EXHIBIT A

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SCHINDLER ELEVATOR CORPORATION

UNITED STATES DISTRICT COURT
DISTRICT OF NEW JERSEY

SCHINDLER ELEVATOR CORPORATION, Plaintiff, v. OTIS ELEVATOR COMPANY, Defendant/Counterclaim Plaintiff, v. SCHINDLER ELEVATOR CORPORATION and SCHINDLER AUFZÜGE AG Counterclaim-Defendants.	Civil Action No. 2:09-cv-00560-DMC-JAD Hon. Dennis M. Cavanaugh, U.S.D.J. Hon. Joseph A. Dickson, U.S.M.J. **SCHINDLER ELEVATOR CORPORATION'S FIRST AMENDED COMPLAINT** **REVISED REDACTED VERSION**

FIRST AMENDED COMPLAINT

Plaintiff/Counterclaim Defendant Schindler Elevator Corporation ("Schindler"), by and through its undersigned attorneys, brings this First Amended Complaint against Defendant/Counterclaim Plaintiff Otis Elevator Company ("Otis"). Schindler alleges as follows, upon knowledge with respect to itself and its own acts, and upon information and belief as to the circumstances and facts of others:

NATURE OF THE ACTION

1. This is an action for a declaratory judgment that United States Patent No. 6,739,433 ("the '433 patent") entitled "Tension Member for an Elevator" is invalid and unenforceable. A true and correct copy of the '433 patent is attached as Exhibit A.

THE PARTIES

2. Schindler Elevator Corporation (hereinafter "Schindler") is a Delaware corporation with its principal place of business at 20 Whippany Road, Morristown, New Jersey, USA.

3. On information and belief, Otis Elevator Company (hereinafter "Otis") is a New Jersey corporation with its principal place of business at 10 Farm Springs Road, Farmington, Connecticut, USA.

JURISDICTION AND VENUE

4. This action arises under the patent laws of the United States, Title 35 of the United States Code, and the Declaratory Judgment Act, 28 U.S.C. § 2201. This Court has original jurisdiction over the subject matter of all causes of action herein pursuant to 28 U.S.C. § 1338(a), § 1331, and §2201(a).

5. On information and belief, Otis has systematic and continuous contacts with this judicial district.

6. On information and belief, Otis regularly avails itself of the benefits of this judicial district, including the jurisdiction of its courts.

7. On information and belief, Otis regularly transacts business within this judicial district.

8. On information and belief, Otis regularly sells products in this judicial district, from which Otis derives substantial revenue.

9. For all of the foregoing reasons and others, including the fact that Otis resides in this district because it is incorporated in the state of New Jersey, this Court has personal jurisdiction over Otis.

10. Venue is proper in this judicial district pursuant to 28 U.S.C. § 1391(b) and (c) because Otis is subject to personal jurisdiction in this judicial district.

BACKGROUND

11. Schindler is a world leader in the development, manufacture and supply of elevators, escalators, and related components.

12. Otis directly competes with Schindler at least in the field of elevators and elevator components.

13. Schindler operates a facility at 20 Whippany Road, Morristown, New Jersey, USA ("the Morristown facility").

14. Schindler sister corporations in various countries have manufactured, sold and used certain elevator belt products, including the Gates LL MV 90-07 Tension Member ("the Gates Tension Member") and products substantially similar to the Gates Tension Member.

15. Schindler has used in the United States the Gates Tension Member in connection with testing activity at its Morristown facility. This Gates Tension Member used by Schindler

in New Jersey is the same as the Gates Tension Members sold by sister Schindler entities in Europe. On the filing date of Schindler's original Complaint in this action (i.e., December 23, 2008), Schindler anticipated that, in March 2009, it would install Gates Tension Members into an elevator at its Morristown facility for the purposes of continued testing and commercialization.

16. On information and belief, Otis is the owner, by way of assignment, of U.S. Patent No. 6,739,433 ("the '433 patent") entitled "Tension Member for an Elevator."

17. The '433 patent is generally directed to a tension member for use with an elevator, where the tension member includes a plurality of discrete cords made of individual wires, each wire having a diameter of less than 0.25 millimeters.

18. On information and belief, Otis is the owner of U.S. Patent Application Serial No. 10/839,550 ("the '550 application"), which is a divisional application of the '433 patent. On the filing date of Schindler's original Complaint in this action (i.e., December 23, 2008), the '550 application, which includes claims similar to the '433 patent, stood rejected by the U.S. Patent & Trademark Office as being unpatentable in view of identified prior art references.

19. Otis has initiated several patent infringement suits against sister Schindler entities in Europe in connection with tension members for elevators which include wires having a diameter of less than 0.25 millimeters, such as the Gates Tension Member

20. In view of its litigious activity, Otis has demonstrated a consistent propensity to file patent infringement suits.

21. On the filing date of Schindler's original Complaint in this action (i.e., December 23, 2008), Schindler planned to introduce into the United States on a commercial scale, the

Gates Tension Members which were being sold in Europe by sister Schindler corporate entities. On the filing date of Schindler's original Complaint in this action (i.e., December 23, 2008), Schindler intended and desired to make, sell, offer to sell and/or use the Gates Tension Members within the United States as soon as the threat of a patent infringement action by Otis was removed.

22. On the filing date of Schindler's original Complaint in this action (i.e., December 23, 2008), Schindler could not proceed with its plan to make, sell, offer to sell and/or use the Gates Tension Members within the United States until it obtained a declaration that each and every claim of the '433 patent is invalid.

23. In view of the foregoing, there is a present, real, immediate, and substantial controversy between Otis and Schindler concerning the validity of the '433 Patent

COUNT I – INVALIDITY OF U.S. PATENT NO. 6,739,433

24. Schindler repeats and realleges each and every allegation contained in paragraphs 1-23 of this Complaint as though fully set forth herein.

25. Each of the claims of the '433 patent are invalid for failure to comply with one or more of the requirements of Title 35, United State Code, including, but not limited to, 35 U.S.C. §§ 101, 102, 103, 112 and 113.

COUNT II – UNENFORCEABILITY OF U.S. PATENT NO. 6,739,433 DUE TO INEQUITABLE CONDUCT

26. Schindler repeats and realleges each and every allegation contained in paragraphs 1-25 of this Complaint as though fully set forth herein.

27. The '433 patent issued from U.S. Patent Application Serial No. 09/218,990 ("the '990 application"), which was filed on December 22, 1998.

28. Dr. Pedro Baranda is a named inventor of the '433 patent.

29. Hugh O'Donnell is a named inventor of the '433 patent.

Inequitable Conduct by Inventor Pedro Baranda

30. As a named inventor of the '433 patent, Dr. Pedro Baranda owed a duty of candor and good faith to the United States Patent and Trademark Office ("USPTO") in connection with the prosecution of the '990 application. *See* 37 CFR § 1.56. Pursuant to this duty of candor and good faith, Dr. Baranda was obligated to disclose to the USPTO all information known to him that would have been material to the patentability of the alleged invention claimed in the '990 application and the '433 patent. Pursuant to 37 CFR § 1.56, information is material to the patentability of an application if: (i) it establishes, by itself or in combination with other information, a *prima facie* case of unpatentability as to at least one claim in the application; or (ii) it refutes, or is inconsistent with, a position taken by the applicant in opposing an argument of unpatentability relied on by the USPTO, or in asserting an argument of patentability.

