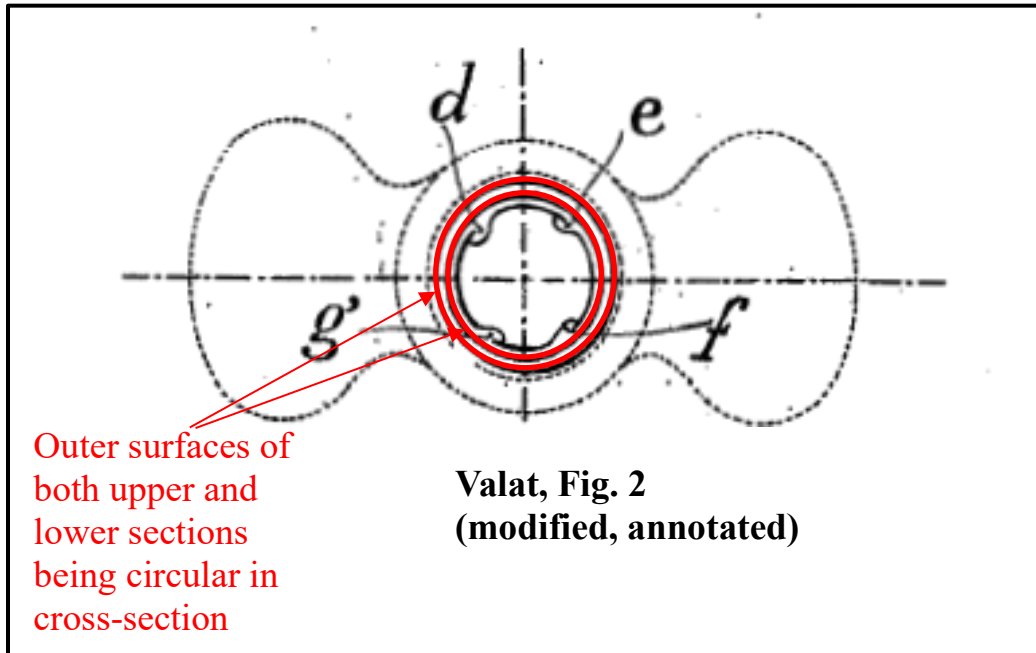
d. Claim term 1[c]

Valat also discloses that in one embodiment, the “external diameter” is greater at lower part *a* and taper *c* (together “lower section”) where the reinforcements are formed, compared to the upper part *b*, as shown below. Valat, 1:70-90, 1:102-105, Fig. 1; Ex. 1003, ¶181.



Valat, Fig. 1 (annotations added).

Based on Valat’s statement about “external diameter,” a POSITA would have understood that the cross-sections of the outer surface of upper part *b* (“upper section”) and the outer surface of lower part *a* and taper *c* (together “lower section”) would be circular. Ex. 1003, ¶182. Indeed, like the ’993 patent, Valat shows that the outer surfaces of the upper and lower sections are circular in a cross-sectional view perpendicular to the steering axis, as shown below. Valat, 1:70-78, Fig. 2-5; Ex. 1003, ¶182.

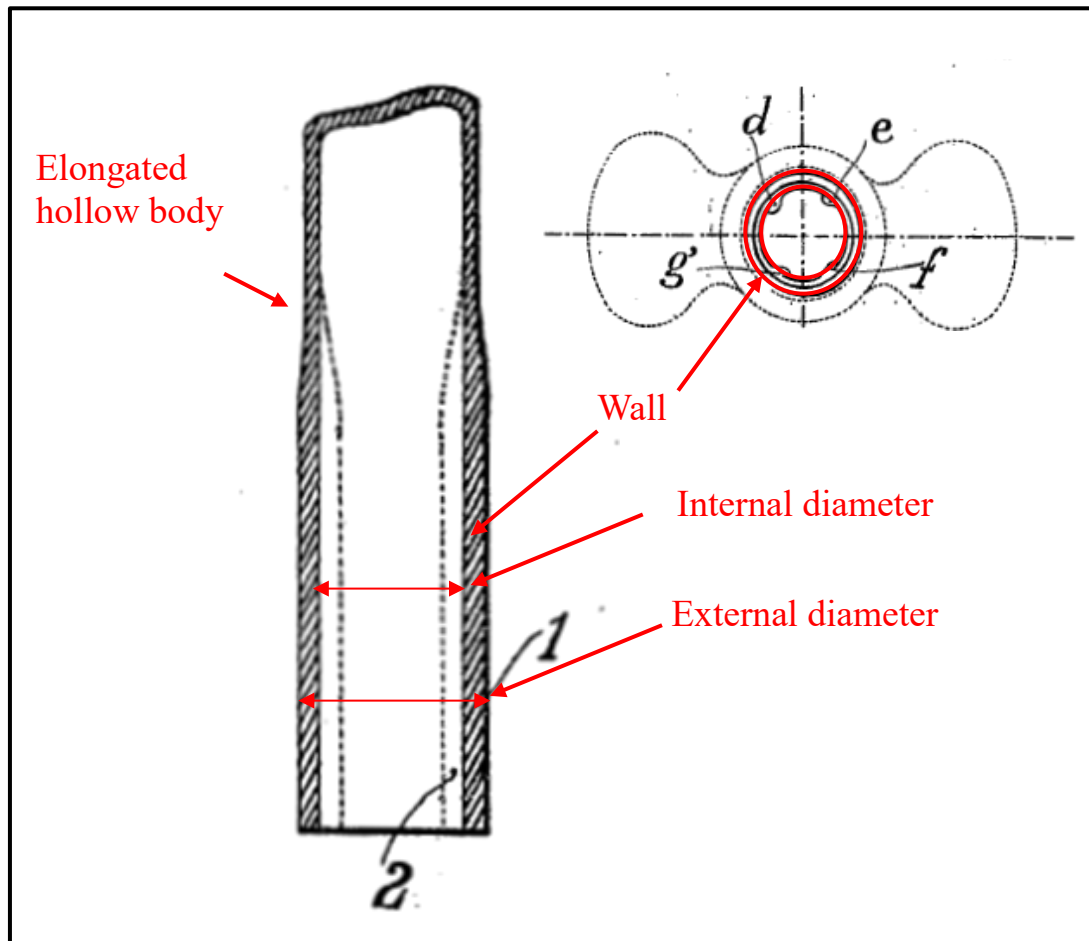


Valat, Figs. 3-5.

