

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CAIHONG DISPLAY DEVICES CO., LTD.,
Petitioner

v.

CORNING INCORPORATED,
Patent Owner

Case IPR2025-01137
U.S. Patent No. 8,627,684

DECLARATION OF DR. THOMAS R. KURFESS

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Corning Incorporated EX2006
Caihong Display Devices v. Corning
IPR2025-01137

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I, Dr. Thomas Kurfess, hereby declare as follows.

I. INTRODUCTION

1. I have been retained as an expert witness on behalf of Patent Owner Corning Incorporated (“Patent Owner”) for the above-captioned *inter partes* review (IPR). I am being compensated for my time in connection with this IPR at my standard consulting rate, which is \$750 per hour.

2. I understand that this Declaration accompanies a Patent Owner Preliminary Response involving U.S. Patent No. 8,627,684 (“the ’684 patent”) (EX1001). The ’684 patent, entitled “Pull Roll Apparatus and Method for Controlling Glass Sheet Tension,” issued on January 14, 2014 to Shultz et al. *See* EX1001, (54), (45), (75). It issued from U.S. Patent Application No. 11/978,333, filed on October 29, 2007. I understand that the effective priority date for the ’025 patent is no later than October 29, 2007. I refer to this date throughout for purposes of this Declaration.

3. The claims of the ’684 patent are directed to manufacturing equipment and processes for making glasses that can be used for displays, such as LCDs. EX1001, Abstract, 1:12-2:21. The process allows for the production of high-quality glass that is more efficient and easier to maintain than prior-art technology. The claimed apparatus and process recite a process that uses a pull roll apparatus to create tension in the molten glass in both transverse and longitudinal directions.

EX1001, claims 1, 7. The process allows for tightly controlled and reproducible glass dimensions, and produces sheets that are flat, smooth, defect-free, and thermally and mechanically durable. EX1001, 4:24-41, 13:65-15:29.

4. In preparing this Declaration, I have reviewed the entirety of the '684 patent, the Petition filed in the above-captioned *inter partes* review, and each of the documents cited herein, in light of general knowledge in the art as of October 29, 2007. In formulating my opinions, I have relied upon my experience, education, and knowledge in the relevant art. In formulating my opinions, I have also considered the viewpoint of a person of ordinary skill in the art ("POSA"), as defined further below, in light of general knowledge in the art.

II. MY BACKGROUND AND QUALIFICATIONS

5. I received my Ph.D. in 1989 from Massachusetts Institute of Technology ("MIT") in Mechanical Engineering. Prior to that, I received dual S.M. degrees in Electrical Engineering & Computer Science and Mechanical Engineering. I received my S.B. in Mechanical Engineering in 1986, also from MIT.

6. I serve as the Chief Manufacturing Officer of the Georgia Institute of Technology ("Georgia Tech"), as well as the Executive Director of the Georgia Tech Manufacturing Institute. I am also a Regents' Professor of mechanical

engineering and HUSCO/Ramirez Distinguished Chair in Fluid Power and Motion Control; I was recently promoted to Regents' Professor.

7. I have extensive experience in academia, governmental organizations, and private industries. My primary research areas include Manufacturing and Automation & Mechatronics, advanced automation, precision manufacturing, metrology, and technology policy.

8. I focus on the design and development of advanced systems targeting complex production and optimization of products. My focus spans a wide array of technologies, including high precision manufacturing and metrology systems, as well as national and international manufacturing policy.

9. I have worked on a variety of mechatronic and robotic systems in my career that include components and machines that are used in producing materials for use in consumer products, including complex continuous processes such as continuous casting for steel, rolling steel and aluminum, polymer extrusion and injection molding, film blowing to make polymer tubes, and fiber drawing for fiber optics.

10. I have also authored several different book chapters and papers that discuss manufacturing and robotic systems and their implementation. I have taught engineering courses at both the undergraduate and graduate levels on the topics of mechanical design, control theory, robotics and advanced dynamics,

manufacturing, and real-time signal processing and control, all of which are applicable to the manufacturing sector.