31. On information and belief, Dr. Baranda violated his duty of candor and good faith by intentionally withholding from the USPTO certain prior art, of which he was personally aware, that was highly material to the patentability of each claim that issued in the '433 patent. On information and belief, Dr. Baranda intentionally withheld this prior art from the USPTO, with the specific intent to deceive the USPTO into improperly granting the '433 patent.

32. Dr. Baranda's violation of the duty of candor and good faith constitutes inequitable conduct which renders the '433 patent unenforceable in its entirety.

33. Dr. Baranda was an employee of Otis for at least the period beginning in the middle of 1997 and ending in the middle of 2000. During this period, Dr. Baranda was primarily

employed at Otis's headquarters facility in Farmington, Connecticut, where he was part of a team of Otis engineers investigating the use of flexible flat ropes ("FFR") to provide lifting force to elevators.

34. In [redacted], several Otis employees associated with the FFR project [redacted] Contitech Transportbandsysteme GmbH ("Transportbandsysteme") and Contitech Antriebssysteme GmbH ("Antriebssysteme").

35. On information and belief, Transportbandsysteme and Antriebssysteme are affiliated companies, each of which is incorporated and headquartered in Germany.

36. On information and belief, one of Otis's primary purposes in conducting the [redacted] was to determine whether Transportbandsysteme and/or Antriebssysteme [redacted]

37. During the [redacted], certain Otis employees [redacted]

38. During the [redacted], [redacted]."

39. On information and belief, [redacted] by, at the latest, [redacted] The [redacted] was [redacted]

40. On information and belief, there is no evidence that Otis had conceived all the elements of the claims of the '433 patent (including, without limitation, the claimed cord

arrangements, cord constructions, wire diameters and/or aspect ratios) until [redacted] sample [redacted] in [redacted] Accordingly, on information and belief, [redacted]

41. Upon [redacted]

42. Dr. Baranda [redacted] the [redacted] sample after it was [redacted] On information and belief, Dr. Baranda [redacted] the [redacted] sample before [redacted]

43. Dr. Baranda is the sole named author of an internal Otis document dated [redacted] and entitled [redacted] In [redacted] of this [redacted], Dr. Baranda wrote that "[redacted]" [redacted] to the [redacted] lists [redacted] including the [redacted] sample. Specifically, [redacted] lists the following information about the [redacted] sample: [redacted] Accordingly, on information and belief, Dr. Baranda, the sole named author of the [redacted],

[redacted].

44. The [redacted] This fact is stated in [redacted] of the [redacted], of which Dr. Baranda was the sole named author. On information and belief, Dr. Baranda also learned this fact from, at least, his [redacted] of the [redacted] sample. Accordingly, on information and belief, Dr. Baranda [redacted]

45. The [redacted] of the [redacted] were [redacted] This fact is stated in [redacted] of the [redacted], of which Dr. Baranda was the sole named author. On information and belief, Dr. Baranda also [redacted] from, at least, his [redacted] of the [redacted] sample. Accordingly, on information and belief, Dr. Baranda [redacted], that the [redacted] of the [redacted] were each [redacted]

46. Each of the [redacted] of the [redacted] were [redacted]. This fact is stated in [redacted] of the [redacted], of which Dr. Baranda was the sole named author. On information and belief, Dr. Baranda also learned this fact from, at least, his [redacted] of the [redacted] sample. Accordingly, on information and belief, Dr. Baranda [redacted], that each of the [redacted] of the [redacted] were [redacted] and thus were [redacted].

47. On information and belief, the [redacted] of the [redacted] were [redacted] On information and belief, Dr. Baranda learned this fact from, at least, his [redacted] of the [redacted] sample. Accordingly, on information and belief, Dr. Baranda knew, before [redacted] that the [redacted] of the [redacted] were [redacted]

48. The [redacted] included [redacted]. This fact is stated in [redacted] of the [redacted], of which Dr. Baranda was the sole named author. On information and belief, Dr. Baranda also learned this fact from, at least, his [redacted] of the [redacted] sample. Accordingly, on information and belief, Dr. Baranda [redacted].

49. The [redacted] had a [redacted] of [redacted] and a [redacted] of [redacted]. These facts are stated in [redacted] of the [redacted], of which Dr. Baranda was the sole named author. On information and belief, Dr. Baranda [redacted] learned these facts from, at least, his [redacted] of the [redacted] sample. Defining the aspect ratio of [redacted] as the ratio of its width to its thickness, the [redacted] had an aspect ratio of [redacted]. Accordingly, on information and belief, Dr. Baranda [redacted]

50. On information and belief, the [redacted] was [redacted]. In [redacted] of the [redacted] of which Dr. Baranda was the sole named author, the [redacted] of the [redacted] was [redacted]. On information and belief, this [redacted] was [redacted] On information and belief, Dr. Baranda [redacted]. Accordingly, on information and belief, Dr. Baranda [redacted]

51. In view of the foregoing, the [redacted] (*see* ¶ 50); (ii) the [redacted] (*see* ¶ 44); (iii) the [redacted] were [redacted] (*see* ¶ 45); (iv) each of the [redacted] were [redacted] (*see* ¶ 46); (v) the [redacted] were [redacted] (*see* ¶ 47); (vi) the [redacted] were [redacted] (*see* ¶ 48); and (vii) the [redacted] had [redacted] (*see* ¶ 49).

52. In view of the foregoing, and on information and belief, Dr. Baranda knew, before the filing date of the '433 patent (i.e., December 22, 1998), that [redacted] (*see* ¶¶ 42-51).

53. Neither Otis nor any of the named inventors of the '433 patent had any input into the development, conception or reduction to practice of [redacted]. Instead, the [redacted] was [redacted], [redacted]

54. In his [redacted], Dr. Baranda wrote that the "[redacted]" including the [redacted], were "[redacted]." Accordingly, by [redacted] at the latest, Dr. Baranda knew that the [redacted] was [redacted]

55. The [redacted], and information pertaining thereto, was not cumulative of any other information that was made of record by the USPTO during prosecution of the '990 application.

56. If submitted to the USPTO during prosecution of the '990 application, the [redacted], and information pertaining thereto, would have by itself established a *prima facie* case of unpatentability as to, at least, claim 1 of the '433 patent under, at least, 35 U.S.C. §§ 102(f) and/or 103, because: (i) [redacted] (*see* ¶¶ 44-51); (ii) [redacted] (*see* ¶¶ 39-40 and 53-54); and (iii) [redacted] (*see* ¶¶ 39-42).

57. Claim 1 is the only independent claim in the '433 patent. All other clams in the '433 patent (i.e., claims 2-28) depend from claim 1. Accordingly, if submitted to the USPTO during prosecution of the '990 application, the [redacted], and information pertaining thereto, would have established a *prima facie* case of unpatentability as to the only independent claim in the application, as well as many of its dependent claims.