Accordingly, a POSITA would have understood that Valat discloses that the outer surfaces of the upper and lower sections of the steerer tube are circular in cross-section. Ex. 1003, ¶183.

e. Claim term 1[d]

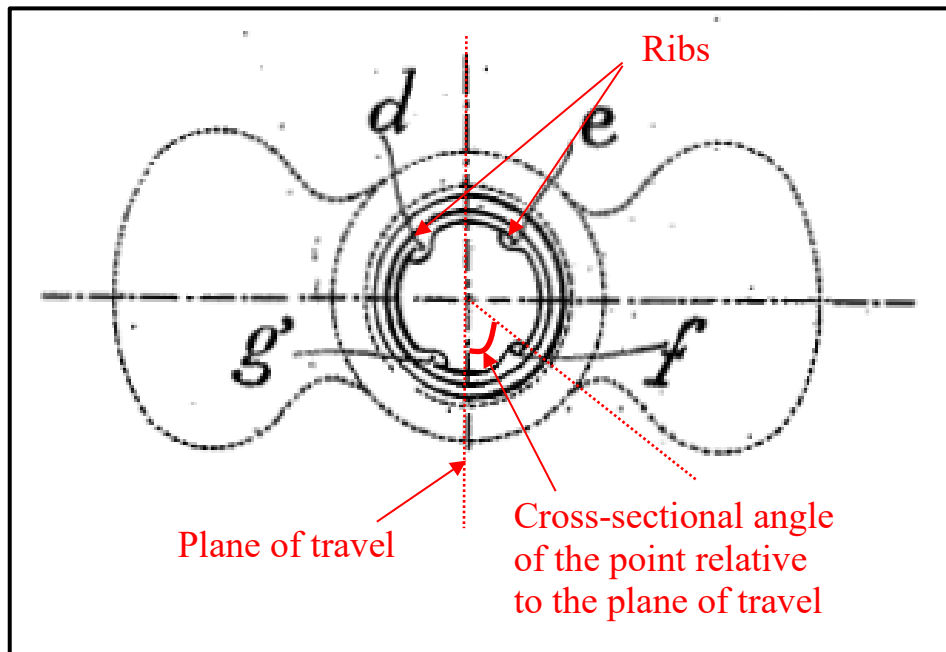
Valat discloses that the steerer tube body is formed by a wall that extends between the internal and external diameters, as shown below. Ex. 1003, ¶185.



Valat, Figs. 1-2 (modified, annotations added).

Valat discloses that the wall thickness at any point in the lower section of the body—lower part *a* and taper *c*—varies as a function of the cross-sectional angle of the point relative to the plane of travel. Ex. 1003, ¶¶186-189. Specifically, lower part *a*, where the loads are greatest, has a greater thickness than upper part *b* by having

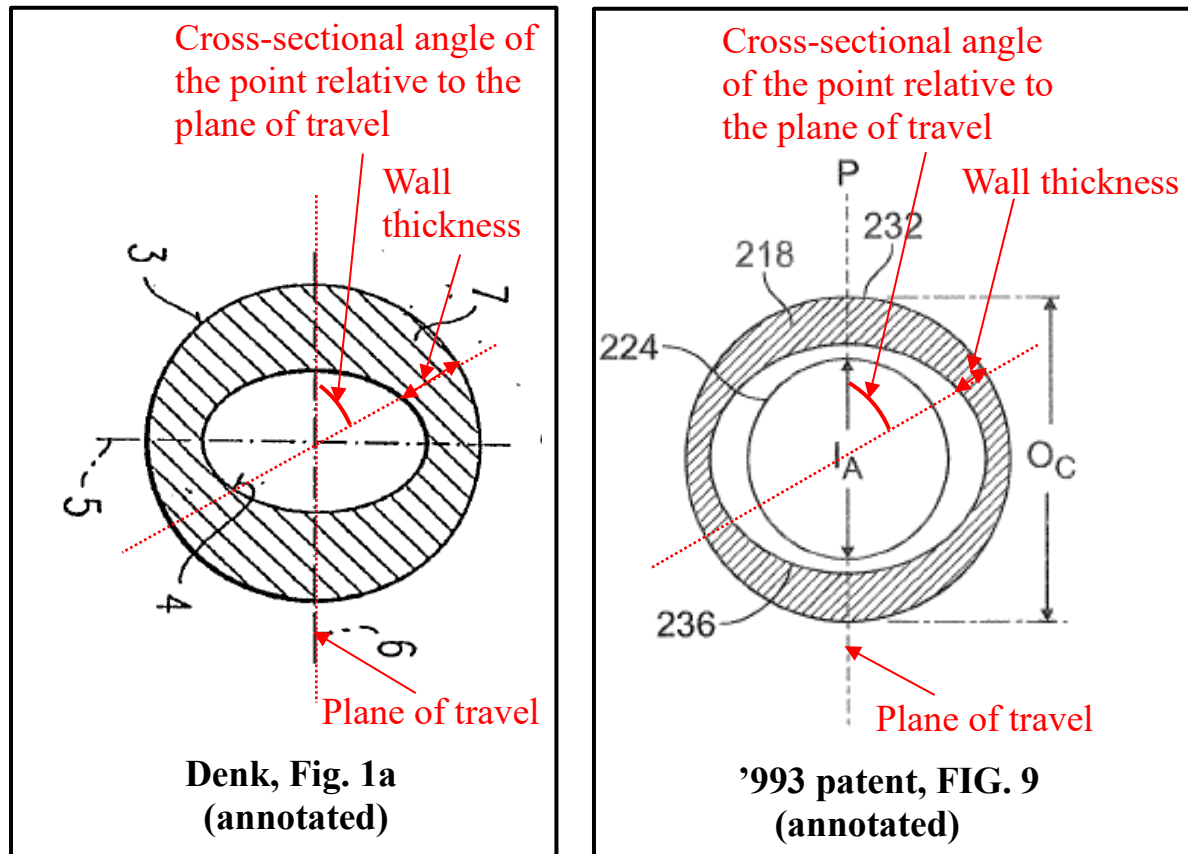
either a smaller internal diameter or a greater external diameter. Valat, 1:70-78, 1:102-105, Figs. 1-2. Valat further discloses that the steerer tube includes interior reinforcements, such as parallel or helical ribs, over the whole length of the tube or confined to those parts that are subject to shear when in use. *Id.*, 1:35-43, Fig. 2. For example, Valat discloses that reinforcements are provided in lower part *a* that taper towards the change in the internal diameter of the tube at taper *c*. *Id.*, 1:86-90, Figs. 2-5. Accordingly, as shown below, the wall thickness at any point in the lower section of the body—lower part *a* and taper *c*—depends on whether the point is in a region with reinforcement. Ex. 1003, ¶186.



Valat, Fig. 2 (modified, annotations added).

A POSITA would have understood that the wall thickness of Valat's tube at any point on the wall, e.g., a point on the internal reinforcement rib, would "vary[] as a function" of the cross-sectional angle of the point relative to the vertical plane ("the plane of travel") of the bicycle because the wall thickness changes based on the angular position of the point on the wall. Ex. 1003, ¶187.