11. I began my academic career at Carnegie Mellon University where I rose to the rank of Associate Professor. In 1994, I moved to Georgia Tech and was appointed Professor in the George W. Woodruff School of Mechanical Engineering. In 2005, I was named Professor and BMW Chair of Manufacturing in the Department of Mechanical Engineering at Clemson University's International Center for Automotive Research. In 2012, I returned to Georgia Tech as a Professor of Mechanical Engineering and the HUSCO/Ramirez Distinguished Chair in Fluid Power and Motion Control. From 2019 to 2022, I was on a three-year leave of absence to serve as the Chief Manufacturing Officer for Oak Ridge National Laboratory ("ORNL"). My responsibility at ORNL was to develop and execute a long-range plan for advanced manufacturing as it applies to ORNL, national laboratories, and the United States of America.

12. Between 2012 and 2013, I took leave to serve as the Assistant Director for Advanced Manufacturing at the Office of Science and Technology Policy in the Executive Office of the President of the United States of America. In this position, I was responsible for engaging the federal sector and the greater scientific community to identify possible areas for policy actions related to manufacturing. In this role, I also coordinated federal advanced manufacturing

R&D, addressing issues related to technology commercialization, identifying gaps in current federal R&D in advanced manufacturing, and developing strategies to address these gaps.

13. Additionally, I have served as a special consultant of the United Nations to the Government of Malaysia in the area of applied mechatronics and manufacturing, and as a participating guest at the Lawrence Livermore National Laboratory's Precision Engineering Program.

14. Currently, I serve on the Board of Directors for the National Center for Manufacturing Sciences ("NCMS") and the National Center for Defense Manufacturing and Machining, and on the Board of Trustees for the MT Connect Institute. I am the Chief Technical Officer of NCMS. I also served on the Board of Governors for the American Society of Mechanical Engineers and the Board of Directors for the Society of Manufacturing Engineers. I served as the President of the Society of Manufacturing Engineers in 2018 and as the President of the American Society of Mechanical Engineers in 2023-2024.

15. I have significant experience in advanced manufacturing system design and fabrication, as well as metrology systems, which I bring to bear in this case.

16. I have received several awards identified on my curriculum vitae (CV), which is attached as Exhibit 2007. I am a Fellow of the American

Association for the Advancement of Science, the Society of Manufacturing Engineers, and the American Society of Mechanical Engineers, and an elected member of the U.S. National Academy of Engineering.

17. I am the author of numerous publications, all of which are listed on my CV. My CV also contains a list of other cases in which I have testified as an expert at trial or by deposition within the preceding four years.

III. LIST OF DOCUMENTS CONSIDERED

Exhibit No.	Description
EX1001	U.S. Patent No. 8,627,684 (“the ’684 Patent”) with certified Japanese translation
EX1002	JP1998201826 with certified English translation (“JP ’826”)
EX1003	Declaration of Murakami Tsugunobu
EX1004	U.S. 2005/0268655 with certified Japanese translation (“Butts”)
EX1005	JP20070151027 with certified English translation (“JP ’027”)
EX1006	KR200407349 with certified English and Japanese translations (“KR ’349”)
EX1007	U.S. Patent No. 1,586,618 with certified Japanese translation (“Fengren”)
EX1008	U.S. 2005/0076675 with certified Japanese translation (“Bogdahn”)
EX1009	U.S. 2009/0019892 with certified Japanese translation (“Fredholm”)
EX1010	U.S. Patent No. 4,612,030 with certified Japanese translation (“Smids”)
EX1011	The ’684 patent Partial file history with certified Japanese translation
EX1012	<i>Curriculum Vitae</i> of Murakami Tsugunobu

Exhibit No.	Description
EX2002	Display of the Year Award Archive, accessed at https://www.sid.org/Awards/Display-Industry-Awards/DIAAwardsArchive (last accessed Apr. 9, 2025)
EX2003	“Corning wins awards for EAGLE XG(TM),” accessed at: https://www.glassonline.com/corning-wins-awards-for-eagle-xgtm/ (last accessed Apr. 9, 2025) (May 23, 2007)
EX2004	Bocko, Peter L., “Handbook of Visual Display Technology,” Chapter 5.1.1: Glass Substrates for AMLCD, OLED and Emerging Display Platforms, pp. 599-623 (2012)
EX2005	File History of U.S. Patent No. 8,627,684
EX2007	Curriculum Vitae of Dr. Thomas R. Kurfess

IV. PERSON OF ORDINARY SKILL IN THE ART (“POSA”)

18. As an expert, I have offered opinions throughout this Declaration from the perspective of a POSA. I understand that a POSA is a hypothetical person who is presumed to be aware of all pertinent art, who thinks along conventional wisdom in the art, and is a person of ordinary creativity.