58. In view of the foregoing, the [redacted], and information pertaining thereto, was highly material, non-cumulative prior art as to the claims of the '433 patent.

59. If the [redacted] and/or information pertaining thereto had been provided to the USPTO during prosecution of the '990 application, a reasonable patent examiner would have used it to reject each claim in the '433 patent under 35 U.S.C. §§ 102(f) and/or 103.

60. The highly material, non-cumulative [redacted] was never provided to the USPTO during prosecution of the '990 application. No information pertaining to this [redacted] was ever provided to the USPTO during prosecution of the '990 application. The USPTO was never made aware of the existence of the [redacted] at any time.

61. The [redacted], and information pertaining thereto, was also highly material, non-cumulative information because it refutes and is inconsistent with positions that were taken by the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis during prosecution of the '990 application.

62. On August 16, 2000, the USPTO issued an Office Action in connection with the '990 application. This Office Action rejected all pending, non-withdrawn claims in the application, including independent claim 1, as being obvious over certain prior art references, including U.S. Patent No. 5,461,850 to Bruyneel et al. ("Bruyneel").

63. In the August 16, 2000 Office Action, the Examiner found that Bruyneel disclosed a cord comprising several strands twisted around a center strand. The Examiner also found that the center strand of Bruyneel comprised several wires, including some wires that are less than 0.25 mm in diameter. The Examiner relied on these findings to reject certain claims in the '990 application, including independent claim 1, for obviousness over the prior art, including Bruyneel.

64. On December 18, 2000, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis filed "Amendment A" with the USPTO in response to the August 16, 2000 Office Action. A true and correct copy of Amendment A is attached as Exhibit B.

65. In Amendment A, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis amended claim 1 of the '990 application to address the Examiner's rejection of this claim in view of Bruyneel. Prior to Amendment A, claim 1 recited, in pertinent part: "a plurality of discrete cords, constructed from a plurality of individual wires, **including** wires less than .25 millimeters in diameter" (emphasis added).

66. In Amendment A, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis amended this portion of claim 1 to read as follows: "a plurality of discrete cords, constructed from a plurality of individual wires, **wherein all wires are** less than .25 millimeters in diameter" (emphasis added).

67. Accordingly, in Amendment A, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis narrowed the scope of claim 1 to require that all wires in the discrete cords be less than 0.25 millimeters in diameter.

68. In their Remarks in support of Amendment A, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis argued that claim 1, as amended, was patentable over Bruyneel

because "[t]here is no disclosure or suggestion within Bruyneel et al. of a tension member formed from cords having all wires with a diameter less than 0.25 mm, as claimed in Claim 1," and because "[t]his element of the claim is not disclosed in either [cited] reference and the benefits of this element are not recognized or suggested."

69. Accordingly, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis took the position that claim 1 was patentable over the prior art, including Bruyneel, because claim 1 required that all wires in the cords be less than 0.25 mm in diameter. Thus, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis represented to the USPTO that a belt having cords constructed from individual wires, wherein all wires are less than 0.25 mm in diameter, was not known in the prior art.

70. On April 17, 2001, the USPTO issued another Office Action in connection with the '990 application. In this Office Action, the Examiner rejected claim 1, as amended in Amendment A, as being obvious in view of Bruyneel. The Examiner found that, although Bruyneel did not expressly disclose making all the wires in the cord less than 0.25 mm in diameter, "[h]aving all the wire[] diameters of less than 0.20 [sic, 0.25] mm would have been an obvious choice . . . based upon the application and design preferences."

71. On January 15, 2002, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis filed "Amendment B" in response to the April 17, 2001 Office Action. A true and correct copy of Amendment B is attached as Exhibit C.

72. In Amendment B, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis did not further amend claim 1. Instead, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis once again argued that "[t]here is no disclosure or suggestion within

Bruyneel et al. of a tension member formed from cords having all wires with a diameter less than 0.25 mm, as claimed in claim 1" (emphasis in original). The inventors (including Dr. Baranda and Mr. O'Donnell) and Otis stressed "[t]he importance of this distinguishing feature to the subject invention," arguing that, based on the prior art, "there would have been no reason to use . . . all smaller wires which, as Bruyneel et al. recognizes . . . generally have lower tensile strength." Accordingly, in Amendment B, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis took the position that the prior art did not disclose a belt having cords made of wires that were each less than 0.25 mm in diameter.

73. On March 26, 2002, the USPTO issued a Final Office Action in connection with the '990 application. In the Final Office Action, the Examiner again rejected claim 1 as being obvious over Bruyneel. The Examiner found that it would have been obvious to a person of ordinary skill in the art to have all wires in the cords be less than 0.25 mm in diameter, in view of Bruyneel's disclosure of wire diameters in the range of 0.15 to 1.20 mm.

74. On September 25, 2002, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis filed an Appeal Brief with the Board of Patent Appeals and Interferences from the March 26, 2002 Final Rejection. A true and correct copy of the Appeal Brief is attached as Exhibit D.

75. In the Appeal Brief, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis once again argued that "[t]here is no disclosure or suggestion within Bruyneel et al. of a tension member formed from cords having all wires with a diameter less than 0.25 mm, as claimed in claim 1" (emphasis in original). The inventors (including Dr. Baranda and Mr. O'Donnell) and Otis stressed that "this feature is critical to the claimed invention,"

arguing that, based on the prior art, "there would have been no objective reason to use (especially in an elevator tension member) all smaller wires" (emphasis in original). Accordingly, in their Appeal Brief, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis took the position that the prior art did not disclose a belt having cords made of wires that were each less than 0.25 mm in diameter.

76. In view of the foregoing, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis expressly took the position that the prior art did not disclose a belt having cords constructed from individual wires that were each less than 0.25 mm in diameter, in the following communications to the USPTO: (i) the December 18, 2000 Amendment A (*see* ¶ 69); (ii) the January 15, 2002 Amendment B (*see* ¶ 72); and (iii) the September 25, 2002 Appeal Brief (*see* ¶ 75).

77. The [redacted], which was prior art as to the '990 application (*see* ¶ 58), was a [redacted] having [redacted] (*see* ¶ 46).

78. Accordingly, the [redacted] and information pertaining thereto, of which Dr. Baranda was aware prior to the filing date of the '990 application, directly refuted and was inconsistent with the position that the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis took in their Amendment A, Amendment B and Appeal Brief; i.e., that the prior art did not disclose a belt having cords constructed from individual wires, wherein all wires are less than 0.25 mm in diameter.

79. The [redacted] and information pertaining thereto, of which Dr. Baranda was aware prior to the filing date of the '990 application, was therefore highly material, non-cumulative information as to the '990 application, for at least the additional reason that it directly

refutes and is inconsistent with positions that the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis took before the USPTO during prosecution.

80. If the [redacted] and/or information pertaining thereto had been provided to the USPTO during prosecution of the '990 application, a reasonable patent examiner would have used it to conclusively show that the claimed feature of having all wires in the cords be less than [redacted] was known in the prior art, contrary to the assertions of the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis.

81. The highly material, non-cumulative [redacted] was never provided to the USPTO during prosecution of the '990 application. No information pertaining to this [redacted] was ever provided to the USPTO during prosecution of the '990 application. The USPTO was never made aware of the existence of the [redacted] at any time.