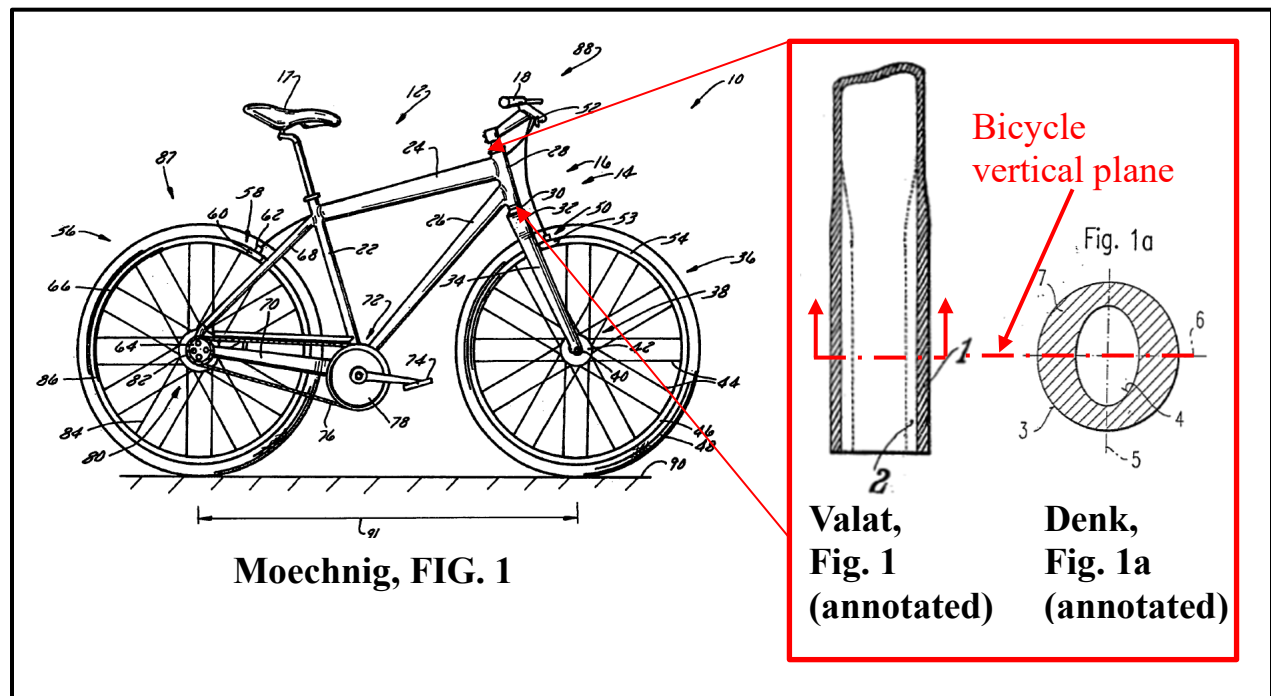
Further, as discussed in Ground 1 (Section VI.A.4) and shown below, Denk discloses an elongated tubular body that includes a wall formed between the inner elliptical and outer circular cross-sectional contours, and the wall thickness at any point in the lower section of the body varies as a function of the cross-sectional angle of the point relative to the plane of travel. Denk, cols. 1-2, 9; Ex. 1003, ¶188.



A POSITA would have been motivated to modify Valat's lower part *a* and taper *c* (together, the "lower section") to have an elliptical inner contour as disclosed in Denk to improve the strength and rigidity properties of Valat's steerer tube in the vertical plane of the bicycle while maintaining light weight, as expressly disclosed in Denk and explained above in Section VII.A.2. Ex. 1003, ¶189. A POSITA would have understood based on Denk's teachings that the wall thickness at any point on the wall of Valat's steerer tube (modified in view of Denk to have an elliptical inner

contour in the lower part) would “vary[] as a function” of the cross-sectional angle of the point relative to the vertical plane (“the plane of travel”) of the bicycle. *Id.*

Based on Denk and Moechnig’s teachings, a POSITA would have been motivated to position the areas of maximum thickness of the elliptical inner contour of Valat’s steerer tube (as modified in view of Denk) in the vertical plane of travel where the loads are highest to have better strength and rigidity in those areas, as illustrated below (*id.*):



4. Independent Claim 61

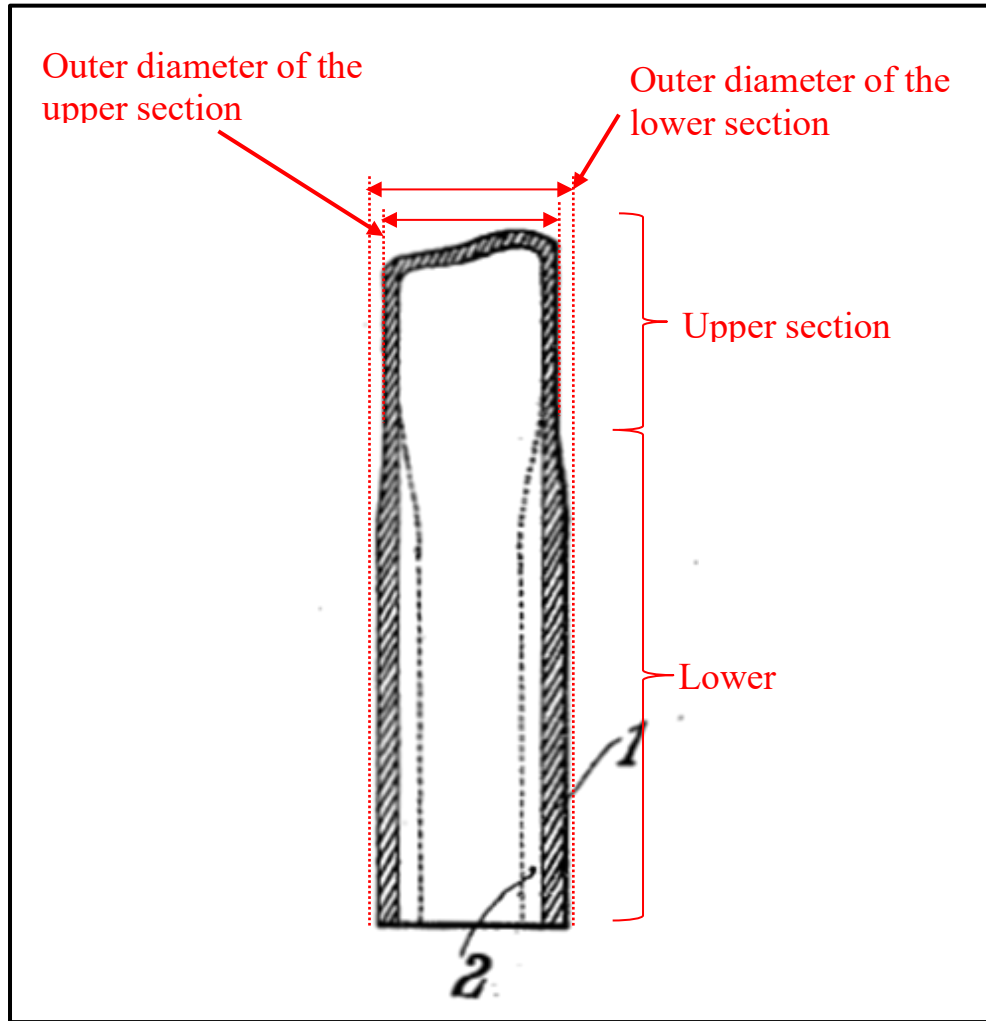
Valat in view of Moechnig and Denk renders claim 61 obvious. Ex. 1003, ¶¶190-197.

a. 61[preamble]-61[b] and 61[d]

Valat in view of Moechnig and Denk teach 61[preamble]-61[b] and 61[d] for the reasons discussed above in Ground 3, 1[preamble]-1[b] and 1[d] (Sections VII.A.3.a-VII.A.3.c, VII.A.3.e). Ex. 1003, ¶¶191-193, 197.

b. Claim term 61[c]

As discussed in Ground 3, 1[b] (Section VII.A.3.c) and shown below, Valat discloses that its steerer tube has an upper section and a lower section. *See* Valat, 1:70-78, 1:102-105, Fig. 1; Ex. 1003, ¶195.