19. I also understand that the following factors are pertinent to the determination of the level of ordinary skill: (1) educational level and any specialties of the inventor(s), (2) types of problems encountered in the art, (3) prior-art solutions to those problems, (4) rapidity with which innovations are made, (5) sophistication of the technology, (6) educational level of active workers in the field, and (7) nature of any testing described in the patent (and skills required of those doing such testing).

20. I also understand that for the purposes of its Preliminary Response, Patent Owner does not dispute Petitioner's level of skill for a person of ordinary skill in the art (POSA) as articulated in the Petition.

21. In my opinion, the precise definition of a POSA is not important at this juncture. I would meet the definition of a POSA under Petitioner's or any reasonable definition. I also do not see any reason why a difference in the precise definition of a POSA would change the outcome of the obviousness analysis presented in the Petition, or its failings.

V. LEGAL BASIS FOR MY ANALYSIS

22. In formulating my opinions set forth in this Declaration, I applied the following legal principles.

A. Claim Construction

23. I understand that in an IPR, patent claim terms are given their ordinary and customary meanings as understood by a POSA at the time of the invention, in view of the patent's specification and its prosecution history, unless the patent explicitly defines the claim term. I also understand that when a patent explicitly defines a claim term in the specification, the patent's definition controls.

24. I understand that a dependent claim contains all limitations of the claim from which it depends.

B. Obviousness

25. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed subject matter would have been obvious to a POSA in view of the prior art and general knowledge in the prior art at the time of the patent's priority date (here, October 29, 2007). I understand that obviousness must be assessed from the viewpoint of a POSA at the time of the invention. I further understand that to establish obviousness, a party must perform the following factual inquiries: (a) determining the scope and content of the prior art; (b) ascertaining the differences between the claimed invention and the prior art; and (c) resolving the level of skill in the art. I understand that, in determining the scope and content of the prior art and ascertaining the differences between the claimed invention, a patent challenger must specify where each element of the claim is found in the prior art.

26. I understand that one way of establishing obviousness is by establishing that a POSA would have had both (i) a reason to modify or combine the teachings of the prior art to achieve the claimed invention and (ii) a reasonable expectation of success in doing so. I understand that the reason to combine prior-art references can come from a variety of sources, not just the prior art itself or the specific problem the patentee was trying to solve. And I understand that the references themselves need not provide a specific hint or suggestion of the

alteration needed to arrive at the claimed invention; the analysis may include recourse to logic, judgment, and common sense available to a person of ordinary skill that does not need to be explicit in any reference.

27. I understand that a “reasonable expectation of success” is assessed in view of the prior art and general knowledge in the art from the viewpoint of a POSA at the time of the patent’s priority date, and it does not require an absolute certainty of success. Furthermore, I understand that determining whether the prior art would have suggested to those of ordinary skill in the art to carry out the claimed invention with a reasonable expectation of success must be done after determining that the claimed elements are present in the prior art.

28. I also understand that, before reaching a conclusion that the claimed invention would have been obvious, one must consider any objective evidence of non-obviousness if it is available. The objective evidence of non-obviousness can include evidence of commercial success attributable to the claimed invention, evidence of industry praise for the claimed invention, evidence of a long-felt need that was solved by the claimed subject matter, evidence that others copied the claimed subject matter, or evidence that the claimed subject matter achieved an unexpected, superior result relative to the closest prior art. I understand that such evidence must have a nexus, or causal relationship, to the claimed subject matter

beyond what was available in the prior art, and must be commensurate in scope with the patent claim(s) at issue.