82. On May 6, 1999, Dr. Baranda signed a Combined Declaration and Power of Attorney in connection with the '990 application.

83. In his Combined Declaration and Power of Attorney, Dr. Baranda certified, under penalty of fine and/or imprisonment pursuant to 18 U.S.C. § 1001, that he reviewed and understood the contents of the '990 application, including its claims. Accordingly, on information and belief, Dr. Baranda knew the scope of the claims in the '990 application while that application was pending before the USPTO.

84. In his Combined Declaration and Power of Attorney, Dr. Baranda also certified, under penalty of fine and/or imprisonment pursuant to 18 U.S.C. § 1001, that he was aware of his duty under 37 CFR § 1.56 to disclose to the USPTO all information known to him that was material to the patentability of the claims in the '990 application. Accordingly, on information and belief, Dr. Baranda knew, while the '990 application was pending

before the USPTO, of his duty to disclose all information known to him that was material to the patentability of the claims in that application.

85. In view of the foregoing, and on information and belief, Dr. Baranda knew, while the '990 application was pending before the USPTO, that the [redacted], and information pertaining thereto, established a *prima facie* case of unpatentability as to, at least, claim 1 of the '433 patent. He knew this because he knew the scope of claim 1 (*see* ¶ 83), and because he knew that the [redacted] (i) [redacted] (*see* ¶¶ 42-52); (ii) [redacted] (*see* ¶¶ 53-54); and (iii) [redacted] (*see* ¶¶ 38-42).

86. On information and belief, Dr. Baranda knew, while the '990 application was pending before the USPTO, that the [redacted] and information pertaining thereto, was not cumulative of any information that was made of record during prosecution of the '990 application, at least because he knew that the [redacted]

87. In view of the foregoing, and on information and belief, Dr. Baranda knew, while the '990 application was pending before the USPTO, that the [redacted], and information pertaining thereto, was highly material prior art as to, at least, claim 1 of the '433 patent.

88. In view of the foregoing, and on information and belief, Dr. Baranda knew, while the '990 application was pending before the USPTO, that the [redacted], and information pertaining thereto, was highly material to the '990 application for at least the additional

reason that it was inconsistent with and directly refuted positions taken by the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis during prosecution of the '990 application.

89. In view of the foregoing, and on information and belief, Dr. Baranda intentionally withheld from the USPTO the [redacted], and information pertaining thereto, which he knew to be highly material to the patentability of, at least, claim 1 of the '433 patent, with the specific intent to deceive the USPTO into improperly granting the '433 patent.

90. Because Dr. Baranda knew that the [redacted] was highly material to the patentability of, at least, claim 1 of the '433 patent, and knew of his duty to disclose material information under 37 CFR § 1.56, but intentionally withheld the [redacted] and information pertaining thereto, from the USPTO in contravention of this known duty, the totality of the circumstances supports the reasonable inference that Dr. Baranda withheld the [redacted], and information pertaining thereto, from the USPTO with the specific intent to deceive the USPTO into improperly granting the '433 patent. Accordingly, Dr. Baranda committed inequitable conduct in connection with the prosecution of the '990 application, which renders the '433 patent unenforceable in its entirety.

91. Furthermore, because the [redacted] was [redacted] (*see* ¶¶ 38-40 and 53-54), and because the [redacted] (*see* ¶¶ 44-51) [redacted] are the original, first and sole inventor(s) of the subject matter claimed in the '433 patent.

92. Alternatively, the employee(s) of [redacted] who conceived, developed and reduced to practice the [redacted] are original, first and joint inventor(s) of the subject matter claimed in the '433 patent, along with one or more of the named inventors of the '433 patent (i.e., Pedro Baranda, Hugh O'Donnell and/or Ary Mello).

93. Because Dr. Baranda knew that the [redacted] was [redacted] (*see* ¶¶ 38-40 and 53-54), and knew that [redacted] (*see* ¶¶ 42-52), Dr. Baranda knew, [redacted]

94. On information and belief, Dr. Baranda deliberately concealed from the USPTO the contribution of [redacted] to the invention claimed in the '433 patent, with the specific intent to deceive the USPTO into omitting these inventor(s) from the '433 patent. On information and belief, Dr. Baranda deliberately concealed this information so that Otis could improperly obtain full ownership of the '433 patent, rather than sharing ownership with [redacted]. For at least this additional reason, Dr. Baranda committed inequitable conduct in connection with the prosecution of the '990 application, which renders the '433 patent unenforceable in its entirety.

95. For at least the foregoing reasons, Dr. Baranda committed inequitable conduct in connection with the prosecution of the '990 application, which renders the '433 patent unenforceable in its entirety.

Inequitable Conduct by Inventor Hugh O'Donnell

96. As a named inventor of the '433 patent, Hugh O'Donnell owed a duty of candor and good faith to the United States Patent and Trademark Office ("USPTO") in connection with the prosecution of the '990 application. See 37 CFR § 1.56. Pursuant to this duty of candor and good faith, Mr. O'Donnell was obligated to disclose to the USPTO all information known to him that would have been material to the patentability of the alleged invention claimed in the '990 application and the '433 patent. Pursuant to 37 CFR § 1.56, information is material to the patentability of an application if: (i) it establishes, by itself or in combination with other information, a *prima facie* case of unpatentability as to at least one claim in the application; or (ii) it refutes, or is inconsistent with, a position taken by the applicant in opposing an argument of unpatentability relied on by the USPTO, or in asserting an argument of patentability.

97. On information and belief, Mr. O'Donnell violated his duty of candor and good faith by intentionally withholding from the USPTO certain prior art, of which he was personally aware, that was highly material to the patentability of each claim that issued in the '433 patent. On information and belief, Mr. O'Donnell intentionally withheld this prior art from the USPTO, with the specific intent to deceive the USPTO into improperly granting the '433 patent.

98. Mr. O'Donnell's violation of the duty of candor and good faith constitutes inequitable conduct which renders the '433 patent unenforceable in its entirety

99. Mr. O'Donnell was an employee of Otis for at least the period beginning in June 1986 and ending in June 2006. Starting in late [redacted], Mr. O'Donnell was part of the team of Otis engineers who were investigating the use of flexible flat ropes ("FFR") to provide lifting force to elevators.

100. After the [redacted]

101. On [redacted], Otis [redacted]

102. [redacted] of [redacted] to the [redacted] states that "[redacted]" Accordingly, [redacted] and [redacted] were [redacted]

103. On information and belief, Otis [redacted]

104. On information and belief, [redacted] fully conceived, developed and reduced to practice the [redacted] and [redacted] by, at the latest, [redacted] The [redacted] and [redacted]

105. On information and belief, there is no evidence that Otis had conceived all the elements of the claims of the '433 patent (including, without limitation, the claimed cord arrangements, cord constructions, wire diameters and/or aspect ratios) until after Otis received [redacted] the [redacted] and [redacted] samples [redacted]. Accordingly, on information and belief, [redacted] fully conceived, developed and reduced to practice the [redacted] and [redacted].