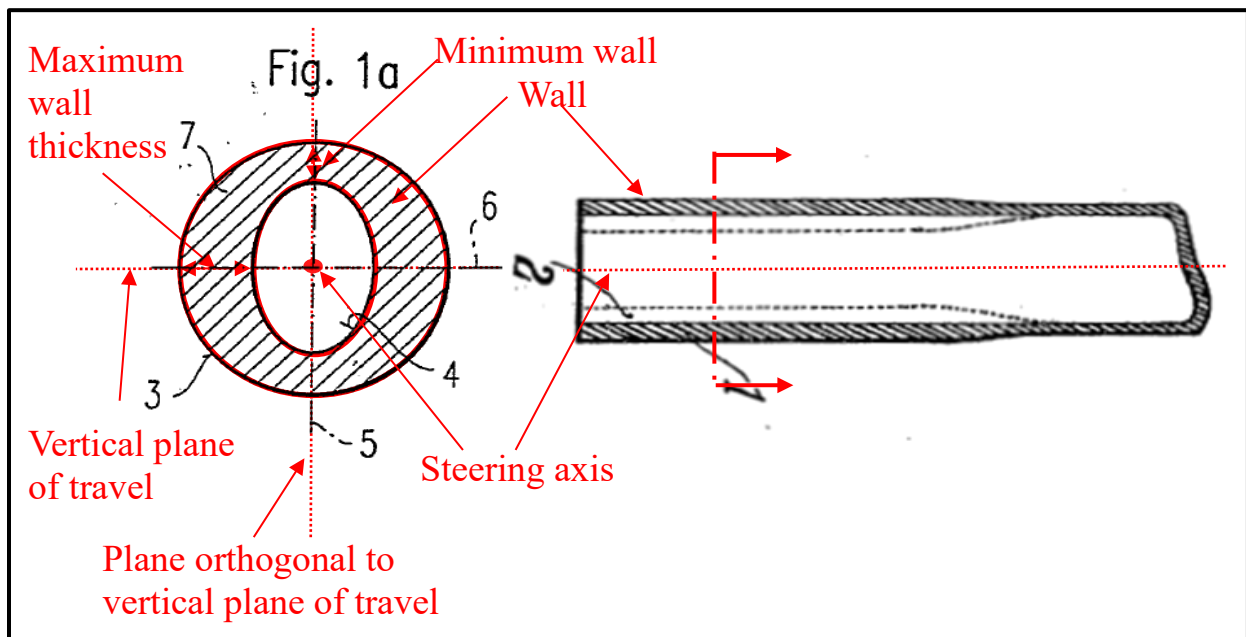


Valat, Fig. 1 (annotations added).

And as discussed above in Ground 3, 1[c] (Section VII.A.3.d), Valat discloses that the outer surfaces of the upper and lower sections of the body have circular cross-sections. Valat further discloses the outer diameter of the lower section where reinforcements are added is greater than the outer diameter of the upper section, as shown above. *See* Valat, 1:70-78, 1:102-105, Fig. 1; Ex. 1003, ¶196.

5. Claim 15

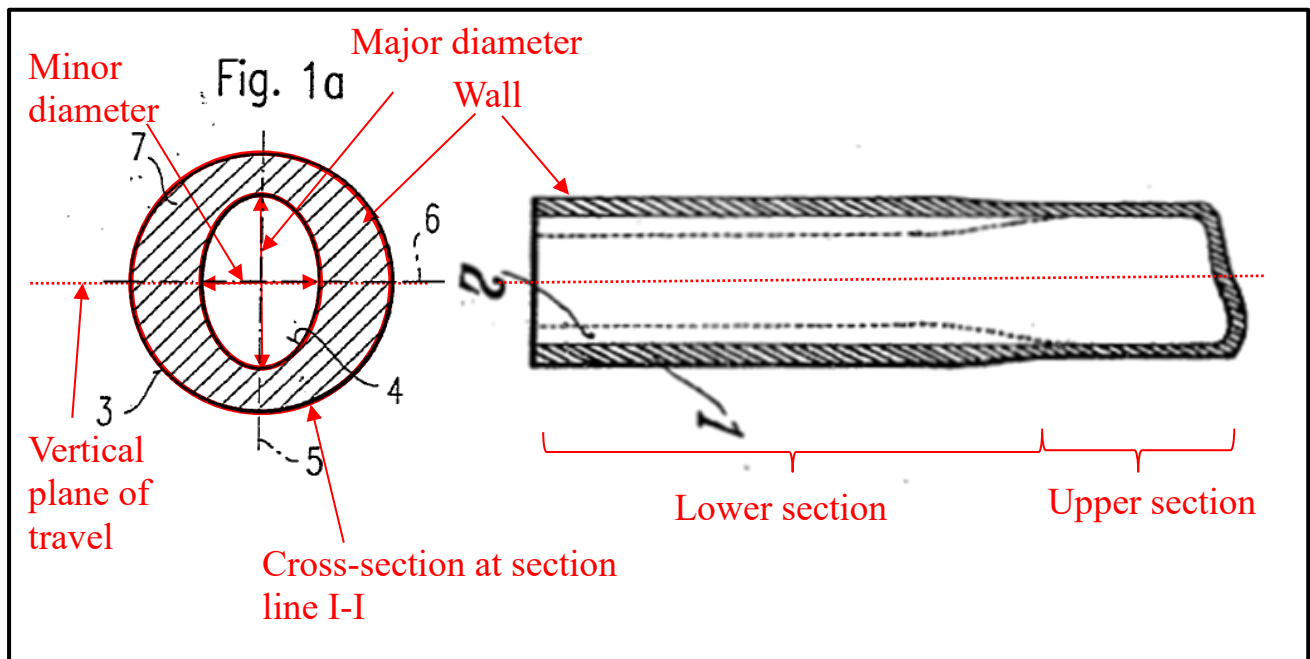
As discussed above in Ground 3, 1[a] and 1[d] (Sections VII.A.3.b, VII.A.3.e) and as shown below, Valat in view of Moechnig and Denk discloses that the elongate hollow body is arranged around a steering axis located in a vertical plane of travel of the bicycle. And for the reasons discussed in Ground 3, 1[d] and Ground 1, claim 15 (Sections VII.A.3.e, VI.A.6), the wall of the elongated hollow body has maximum thickness in “the plane of travel of the bicycle” (Denk’s plane 6) and minimum thickness in “a plane ... and orthogonal to the plane of travel of the bicycle” (Denk’s plane 5); both planes intersect orthogonally at the steering axis, as shown below, so the “plane ... orthogonal to the plane of travel of the bicycle” includes the steering axis. Ex. 1003, ¶200.