C. Anticipation

29. My understanding is that a patent claim is invalid as anticipated if each and every limitation of that claim: (1) is disclosed, either explicitly or inherently, in a single prior-art reference; (2) is already in practice in the industry in a single process or method; (3) is already in a single marketed product; or (4) is otherwise previously invented. For a step or limitation to be inherent in a reference, I understand that the step or limitation must necessarily always occur or be present when one follows the teachings of the reference. I am informed that for a reference to be considered as anticipating it must disclose the relevant technology in a manner such that a person of ordinary skill in the art would be able to carry out or utilize the technology that the reference describes without having to undertake undue experimentation.

VI. THE PETITION DOES NOT SHOW UNPATENTABILITY OF ANY CLAIM.

30. Having carefully considered the materials listed above, it is my opinion that Grounds 1 and 2 do not show every independent claim element in the cited art. They also do not provide any substantive analysis of motivation to modify and combine the cited art or a reasonable expectation of success.

- A. The combination of JP '826 and Butts does not teach or suggest “controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair to be a predetermined percentage of the torque of the at least one pull roll,” as required by claims 1-6.**

31. Ground 1 does not show obviousness of any of claims 1-6 because the cited art does not teach or suggest “controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair to be a predetermined percentage of the torque of the at least one pull roll,” as found in independent claim 1 of the '684 patent.

32. Petitioner does not point to a single reference (or combination of references) that discloses controlling the torque of one roller to be a predetermined percentage of the torque of another roller, as recited in the independent claims. *See, e.g.,* Pet., 21. Nor does the cited art disclose the claimed configuration of rollers such that a torque of at least one of the stub rolls in an upper pair of rollers (the first and second stub roll pairs) is a predetermined percentage of the torque of a roll in a lower pair of rollers. *See* EX1001, claim 1.

33. As the Office has already found, “Butts is silent with regard to any second pair of rollers that are above or below a first pair of rolls and is silent with regard to any splitting or apportioning of the torque in different roll pairs that are located in.” *See* EX1011, 4.

34. Petitioner cites Butts for disclosing setting the rotational speed of the cooling rollers to a preset value that is lower than the rotational speed of the pulling rollers. Pet., 20. Other sections of the Petition appear to change the argument when addressing claim limitations 1[d]-1[g] and 7[d]-7[g], and rely on JP '826 to allegedly teach setting the rotational/peripheral speed of a cooling roller lower than the peripheral speed of a pulling roller feature. Pet., 19-20, 33, 39. In these sections, Petition seems to rely on a combination of JP '826 and Butts to teach or suggest the “controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair” claim limitation. Pet., 20-22.

35. Either way, Butts does not teach “controlling torque rather than speed can allow for a speed difference between the rolls, enabling the surface speed of the glass sheet to match the speed of the rolls, thereby preventing the rolls from slipping relative to the glass plate.” Pet., 21. This excerpt does not exist in Butts. The Petition strategically rephrases it and then misleadingly presents it as a quote.

36. In fact, Butts only describes delivering equal and constant torque to the rolls 206 and 212 while allowing the rotational speeds of each of the rolls 206 and 212 to change with respect to one another based on the small but unavoidable difference between the radii of roll 206 and roll 212. EX1004, ¶21. Thus, Butts expressly teaches only setting or allowing the speed (not the torque) of a roller to

be different from another roller. EX1004, ¶21. Butts does not teach controlling the torque of an upper roller based on the torque of another roller. It discloses only controlling and adjusting the speed.

37. Neither JP '826 nor Butts, alone or in combination, teach controlling the torque of one roller to be lower than, or to be a percentage of, the torque of another roller. JP '826 generally teaches setting the peripheral speed of a cooling roller lower than the peripheral speed of a pulling roller, EX1002, ¶28, while Butts teaches delivering equal and constant torque to two rolls and allowing the angular velocity of each of the two rolls to change, EX1004, ¶21. Neither of these references discusses controlling the torque of one roller to be lower than, or to be a percentage of, the torque of another roller for any reason.

38. Petitioner's arguments do not provide the required rationale to combine JP '826 and Butts to teach or suggest the claims. Petitioner fails to identify a starting point (for example, a specific embodiment or example) in JP '826, the differences between that starting point and claim 1, or the proposed modification of that starting point in view of Butts. Pet., 20-22. Rather, the alleged motivation to combine JP '826 and Butts is a single sentence. Pet., 16-17 (limitation 1[a]), 21 (limitation 1[d]). Petitioner does not explain why one would look to the controlling the torque of rollers taught by JP '826, how or why one

would modify or be motivated to modify JP '826 in view of Butts, or why one would have an expectation of success in doing so. Pet., 20-22.