106. Before the filing date of the '433 patent (i.e., December 22, 1998), Mr. O'Donnell [redacted] the [redacted] and [redacted] samples that [redacted].

107. On information and belief, Mr. O'Donnell [redacted]

108. [redacted] in connection with his [redacted] of the [redacted] and [redacted], Mr. O'Donnell [redacted]

109. The [redacted] and [redacted] In [redacted] of the [redacted], the [redacted] of the [redacted]. On information and belief, this [redacted] On information and belief, the [redacted] On information and belief, Mr.

O'Donnell [redacted], the [redacted] of the [redacted], and accordingly [redacted]. Mr. O'Donnell further [redacted] from [redacted]. Accordingly, on information and belief, [redacted], Mr. O'Donnell [redacted]

110. The [redacted] and [redacted] each [redacted] On information and belief [redacted] Mr. O'Donnell [redacted]

111. The [redacted] of the [redacted] and [redacted] were each [redacted]. On information and belief, [redacted] Mr. O'Donnell [redacted], that the [redacted]

112. Each of the [redacted] in the [redacted] of the [redacted] were [redacted] Each of the [redacted] in the [redacted] of the [redacted] were [redacted]. On information and belief, [redacted] Mr. O'Donnell [redacted], in connection with his [redacted] of the [redacted]

[redacted]. Accordingly, on information and belief, Mr. O'Donnell [redacted]

113. The [redacted] of the [redacted] and [redacted] were [redacted] On information and belief, [redacted] Mr. O'Donnell [redacted]

114. The [redacted] and [redacted] each included a [redacted] On information and belief, [redacted] Mr. O'Donnell [redacted], in connection with his [redacted] of the [redacted] and [redacted], that the [redacted] and [redacted] each included a [redacted]

115. The [redacted] and [redacted] each had a width of [redacted] and a thickness of [redacted] Thus, defining the aspect ratio [redacted] as the ratio of its width to its thickness, the [redacted] and [redacted] each had an aspect ratio of [redacted]. On information and belief, [redacted] Mr. O'Donnell [redacted], in connection with his [redacted] of the [redacted] and [redacted], that the [redacted] and [redacted] each had an [redacted] of [redacted] which is greater than [redacted]

116. In view of the foregoing, the [redacted] and [redacted] each [redacted] Specifically: (i) the [redacted] and [redacted] were [redacted] (*see* ¶ 109); (ii) the [redacted] and [redacted] each included [redacted] (*see* ¶ 110); (iii) the [redacted] of the [redacted] and [redacted] were [redacted] (*see* ¶ 111); (iv) each of the [redacted] of the [redacted] and [redacted] were less than [redacted] (*see* ¶ 112); (v) the [redacted] in the [redacted] and [redacted] were [redacted] (*see* ¶ 113); (vi) the [redacted] were [redacted] (*see* ¶ 114); and (vii) [redacted] (*see* ¶ 115).

117. In view of the foregoing, and on information and belief, Mr. O'Donnell [redacted] (*see* ¶¶ 109-116).

118. Neither Otis nor any of the named inventors of the '433 patent had any input into the development, conception or reduction to practice of the [redacted] or [redacted] Instead, [redacted]

119. On information and belief, Mr. O'Donnell [redacted]

120. The [redacted] and [redacted] and information pertaining thereto, were not cumulative of any other information that was made of record by the USPTO during prosecution of the '990 application.

121. If submitted to the USPTO during prosecution of the '990 application, each of the [redacted] and [redacted] and information pertaining thereto, would have, by itself, established a *prima facie* case of unpatentability as to, at least, claim 1 of the '433 patent under, at least, 35 U.S.C. §§ 102(f) and/or 103, because: (i) [redacted] (*see* ¶¶ 109-116); (ii) [redacted] (*see* ¶¶ 102-105 and 118-119); and (iii) [redacted] (*see* ¶¶ 100-103).

122. Claim 1 is the only independent claim in the '433 patent. All other clams in the '433 patent (i.e., claims 2-28) depend from claim 1. Accordingly, if submitted to the USPTO during prosecution of the '990 application, the [redacted] and [redacted], and information pertaining thereto, would have established a *prima facie* case of unpatentability as to the only independent claim in the application, as well as many of its dependent claims.

123. In view of the foregoing, the [redacted] and [redacted], and information pertaining thereto, were highly material, non-cumulative prior art as to the claims of the '433 patent.

124. If the [redacted] and [redacted] and/or information pertaining thereto had been provided to the USPTO during prosecution of the '990 application, a reasonable patent examiner

would have used each of them to reject each claim in the '433 patent under 35 U.S.C. §§ 102(f) and/or 103.

125. The highly material, non-cumulative [redacted] and [redacted] were never provided to the USPTO during prosecution of the '990 application. No information pertaining to these [redacted] was ever provided to the USPTO during prosecution of the '990 application. The USPTO was never made aware of the existence of the [redacted] and [redacted] at any time.

126. The [redacted] and [redacted], and information pertaining thereto, were also highly material, non-cumulative information because they refute and are inconsistent with positions that were taken by the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis during prosecution of the '990 application.

127. As addressed in Paragraphs 61-79 *supra*, the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis asserted during prosecution of the '990 application that belts having cords constructed from individual wires, wherein all wires are less than 0.25 mm in diameter, were not known in the prior art. The inventors (including Dr. Baranda and Mr. O'Donnell) and Otis made this assertion in: (i) their December 18, 2000 Amendment A (*see* ¶ 69); (ii) their January 15, 2002 Amendment B (*see* ¶ 72); and (iii) their September 25, 2002 Appeal Brief (*see* ¶ 75).

128. The [redacted] and [redacted], which were prior art as to the '990 application (*see* ¶ 123), were each [redacted] (*see* ¶ 112).

129. Accordingly, the [redacted] and [redacted] and information pertaining thereto, of which Mr. O'Donnell was aware prior to the filing date of the '990 application, directly refute and are inconsistent with the position that the inventors (including Dr. Baranda and Mr.

O'Donnell) and Otis took in Amendment A, Amendment B and the Appeal Brief; i.e., that the prior art did not disclose a belt having cords constructed from individual wires, wherein all wires are less than 0.25 mm in diameter.

130. The [redacted] and [redacted], and information pertaining thereto, were therefore highly material, non-cumulative information as to the '990 application for at least the additional reason that they directly refute and are inconsistent with positions that the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis took before the USPTO during prosecution of the '990 application.

131. The highly material, non-cumulative [redacted] and [redacted] were never provided to the USPTO during prosecution of the '990 application. No information pertaining to these [redacted] was ever provided to the USPTO during prosecution of the '990 application. The USPTO was never made aware of the existence of the [redacted] and [redacted] at any time.

132. On April 26, 1999, Mr. O'Donnell signed a Combined Declaration and Power of Attorney in connection with the '990 application.

133. In his Combined Declaration and Power of Attorney, Mr. O'Donnell certified, under penalty of fine and/or imprisonment pursuant to 18 U.S.C. § 1001, that he reviewed and understood the contents of the '990 application, including its claims. Accordingly, on information and belief, Mr. O'Donnell knew the scope of the claims in the '990 application while that application was pending before the USPTO.