Denk, Fig. 1a; Valat, Fig. 1 (annotations added).

6. Claim 34

As discussed above in Ground 3, 1[b] and 1[d] (Sections VII.A.3.c, VII.A.3.e), the wall of the lower section of Valat's steerer tube body (modified in view of Denk) has varying thickness formed between the inner elliptical cross-sectional contour 4 and outer circular cross-sectional contour 3 (as evident from the cross-section taken at a section line I-I in the lower section of Denk's tube body).
Ex. 1003, ¶203.



Denk, Fig. 1a; Valat, Fig. 1 (annotations added).

Inner elliptical cross-sectional contour 4 in the lower section of the body is formed as “an ellipse in cross section,” the ellipse having “a major diameter” positioned to be perpendicular to the plane of travel and “a minor diameter”

positioned to be in the plane of travel such that the tube has maximum wall thickness in the plane of travel where the loads are higher, as discussed in Ground 1, claim 34 (Section VI.A.7). Ex. 1003, ¶204.

7. Claim 35

Valat in view of Moechnig and Denk renders claim 35 obvious for the reasons discussed in Ground 3, claims 1[c] and 34 (Sections VII.A.3.d, VII.A.6). Ex. 1003, ¶205.

8. Claims 14, 33, and 53

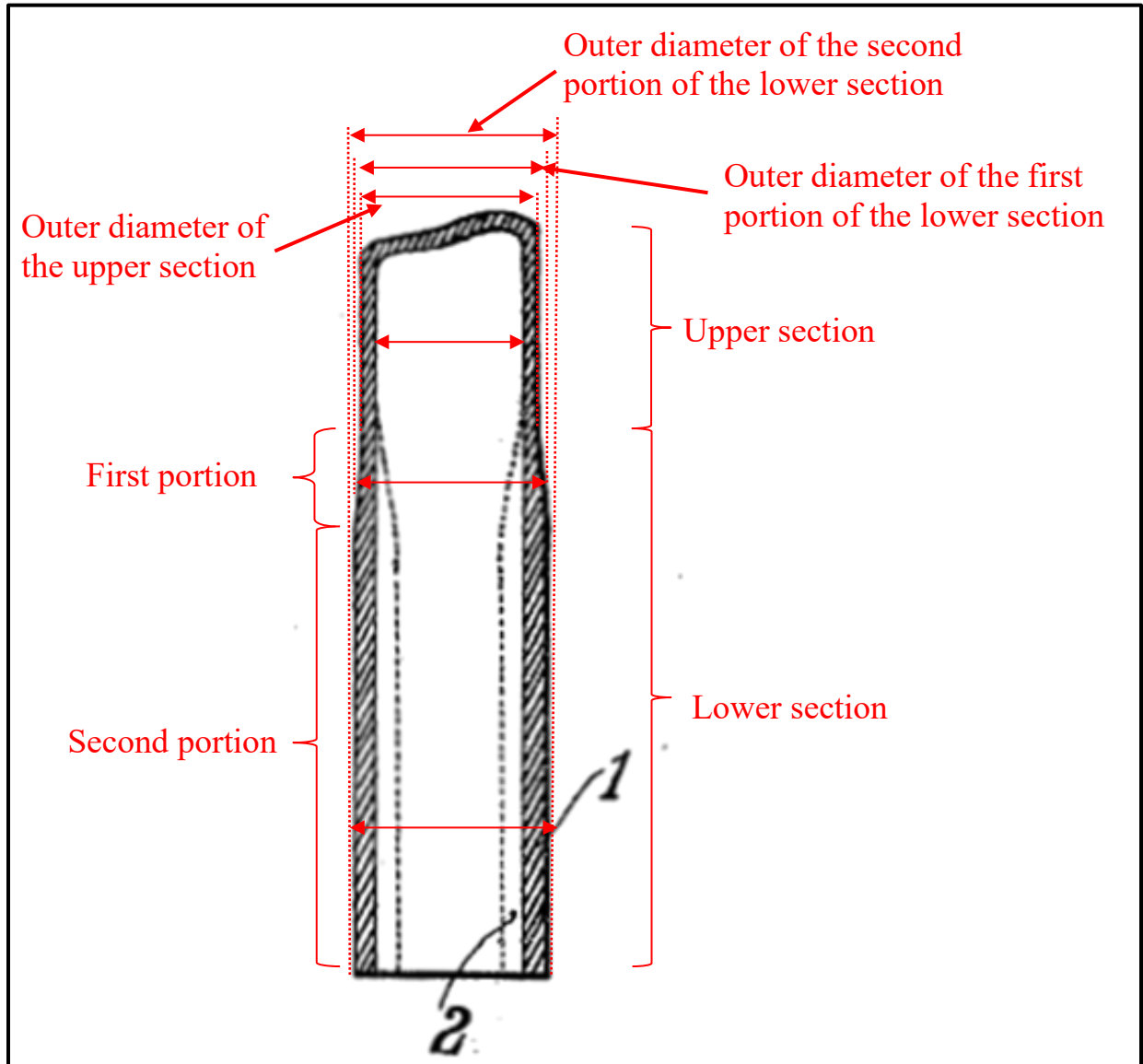
Denk discloses lightweight tubular components for bicycles made of steel, aluminum or titanium alloy, or plastic material reinforced with carbon fibers. Denk, cols. 1, 5. A POSITA would have found it obvious that any of these materials would have been suitable for Valat's steerer tube because Denk teaches that such lightweight component is suitable for practically all tubular components. *Id.*, col. 4; Ex. 1003, ¶208. The materials of Moechnig's steerer tube, such as aluminum or carbon fiber materials, which also were conventional and known, would also have been suitable for Valat's steerer tube because they provide suitable mechanical properties and weight. Moechnig, [0003], [0014]; Ex. 1003, ¶209.

9. Claims 2, 16, 27, 36, and 47

As discussed above in Ground 3, 61[c] (Section VII.A.4.b), Valat discloses the outer diameter of the lower section is greater than the outer diameter of the upper section. Ex. 1003, ¶210.