39. All of the references in the Ground, each alone *and in each possible combination*, fail to teach or suggest the claimed controlling the torque of at least one of stub rolls in a first stub roll pair to be a predetermined percentage of the torque of at least one pull roll, and the claimed controlling the torque of at least one of stub rolls in a second stub roll pair to be a predetermined percentage of the torque of at least one pull roll.

B. The combination of JP '826, Butts, and Smids does not teach or suggest the claimed “controlling the torque of the at least one of the stub rolls in the first stub roll pair and at least one in the stub rolls of second stub roll pair to be a predetermined percentage of the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair,” as required by claims 7-14.

40. Ground 1 does not show obviousness of any of claims 7-14 because the Petition fails to cite art that teaches or suggests “controlling the torque of the at least one of the stub rolls in the first stub roll pair and at least one in the stub rolls of second stub roll pair to be a predetermined percentage of the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair,” as found in independent claim 7 of the '684 patent.

41. Petitioner cites Butts for disclosing setting the rotational speed of the cooling rollers to a preset value that is lower than the rotational speed of the

pulling rollers. Pet., 32. Other sections of the Petition appear to change the argument when addressing claim limitations 1[d]-1[g] and 7[d]-7[g], and rely on JP '826 to allegedly teach setting the rotational/peripheral speed of a cooling roller lower than the peripheral speed of a pulling roller feature. Pet. 19-20, 33, 39.

42. Either way, Butts does not teach “controlling torque rather than speed can allow for a speed difference between the rolls, enabling the surface speed of the glass sheet to match the speed of the rolls, thereby preventing the rolls from slipping relative to the glass plate.” Pet., 33. This excerpt does not exist in Butts. The Petition strategically rephrases it and then misleadingly presents it as a quote.

43. In fact, Butts only describes delivering equal and constant torque to the rolls 206 and 212 while allowing the rotational speeds of each of the rolls 206 and 212 to change with respect to one another based on the small but unavoidable difference between the radii of roll 206 and roll 212. EX1004, ¶21. Thus, Butts expressly teaches only setting or allowing the speed (not the torque) of a roller to be different from another roller. EX1004, ¶21. Butts does not teach controlling the torque of an upper roller based on the torque of another roller—it only discloses controlling or adjusting the speed.

44. To the extent the Petition relies on a combination of JP '826, Butts, *and Smids* to teach or suggest claim 7’s “controlling the torque of the at least one of the stub rolls in the first stub roll pair and at least one in the stub rolls of second

stub roll pair” claim limitation, it still fails. Pet., 32-33. JP ’826, Butts, and Smids, either alone or in combination, do not teach controlling the torque of one roller to be lower than, or to be a percentage of, the torque of another roller at the same elevation.

45. For example, JP ’826 generally teaches setting the peripheral speed of a cooling roller lower than the peripheral speed of a pulling roller, EX1002, ¶28, while Butts teaches delivering equal and constant torque to two rolls and allowing the angular velocity of each of the two rolls to change, EX1004, ¶21. The Petition does not point to anything particular in Smids to teach the torque-controlling feature and fails to teach controlling the torque of any roller. Pet., 32-34. There is nothing to point to as Smids does not control the torque of one roller to be lower than, or to be a percentage of, the torque of another roller for any reason.

46. In addition to failing to cite each element of the claims, Petitioner’s arguments lack the required rationale to combine JP ’826, Butts, and Smids to teach or suggest the claims. Petitioner fails to identify a starting point (for example, a specific embodiment or example) in JP ’826, the differences between that starting point and claim 7, or the proposed modification of that starting point in view of Butts. Pet., 32-34. Rather, the alleged motivation to combine JP ’826, Butts, and Smids is a single sentence. Pet., 33 (limitation 7[d]-[g])). Petitioner does not explain why one would look to the controlling the torque of rollers taught by JP

'826, how or why one would modify or be motivated to modify JP '826 (as modified by Smids) in view of Butts, or why one would have an expectation of success in doing so. Pet., 32-34. Accordingly, all of the references in Ground 1, each alone *and in each possible combination*, fail to teach or suggest the claimed controlling the torque limitation.