134. In his Combined Declaration and Power of Attorney, Mr. O'Donnell also certified, under penalty of fine and/or imprisonment pursuant to 18 U.S.C. § 1001, that he was aware of his duty under 37 CFR § 1.56 to disclose to the USPTO all information known to him that was material to the patentability of the claims in the '990 application. Accordingly,

on information and belief, Mr. O'Donnell knew, while the '990 application was pending before the USPTO, of his duty to disclose all information known to him that was material to the patentability of the claims in that application.

135. In view of the foregoing, and on information and belief, Mr. O'Donnell knew, while the '990 application was pending before the USPTO, that the [redacted] and [redacted], and information pertaining thereto, established a *prima facie* case of unpatentability as to, at least, claim 1 of the '433 patent. He knew this because he knew the scope of claim 1 (*see* ¶ 133), and because he knew that the [redacted] and [redacted] each: (i) [redacted] (*see* ¶¶ 109-117); (ii) [redacted] (*see* ¶¶ 102-105 and 118-119); and (iii) [redacted] (*see* ¶¶ 100-103).

136. On information and belief, Mr. O'Donnell knew, while the '990 application was pending before the USPTO, that the [redacted] and [redacted], and information pertaining thereto, were not cumulative of any information that was made of record during prosecution of the '990 application, at least because he knew that the [redacted] and [redacted].

137. In view of the foregoing, and on information and belief, Mr. O'Donnell knew, while the '990 application was pending before the USPTO, that the [redacted] and [redacted] and information pertaining thereto, were highly material prior art as to, at least, claim 1 of the '433 patent.

138. In view of the foregoing, and on information and belief, Mr. O'Donnell knew, while the '990 application was pending before the USPTO, that the [redacted] and [redacted] and information pertaining thereto, were highly material to the '990 application for at least the additional reason that they were inconsistent with and directly refuted positions taken by the inventors (including Dr. Baranda and Mr. O'Donnell) and Otis during prosecution of the '990 application.

139. In view of the foregoing, and on information and belief, Mr. O'Donnell intentionally withheld from the USPTO the [redacted] and [redacted], and information pertaining thereto, which he knew to be highly material to the patentability of, at least, claim 1 of the '433 patent, with the specific intent to deceive the USPTO into improperly granting the '433 patent.

140. Because Mr. O'Donnell knew that the [redacted] and [redacted] were highly material to the patentability of, at least, claim 1 of the '433 patent, and knew of his duty to disclose material information under 37 CFR § 1.56, but intentionally withheld the [redacted] and [redacted], and information pertaining thereto, from the USPTO in contravention of this known duty, the totality of the circumstances supports the reasonable inference that Mr. O'Donnell withheld the [redacted] and [redacted], and information pertaining thereto, from the USPTO with the specific intent to deceive the USPTO into improperly granting the '433 patent. Accordingly, Mr. O'Donnell committed inequitable conduct in connection with the prosecution of the '990 application, which renders the '433 patent unenforceable in its entirety.

141. Furthermore, because the [redacted] and [redacted] were fully conceived, developed and reduced to practice by [redacted], prior to the earliest

[redacted] (*see* ¶¶ 102-105 and 118-119), and because the [redacted] and [redacted] (*see* ¶¶ 109-116), [redacted] are the original, first and sole inventor(s) of the subject matter claimed in the '433 patent.

142. Alternatively, the employee(s) of [redacted] the [redacted] and [redacted] are original, first and joint inventor(s) of the subject matter claimed in the '433 patent, along with one or more of the named inventors of the '433 patent (i.e., Pedro Baranda, Hugh O'Donnell and/or Ary Mello).

143. Because Mr. O'Donnell [redacted] (*see* ¶¶ 102-105 and 118-119), and [redacted] (*see* ¶¶ 109-117), Mr. O'Donnell [redacted]

144. On information and belief, Mr. O'Donnell deliberately concealed from the USPTO the contribution of [redacted] to the invention claimed in the '433 patent, with the specific intent to deceive the USPTO into omitting these inventor(s) from the '433 patent. On information and belief, Mr. O'Donnell deliberately concealed this information so that Otis could improperly obtain

full ownership of the '433 patent, rather than sharing ownership with [redacted]. For at least this additional reason, Mr. O'Donnell committed inequitable conduct in connection with the prosecution of the '990 application, which renders the '433 patent unenforceable in its entirety.

145. For at least the foregoing reasons, Mr. O'Donnell committed inequitable conduct in connection with the prosecution of the '990 application, which renders the '433 patent unenforceable in its entirety.

PRAYER FOR RELIEF

WHEREFORE, Schindler prays that this court enter judgment in its favor as follows:

(a) A declaration that each and every claim of U.S. Patent No. 6,739,433 is invalid;

(b) A declaration that U.S. Patent No. 6,739,433 in unenforceable in its entirety due to inequitable conduct;

(c) An injunction precluding Defendant and its officers, agents, employees, representatives, counsel and all persons in active concert or participation with any of them from directly or indirectly asserting or instituting any action based on U.S. Patent No. 6,739,433 against Plaintiff, its suppliers, customers, distributors, or users of its products;

(d) A declaration that this is an "exceptional case" within the meaning of 35 U.S.C. § 285;

(e) An award to Plaintiff of the costs and reasonable attorney's fees incurred by Plaintiff in this action; and

(f) Such other and further relief as this Court deems just and proper.

Dated: December 14, 2010

By: */s/ Pierre R. Yanney*

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Attorneys for Plaintiff and Counterclaim-Defendants:
SCHINDLER ELEVATOR CORPORATION

EXHIBIT A

US006739433B1

(12) **United States Patent**
Baranda et al.

(10) **Patent No.: US 6,739,433 B1**
(45) **Date of Patent: May 25, 2004**

(54) **TENSION MEMBER FOR AN ELEVATOR**

(75) Inventors: **Pedro S. Baranda**, Col. Sta. Maria Insugents (MX); **Ary O. Mello**, Farmington, CT (US); **Hugh J. O'Donnell**, Longmeadow, MA (US)

(73) Assignee: **Otis Elevator Company**, Farmington, CT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 415 days.

(21) Appl. No.: **09/218,990**

(22) Filed: **Dec. 22, 1998**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/031,108, filed on Feb. 26, 1998, now Pat. No. 6,401,871.

(51) **Int. Cl.**[7] **B66B 15/00**
(52) **U.S. Cl.** **187/411**; 187/251; 187/254
(58) **Field of Search** 187/250, 251, 187/254, 411; 57/236, 237, 211, 222, 223, 231, 232; 428/295.4, 298.1, 918; 87/1, 8, 23, 24

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Primary Examiner—Eileen D. Lillis
Assistant Examiner—Thuy U. Tran

(57) **ABSTRACT**

A tension member for an elevator system has an aspect ratio of greater than one, where aspect ratio is defined as the ratio of tension member width w to thickness t (w/t). The increase in aspect ratio results in a reduction in the maximum rope pressure and an increased flexibility as compared to conventional elevator ropes. As a result, smaller sheaves may be used with this type of tension member. In a particular embodiment, the tension member includes a plurality of individual load carrying cords encased within a common layer of coating. The coating layer separates the individual cords and defines an engagement surface for engaging a traction sheave.