10. Claims 3, 17, 28, 37, 48, and 62

As shown below, the taper in the lower section of Valat's steerer tube forms a "first portion" of the lower section adjoining the upper section, and the lower part forms the "second portion" of the lower section. Ex. 1003, ¶212. As discussed above in Ground 3, 1[c] and 61[c] (Sections VII.A.3.d, VII.A.4.b), the outer surfaces of the upper and the lower sections are circular in cross-section. The outer diameter of the tubular body tapers gradually from the "second portion" of the lower section to the upper section over the "first portion" of the lower section. Ex. 1003, ¶212. This results in an outer diameter of the "first portion" being greater than an outer diameter of the upper section and less than an outer diameter of the "second portion." *Id.*



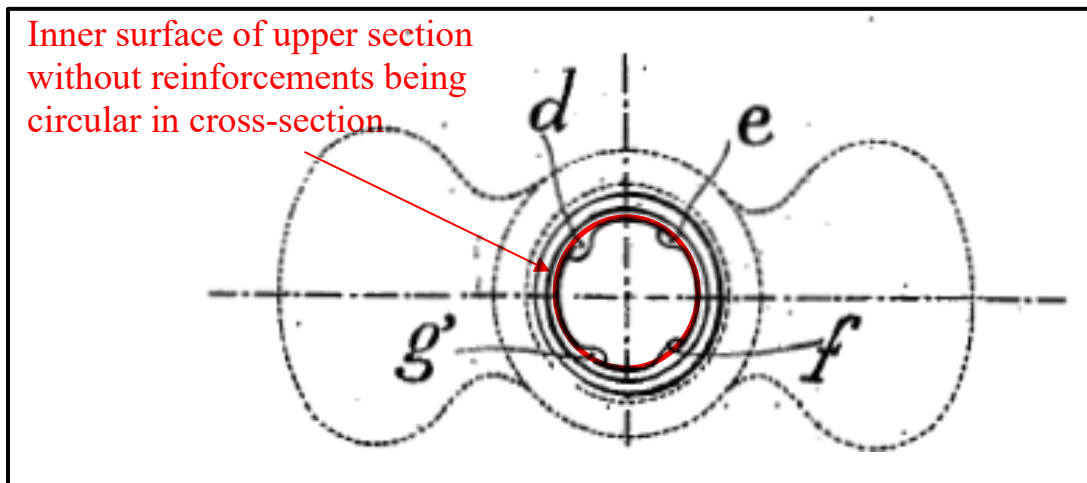
Valat, Fig. 1 (annotations added).

11. Claims 4, 18, 29, 38, 49, and 63

Valat in view of Moechnig and Denk renders these claims obvious for reasons discussed above in Section VII.A.10. Ex. 1003, ¶213.

12. Claims 6, 10, 20, 24, 40, and 44

Valat discloses that its steerer tube body has an internal diameter. Valat, 1:86-90, Figs. 1-2. Valat also shows in a cross-sectional view perpendicular to the steering axis that the inner surface of the lower section is circular with reinforcements *d*, *e*, *g*, *f*, as shown below. *Id.*, Fig. 2. Valat further explains that the reinforcements in the lower section taper away towards the upper section. *Id.*, Fig. 2, 1:58-63, 1:79-90. It would have been obvious to a POSITA that the inner surface of the upper section would also be circular in cross-section with an internal diameter and without the reinforcements. Ex. 1003, ¶215.



Valat, Fig. 2 (modified, annotations added).

Additionally, Denk discloses that the cross-sectional shape can continually transition along the tube length from the elliptical inner cross-sectional contour into a circular inner cross-sectional contour. Denk, cols. 6, 8, Figs. 1a-1b. It would have

been obvious to a POSITA that in Valat's steerer tube modified in view of Denk, the transition of the inner cross-sectional contour would occur over taper *c*, such that the upper section of the steerer tube has a circular inner cross-section. Ex. 1003, ¶216.

13. Claims 8, 12, 22, 26, 42, and 46

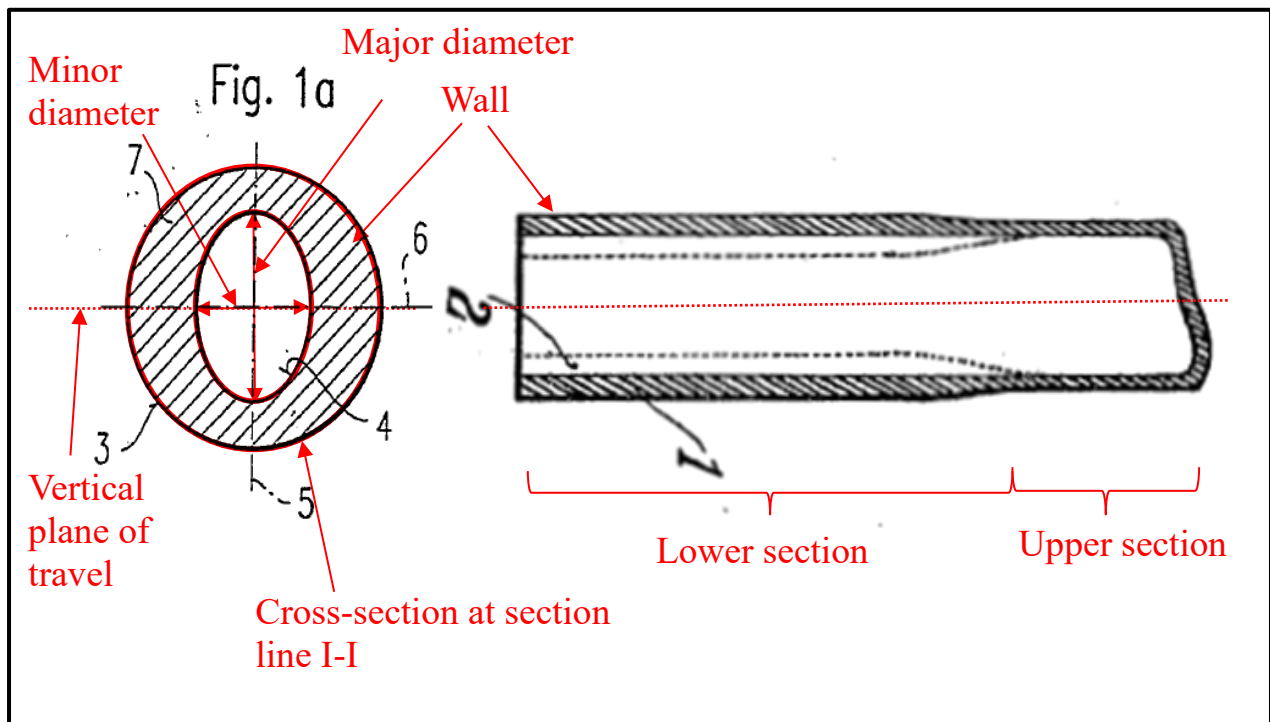
As explained above in Ground 3, 1[c] and claim 6 (Sections VII.A.3.d, VII.A.12), Valat discloses that the inner and outer surfaces of the upper section are circular in cross-section. A POSITA would have known that a ratio of an inner diameter to an outer diameter of the upper section of the steerer tube body being in the range of 0.75 to 0.95 is an obvious design choice and obvious-to-try for Valat's steerer tube based on multiple considerations for the reasons discussed in Ground 1 (Section VI.A.14). Ex. 1003, ¶218.

A POSITA would have understood that the ratio of the inner diameter to the outer diameter of the upper section of the steerer tube body is a result-effective variable that affects strength, rigidity, and weight of the steerer tube. *See id.* And determination of the optimum range of the ratio is within the grasp of one skilled in the art. Therefore, optimization of the ratio of the inner diameter to the outer diameter was nothing other than the exercise of ordinary skill. As discussed in Ground 1, claim 8 (Section VI.A.14), a POSITA would have known to select a suitable wall thickness, i.e., a ratio of the inner to the outer diameters, in the upper section through routine experimentation and design considerations to optimize

strength and rigidity of the steerer tube while maintaining light weight. Ex. 1003, ¶218; *see also id.*, ¶¶123-124.