C. The combination of KR '349 and Bogdahn does not teach or suggest “controlling the torque of at least one of the pull rolls in the pull roll pair,” as required by claims 1-6.

47. Ground 2 does not show obviousness of any of claims 1-6 because the cited art does not teach or suggest “controlling the torque of at least one of the pull rolls in the pull roll pair,” as found in independent claim 1 of the '684 patent. At a high level, Petitioner appears to rely on Bogdahn alone for this limitation, despite presenting Bogdahn in various combinations of one to three other references. Bogdahn discloses a method and device for manufacturing cylindrical glass bodies, and specifically teaches “reduc[ing] or prevent[ing] gearing differences between the individual rolling bodies [and the resulting damage to the glass surface] by coordinating the torques.” Pet., 47-49 (citing EX1008, ¶¶21, 37).

48. But Bogdahn teaches the benefits of coordinating torques among entirely differently situated rollers in forming *cylindrical* glass—not flat glass sheets. EX1008, Abstract, ¶1, FIG. 1, claims 1, 12, 19. The entire apparatus, and relative positions and motions of the rollers, are configured differently from the

'684 patent. *Id.* The purpose of the torque control in the '684 patent is to coordinate the rollers pulling on the perpendicular edges of the flat glass sheet to control cross-draw and down-draw tension of the glass sheet (i.e., in two dimensions). *See* EX1001, 7:66-8:35. This coordination enables control of tension of the glass sheet in two dimensions – cross-draw and down-draw. *See* EX1001, Abstract. Cylindrical glass tubes do not have perpendicular edges and are drawn in a single, longitudinal dimension. No disclosure in Bogdahn teaches how or why one would coordinate the torque ratios of the kind of perpendicularly arranged rollers claimed in the '684 patent.

49. The Petition further argues that the combination of KR '349 and Bogdahn suggests the “controlling the torque of at least one of the pull rolls in the pull roll pair” claim limitation. Pet., 47-49. However, neither KR '349 nor Bogdahn, alone or in combination, teaches controlling the torque of at least one of the pull rolls in the pull roll pair for manufacturing glass sheet.

50. KR '349 generally teaches an “apparatus for manufacturing sheet glass using the downdraw method,” Pet., 45 (citing EX1006, Title), while Bogdahn describes “reduc[ing] or prevent[ing] gearing differences between the individual rolling bodies [and the resulting damage to the glass surface] by coordinating the torques” for manufacturing cylindrical glass bodies, Pet., 47-49 (citing EX1008, ¶¶21, 37). Neither of these references discusses controlling the torque of at least

one of the pull rolls in the pull roll pair for manufacturing glass sheet for any reason.

51. In addition to failing to cite each element of the claims, Petitioner's arguments lack the required rationale to combine KR '349 and Bogdahn to teach or suggest the claims. Petitioner fails to identify a starting point (for example, a specific embodiment or example) in KR '349, the differences between that starting point and claim 1, or the proposed modification of that starting point in view of Bogdahn. Pet., 47-49. Rather, the alleged motivation to combine KR '349 and Bogdahn is, in conclusory fashion, that a POSA "would understand" how to implement extensive modifications to KR '349 to control the torque of its rollers. Pet., 48. Petitioner does not explain why one would look to the controlling the torque of rollers taught by KR '349, how or why one would modify or be motivated to modify KR '349 in view of Bogdahn, or why one would have an expectation of success in doing so. Pet., 47-49.

52. Accordingly, the references in Ground 2, each alone *and in each possible combination* fail to teach or suggest the claimed controlling the torque of at least one of the pull rolls in the pull roll pair.

- D. The combination of KR '349, Bogdahn, and JP '027 does not teach or suggest “controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair to be a predetermined percentage of the torque of the at least one pull roll,” as required by claims 1-6.**

53. Ground 2 does not show obviousness of any of claims 1-6 because the Petition fails to cite art that teaches or suggests “controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair to be a predetermined percentage of the torque of the at least one pull roll,” as found in independent claim 1 of the '684 patent. In purported support for this limitation, Petitioner cites JP '027, which teaches setting the cooling rollers and pulling rollers to different speeds. Pet., 50.