28 Claims, 6 Drawing Sheets

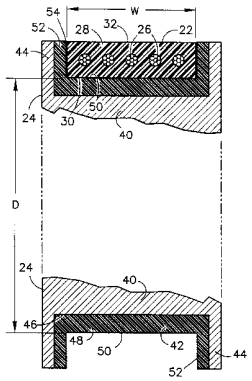

FIG. 1

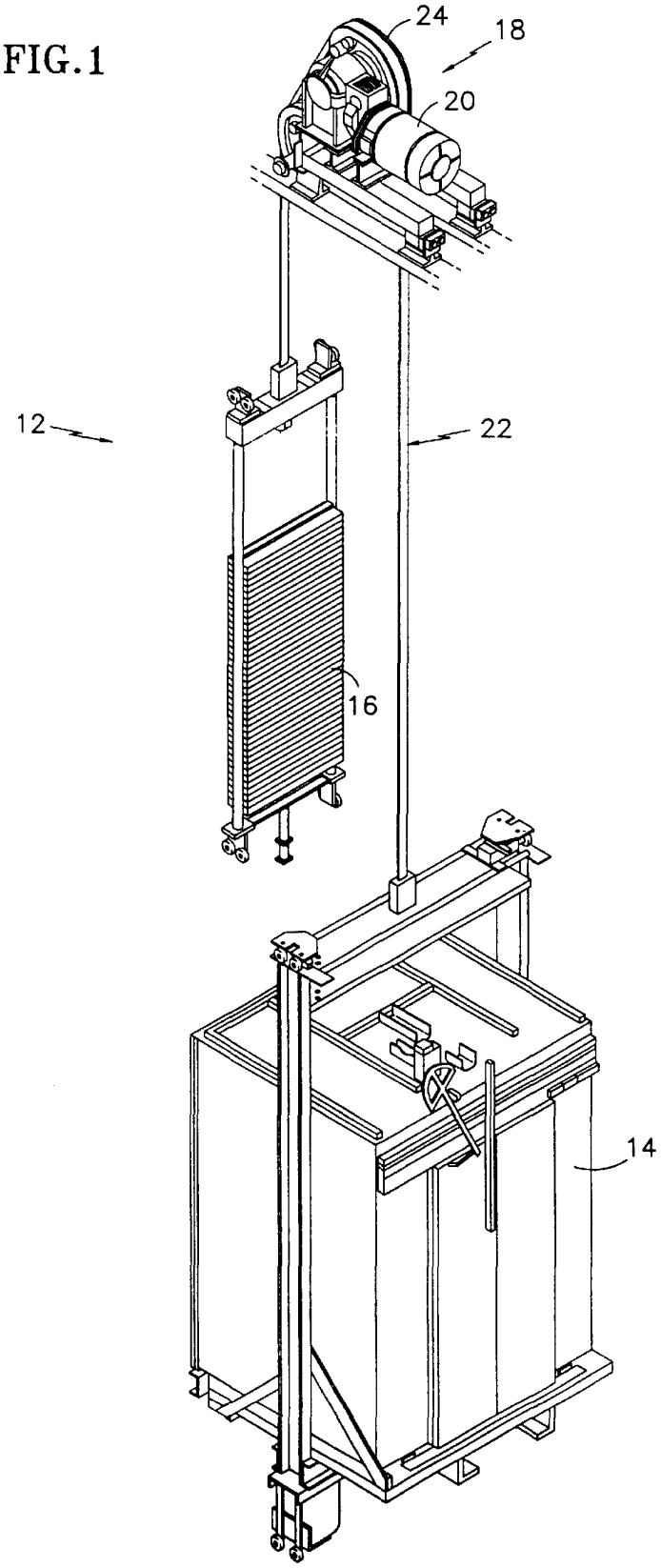

FIG.2

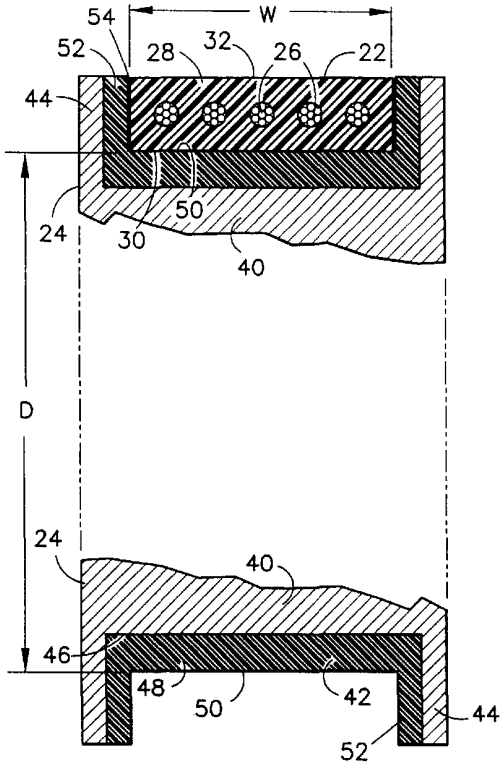
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FIG.3

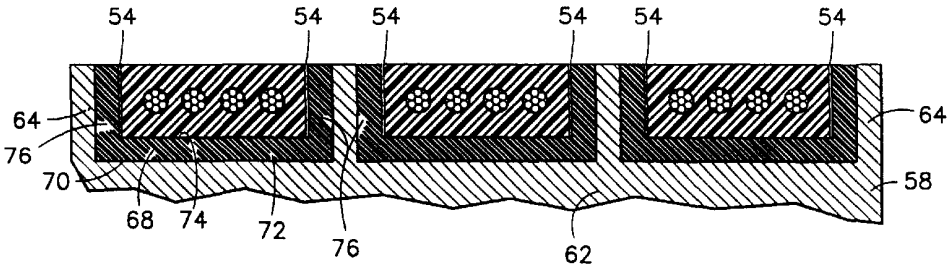
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FIG.4

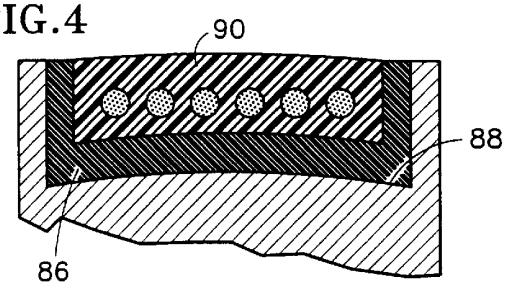


FIG.5

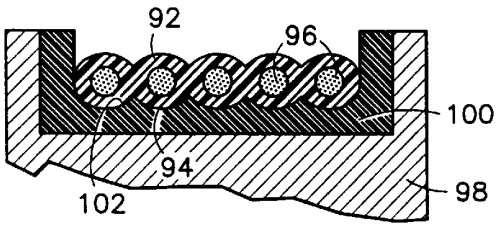
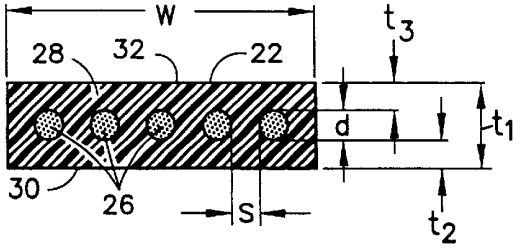