14. Claim 56

As shown below and discussed in Sections VII.A.3.e, VII.A.6, Valat in view of Denk discloses that an inner surface of the wall within the lower section has an elliptical cross-section having a major diameter and a minor diameter. Ex. 1003, ¶221.



Denk, Fig. 1a; Valat, Fig. 1 (annotations added).

A POSITA would have understood that in Valat as modified with Denk's elliptical inner cross-sectional contour in the lower section, the major and minor diameters of the elliptical inner contour would decrease from the lower part to the

upper part generally over the tapered region as the inner contour transitions from an elliptical contour to a circular contour. Ex. 1003, ¶222. That is, the major and minor diameters would decrease from lower part *a* to upper part *b* over taper *c*. *Id.* Additionally, Moechnig explicitly discloses that the major and minor diameters of its lower section decrease (i.e., taper) as a function of proximity to the upper section of the body. Moechnig, [0038]. Based on the teachings of Moechnig, it would have been obvious to a POSITA that in Valat's steerer tube modified in view Denk, a minor diameter of the lower section would decrease from the second portion of the lower section to an end region of the first portion of the lower section. Ex. 1003, ¶223; *see also* discussion of Moechnig in ¶¶137-138.

A POSITA would have understood that the decrease of the minor diameter of the inner elliptical cross-section from the lower section to the upper section would result in the minor diameter to "decrease[]" as a function of proximity to the upper section of the body" because the minor diameter would decrease based on the closeness of a cross-section of the lower section to the upper section. Ex. 1003, ¶223.

15. Claims 57 and 58

As discussed in Ground 3, 1[d] and claim 34 (Sections VII.A.3.e, VII.A.6), in Valat's steerer tube modified in view of Denk's elliptical inner contour in the lower section, the inner elliptical cross-section in the lower section has a major diameter in the plane perpendicular to the plane of travel and a minor diameter in the plane of

travel. For the reasons discussed in Ground 1, claims 57-58 (Section VI.A.15), a POSITA would have known that a ratio of the major diameter to the minor diameter taken at a lower end of the lower section being within the range of 1.05 to 1.3 or the range of 1.10 to 1.25, inclusive, is an obvious design choice and obvious-to-try. Ex. 1003, ¶¶225-226.

Specifically, a POSITA would have known that the ratio of the major to the minor diameters of the lower section of the steerer tube is a result-effective variable that affects strength, rigidity, and weight of the steerer tube, and determination of the optimum range of that variable is within the grasp of a POSITA. *Boesch*, 617 F.2d at 276. A POSITA would have determined the optimum ratio of the major and minor diameters through routine optimization and experimentation to identify an optimum ratio that meets the strength and rigidity requirements in the lower end of the steerer tube while keeping the weight of the tube low. Ex. 1003, ¶229. Moechnig teaches that the widest minor diameter (longitudinal diameter 120) in the lower end of the lower section (106, 108) is greater than 1.125 inches but less than 1.559 inches, and the widest major diameter (lateral diameter 130) is 1.559 inches. *Id.* at ¶231. A POSITA optimizing the ratio of the major and minor diameters in a lower end of the steerer tube would have considered the ratio of the major and minor diameters taught by Moechnig, and would have arrived at the claimed ranges through routine

experimentation to optimize the strength and rigidity of the steerer tube while minimizing weight. *Id.*; see Section VI.A.15.

16. Claim 59

A POSITA would have understood that in Valat as modified with Denk’s elliptical inner cross-sectional contour in the lower section, the major diameter of the elliptical inner contour would decrease from the lower part to the upper part over the tapered region as the inner contour transitions from an elliptical contour to a circular contour. Ex. 1003, ¶234.

Additionally, Moechnig explicitly discloses that the major and minor diameters of its lower section decrease (i.e., taper) as a function of proximity to the upper section of the body. Moechnig, [0038] (“Both longitudinal and lateral diameters 120, 130 transition from lower radial portion 106 to upper radial portion 110.”). Accordingly, a POSITA would have known that Valat’s steerer tube (modified in view of Moechnig and Denk) would also have a major diameter of the lower section taper from the second portion of the lower section to an end region of the first portion of the lower section. Ex. 1003, ¶235.

17. Claim 60

As discussed in Ground 3, claim 6 (Section VII.A.12), Valat discloses that an inner surface of the upper section is circular in cross-section, and as discussed in Ground 3, 1[d] (Section VII.A.3.e), a POSITA would have understood that in Valat

combined with Denk, the inner elliptical cross-sectional contour in lower part *a* would “continually transition” into an inner circular contour in upper part *b* generally over taper *c*. *See* Ex. 1003, ¶216 (discussing claim 6). This would allow Valat’s steerer tube’s lower part *a* to be reinforced with Denk’s elliptical inner contour for improved mechanical properties while maintaining light weight. *See* Valat, 1:10-14; Denk, Abstract, cols. 1-2, 8-9; *see also* Schroeder, 6:22-26. Thus, in Valat combined with Denk, the inner surface contour of the steerer tube would continually transition from an ellipse to a circle, causing the ratio of the major diameter to the minor diameter to decrease gradually from the lower part *a* of the lower section up to upper part *b* of the upper section. Ex. 1003, ¶237. It would have obvious to a POSITA that such decrease of the ratio of the major diameter to the minor diameter would result in the ratio to “decrease[] as a function of proximity to the upper section of the body” because the ratio would decrease based on the closeness of a point in the lower section to the upper section. *Id.*

B. [Ground 4] Group 2 Challenged Claims Are Rendered Obvious by Valat in View of Moechnig, Denk, and Schroeder

1. A POSITA would have been motivated to combine Valat, Moechnig, Denk, and Schroeder, and would have reasonably expected success in doing so

Based on the disclosure of Schroeder, a POSITA would have been motivated to use two different materials for the steerer tube body and the fork crown of Valat

to improve durability and shock absorption capabilities of a bicycle fork, and would have reasonably expected success for the reasons explained in Section VI.B.2 (Ground 2). In short, a POSITA would have been motivated to use the generally preferred aluminum for forming the fork crown and a different material suitable for forming the steerer tube body—such as resin blended with carbon fiber composite as taught by Schroeder—to improve durability and shock absorption capabilities of the steerer tube and fork. Schroeder, 4:22-26; Ex. 1003, ¶239. A POSITA would have known how to connect the steerer tube and the fork crown of different materials and would have reasonably expected success in doing so. Ex. 1003, ¶240.

2. Independent Claim 64

Valat in view of Moechnig, Denk, and Schroeder render claim 64 obvious. *Id.*, ¶¶241-244.

a. 64[preamble]-64[b] and 64[d]

Valat in view of Moechnig and Denk teach 64[preamble]-64[b] and 64[d] for the reasons discussed above in Ground 3, 1[preamble]-1[b] and 1[d] (Sections VII.A.3.a-VII.A.3.c, VII.A.3.e). Ex. 1003, ¶242.

b. 64[c]

Valat in view of Denk and Moechnig and further in view of Schroeder teach claim term 64[c]. *Id.*, ¶¶243-244.