54. JP '027 controlling the *speed* of a roller is not equivalent to controlling the torque of it. Petitioner alleges that “[a]lthough JP '027 does not explicitly refer to the controlling the *torque* of the rollers, a POSITA would understand that circumferential speed is directly proportional to rotational speed, and that both circumferential speed and rotational speed are inversely related to torque in most cases (*e.g.*, assuming power is constant).” Pet., 50. But neither circumferential nor rotational speed is equivalent to torque, *nor in the context of glass making is the conversion straight forward*, and the assumption of power being constant is baseless.

55. To the extent the Petition relies on a combination of KR '349, Bogdahn, and JP '027 to teach or suggest the “controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair” claim limitation, it fails. Pet., 50-51. The reasons that KR '349 and Bogdahn do not teach or suggest this limitation are the same as discussed in Section VI.C, above. JP '027 generally teaches setting the cooling rollers and pulling rollers to different speeds. Pet., 50. None of these references discusses controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair, much less controlling the torque of one of those stub rolls to be a predetermined percentage of the torque of the at least one pull roll.

56. Petitioner does not provide the required rationale to combine KR '349, Bogdahn, and JP '027 to teach or suggest the claims. Petitioner does not identify a starting point (for example, a specific embodiment or example) in KR '349, the differences between that starting point and claim 1, or the proposed modification of that starting point in view of Bogdahn and JP '027. Pet., 50-51. Rather, Petitioner states in conclusory fashion that a POSA “would understand” how to implement extensive modifications to KR '349 to control the torque of its rollers to be a predetermined percentage of the torque of another roller. Pet., 51. Petitioner does not explain why one would look to the controlling the torque of

rollers to be a predetermined percentage of the torque of other rollers taught by KR '349, how or why one would modify or be motivated to modify KR '349 in view of Bogdahn and JP '027, or why one would have an expectation of success in doing so. Pet., 50-51.

57. All of the references in the Ground, each alone *and in each possible combination*, fail to teach or suggest the claimed controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at least one of the stub rolls in the second stub roll pair to be a predetermined percentage of the torque of the at least one pull roll.

E. The combination of KR '349 and Bogdahn does not teach or suggest “controlling the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair,” as required by claims 7-14.

58. Ground 2 fails to show obviousness of any of claims 7-14 because the Petition fails to cite art that teaches or suggests “controlling the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair,” as found in independent claim 7 of the '684 patent. As discussed above, Bogdahn discloses a method and device for manufacturing *cylindrical* glass bodies with a focus on gearing differences between rolling bodies configured specifically for cylindrical configurations. EX1008, Abstract, ¶1, FIG. 1, claims 1, 12, 19. The Petition’s reliance on Bogdahn is therefore misplaced. Pet., 58-59 (citing EX1008, ¶¶21, 37).

59. The purpose of the torque control in the '684 patent is to coordinate the rollers pulling on the perpendicular edges of the glass sheet. *See* EX1001, 7:66-8:35. Cylindrical glass tubes do not have perpendicular edges. No disclosure in Bogdahn teaches how or why one would coordinate the torque ratios of the kind of rollers claimed in the '684 patent.

60. To the extent the Petition relies on a combination of KR '349 and Bogdahn to teach or suggest the “controlling the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair” claim limitation, it still fails. Pet., 58-60. Neither KR '349 nor Bogdahn, alone or in combination, teach controlling the torque of at least one of the stub rolls in the stub roll pair for manufacturing a flat glass sheet. KR '349 generally teaches an apparatus for manufacturing sheet glass using the downdraw method, Pet., 55 (citing EX1006, Title), but does not teach the torque control concept. Bogdahn teaches torque control as a concept, but not in the context of flat glass sheets, which requires perpendicular coordination.

61. Petitioner's arguments lack the required rationale to combine KR '349 and Bogdahn to teach or suggest the claims. Petitioner does not identify a starting point in KR '349, the differences between that starting point and claim 7, or the proposed modification in view of Bogdahn. Pet., 58-60. Rather, the alleged motivation to combine KR '349 and Bogdahn is, in conclusory fashion, that a

POSA “would understand” how to implement extensive modifications to KR ’349 to control the torque of its rollers. Pet., 59-60. Petitioner does not explain why one would look to the controlling the torque of the rollers taught by KR ’349, how or why one would modify or be motivated to modify KR ’349 in view of Bogdahn, or why one would have an expectation of success in doing so. Pet., 58-60.

62. All of the references in Ground 2, each alone *and in each possible combination* fail to teach or suggest the claimed controlling the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair.

F. The combination of KR ’349, Fredholm, Bogdahn, and JP ’027 does not teach or suggest “controlling the torque of the at least one of the stub rolls in the first stub roll pair and at least one in the stub rolls of second stub roll pair to be a predetermined percentage of the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair,” as required by claims 7-14.

63. Ground 2 does not show obviousness of any of claims 7-14 because the Petition fails to cite art that teaches or suggests “controlling the torque of the at least one of the stub rolls in the first stub roll pair and at least one in the stub rolls of second stub roll pair to be a predetermined percentage of the torque of at least one of the stub rolls in the third stub roll pair and at least one of the stub rolls in the fourth stub roll pair,” as found in independent claim 7 of the ’684 patent. Petitioner

appears to cite JP '027 for teaching the concept of setting the cooling rollers and pulling rollers to different speeds. Pet., 61. Petitioner is mistaken.

64. JP '027 controlling the *speed* of a roller is not the same as controlling the *torque* of it. Petitioner alleges that “[a]lthough JP '027 does not explicitly refer to the controlling the torque of the rollers, a POSITA would understand that circumferential speed is directly proportional to rotational speed, and that both circumferential speed and rotational speed are inversely related to torque in most cases (*e.g.*, assuming power is constant).” Pet., 62. But neither circumferential nor rotational speed is equivalent to torque, nor in the context of glass making is the conversion straight forward, and the assumption of power being constant is baseless.

65. To the extent the Petition relies on a combination of KR '349, Fredholm, Bogdahn, and JP '027 to teach or suggest the limitation, it still fails. Pet., 61-63. KR '349, Fredholm, Bogdahn, and JP '027, alone or in combination, fails to teach controlling the torque of a stub roll for manufacturing glass sheet. The reasons regarding KR '349 and Bogdahn are the same as discussed in Sections VI.C. or VI.E above. Fredholm generally teaches cantilevered auxiliary rollers. Pet., 57-58. JP '027 generally teaches setting the cooling rollers and pulling rollers to different speeds. Pet., 50. None of these references discusses controlling the torque of at least one of the stub rolls in the first stub roll pair and the torque of at

least one of the stub rolls in the second stub roll pair, much less controlling the torque of one of those stub rolls to be a predetermined percentage of the torque of the at least other stub roll.

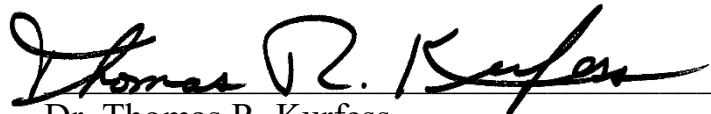
66. Petitioner's arguments lack the required rationale to combine KR '349, Fredholm, Bogdahn, and JP '027. Petitioner does not identify a starting point in KR '349, the differences between that starting point and claim 7, or the proposed modification of that starting point in view of Fredholm, Bogdahn, and JP '027. Pet., 60-63. Rather, the Petition states in conclusory fashion that a POSA "would understand" how to implement extensive modifications to KR '349 to control the torque of its rollers to be a predetermined percentage of the torque of another roller. Pet., 62. Petitioner does not explain why one would look to the controlling the torque of rollers to be a predetermined percentage of the torque of other rollers taught by KR '349, how or why one would modify or be motivated to modify KR '349 in view of Fredholm, Bogdahn, and JP '027, or why one would have an expectation of success in doing so. Pet., 60-63. It fails for the same reasons as the combinations discussed above.

VIII. CONCLUSION

67. In signing this declaration, I recognize that the declaration will be filed as evidence in an *inter partes* review before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required, I will appear for cross-examination within the United States during the time allotted.

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

Executed on this 1st day of October 2025, in Atlanta, Georgia USA.


Dr. Thomas R. Kurfess