As discussed in Ground 3, 1[b] (Section VII.A.3.c), Valat discloses that a segment of the lower section of the steerer tube body is joined to a crown of a front wheel fork. And as discussed above in Sections VI.B.2, VII.B.1, Schroeder discloses that the body of the steerer tube is formed of a material different from that of the fork crown. A POSITA would have been motivated to modify Valat's steerer tube to be formed of a material different from its fork crown to improve durability and shock absorption capabilities, as disclosed in Schroeder. Ex. 1003, ¶244.

3. Claims 31 and 51

Valat in view of Denk and Moechnig and further in view of Schroeder renders claims 31 and 51 obvious for the reasons discussed above in claims 1, 15, 34, and 64[c] (Sections VII.A.3, VII.A.5, VII.A.6, VII.B.2.b). Ex. 1003, ¶¶245-246.

VIII. Discretionary Denial Under *Fintiv* Is Inappropriate

No *Fintiv* factors favor non-institution because, among other things, the parallel district court litigation was stayed in its very early stages and no trial date has been set.

More specifically, discovery has been stayed indefinitely since May 31, 2023, pending the court's ruling on defendant FOX's motion to transfer to the Northern District of California. Ex. 1014. As such, the parties and the district court have made very little progress and investment in the case since its filing on February 1, 2023. The parties have only exchanged preliminary infringement and invalidity

contentions. There has been no meaningful production of documents, or responses to document requests or interrogatories. Claim construction has not started, and there is no trial date scheduled.

It is unclear when the district court will rule on the pending transfer motion and the case will resume. But regardless of the outcome of the motion, the stay is likely to continue pending resolution of the IPR because very little has happened in the case. Even if the stay is lifted shortly after the filing of this Petition, the case is unlikely to go to trial before the final written decision (expected around August 2025) because the median time-to-trial in the Northern District of Georgia is more than 7 years (Ex. 1015, 2). Accordingly, *Fintiv* factors 1, 2, and 3 weigh against denial of institution.

Although there is some overlap in art and arguments between the invalidity contentions in the district court case and the Petition (factor 4), and the parties are the same in both proceedings (factor 5), Petitioner FOX has presented compelling, meritorious challenges, which counsel against denial of institution under *Fintiv* factor 6.

For at least the foregoing reasons, the Board should not exercise its discretion to deny institution.

IX. Discretionary Denial Under 35 U.S.C. § 325(d) Is Inappropriate

Denial of institution under § 325(d) is inappropriate at least because the Examiner did not analyze the prior art combinations in this Petition. The two primary references (Denk and Valat) were not cited during prosecution, much less considered or applied by the Examiner. Ex. 1003, ¶37. Indeed, during prosecution of the counterpart Chinese application CN 2015/11,009,996, the China National Intellectual Property Administration (“CNIPA”) repeatedly rejected all claims based on Denk in combination with Moechnig and Schroeder. Ex. 1004 (discussing Denk (identified as Reference Document 3) throughout the reexamination decision upholding the CNIPA’s rejection). Unable to persuade the CNIPA to allow the claims, Patent Owner SRAM abandoned the Chinese application, but did not report Denk to the USPTO during the prosecution of the application that issued as the ’993 patent, despite the unsuccessful prosecution of very similar claims in China.

Although the USPTO Examiner applied Moechnig during prosecution,⁵ Moechnig has been used in this Petition as only a secondary reference to provide support for certain conventional bicycle features recited in the claims. Specifically,

⁵ The USPTO Examiner applied the Moechnig patent, U.S. Patent No. 7,909,346, that issued from the Moechnig publication (Ex. 1008) used in this Petition.

the Examiner initially rejected the claims as being anticipated by or obvious over Moechnig. Ex. 1002, 210-218. But Patent Owner argued that “Moechnig discloses a cross section having a consistent wall thickness” and does not “disclose varying thickness of a wall.” *Id.*, 185-187 (citation omitted). The Examiner then withdrew the rejection over Moechnig and issued a new office action based on a different set of references. *Id.*, 178-183.

In contrast, in this Petition, Moechnig has not been relied upon for its teachings related to the thickness of a steerer tube wall (or lack thereof); rather, Moechnig has been relied on for its teachings of a conventional steerer tube structure and standard steerer tube mounting configuration. Ex. 1003, ¶37. Relatedly, Schroeder was cited in an IDS during the U.S. prosecution but was never applied by the Examiner as a basis for rejecting the claims. *Id.*; Ex. 1002, 261-263.

Accordingly, the use of Moechnig and Schroeder as secondary references in the Denk and Valat grounds does not warrant denial of institution.

X. Mandatory Notices

A. Real Parties-in-Interest

The real parties-in-interest for this Petition are FOX Factory, Inc. and FOX Factory Holding Corporation.

B. Related Matters

To Petitioner’s knowledge, the ’993 patent is involved in the following:

Name	Number	Court	Filed
<i>SRAM, LLC v. FOX Factory, Inc.</i>	1:23-cv-00492	N.D. GA.	Feb. 1, 2023

Patent Owner SRAM's Taiwanese Patent TWI718116B, which claims priority to the application leading to the '993 patent, is currently being asserted in Taiwan against Fox Factory Switzerland GMBH, Taiwan Branch.

C. Lead and Back-Up Counsel

Lead Counsel	Back-Up Counsel
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D. Service Information

Please address correspondence to counsel at the email addresses above.

Petitioner consents to service by e-mail.

XI. Standing

The '993 patent is eligible for IPR and Petitioner is not barred or estopped from requesting IPR challenging the patent claims on the grounds identified herein.

XII. Conclusion

For the foregoing reasons, Petitioner submits that the Challenged Claims of the '993 patent should be cancelled.

Dated: February 1, 2024

Respectfully submitted,

/Arpita Bhattacharyya/
Arpita Bhattacharyya, Reg. No. 63,681
Counsel for Petitioner

CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

Pursuant to 37 C.F.R. § 42.24(a)(1)(i), the undersigned hereby certifies that the foregoing **Petition for *Inter Partes* Review** contains 13,985 words, excluding the parts of this Petition that are exempted under 37 C.F.R. § 42.24(a), as measured by the word-processing system used to prepare this paper.

/Arpita Bhattacharyya/

Arpita Bhattacharyya, Reg. No. 63,681
Counsel for Petitioner

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(a), the undersigned certifies that on February 1, 2024, a copy of the foregoing Petition for *Inter Partes* Review, the associated power of attorney, and Exhibits 1001-1017 were served by FedEx Priority Overnight on the correspondence address of record indicated in the Patent Office's public Patent Center system for U.S. Patent No. 10,328,993:

Brian Gause
SRAM, LLC
1000 W. Fulton Market, 4th Floor
Chicago, IL 60607

Date: February 1, 2024

By: /William Esper/
William Esper
Case Manager and PTAB Coordinator
FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, LLP