FIG.9



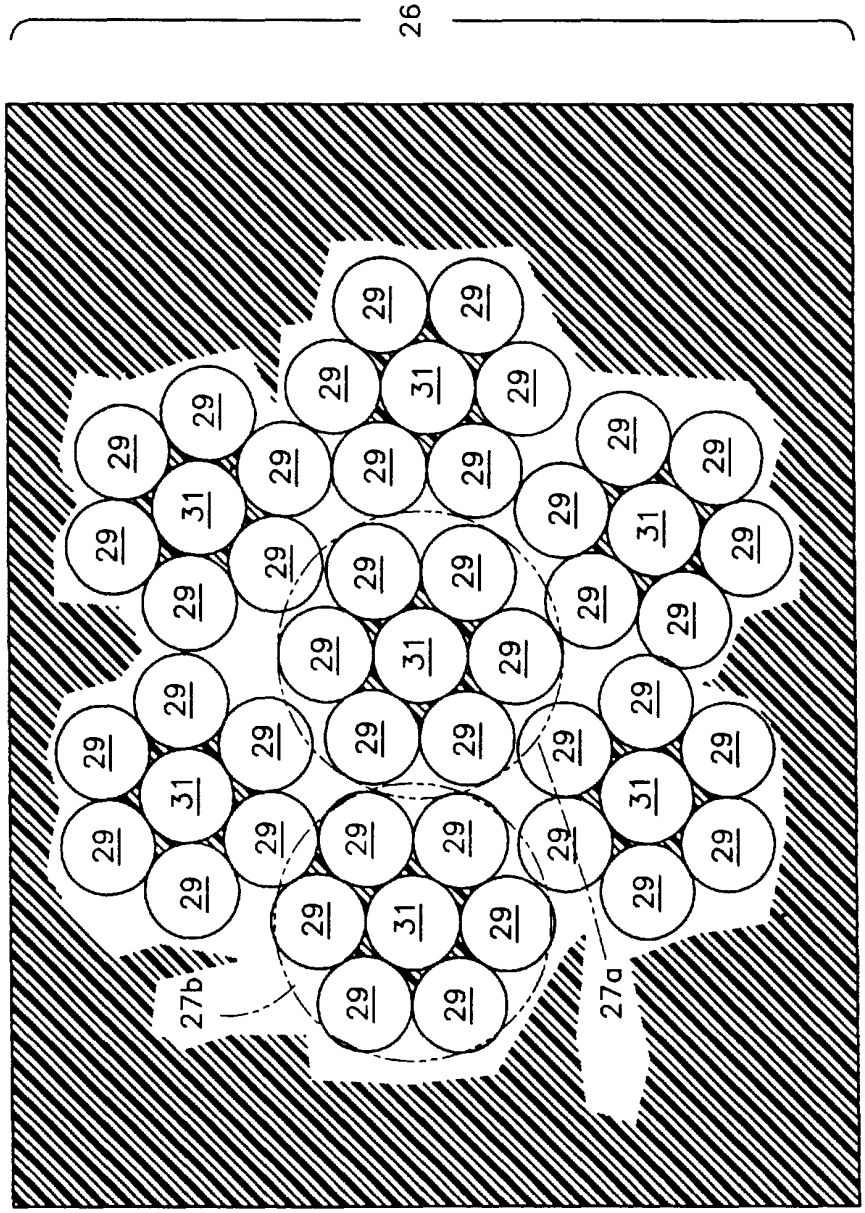


FIG.6

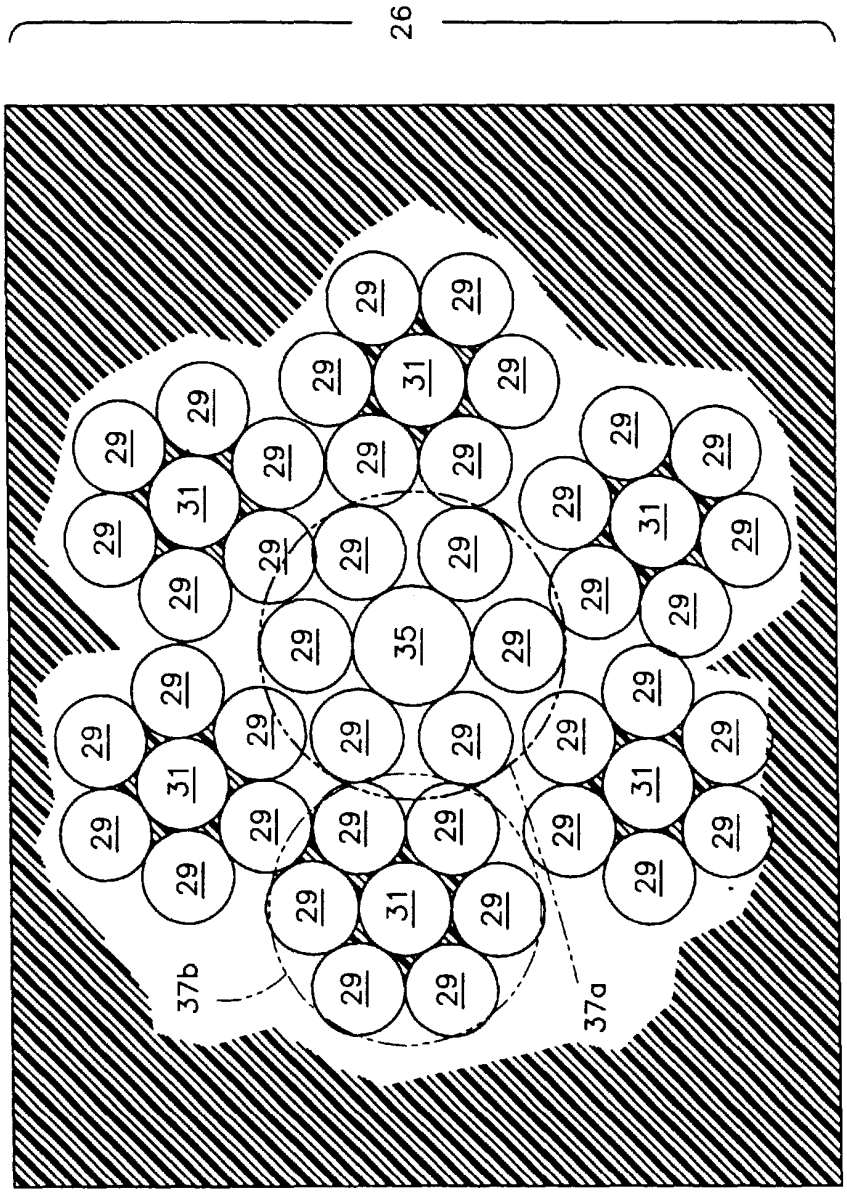


FIG. 7

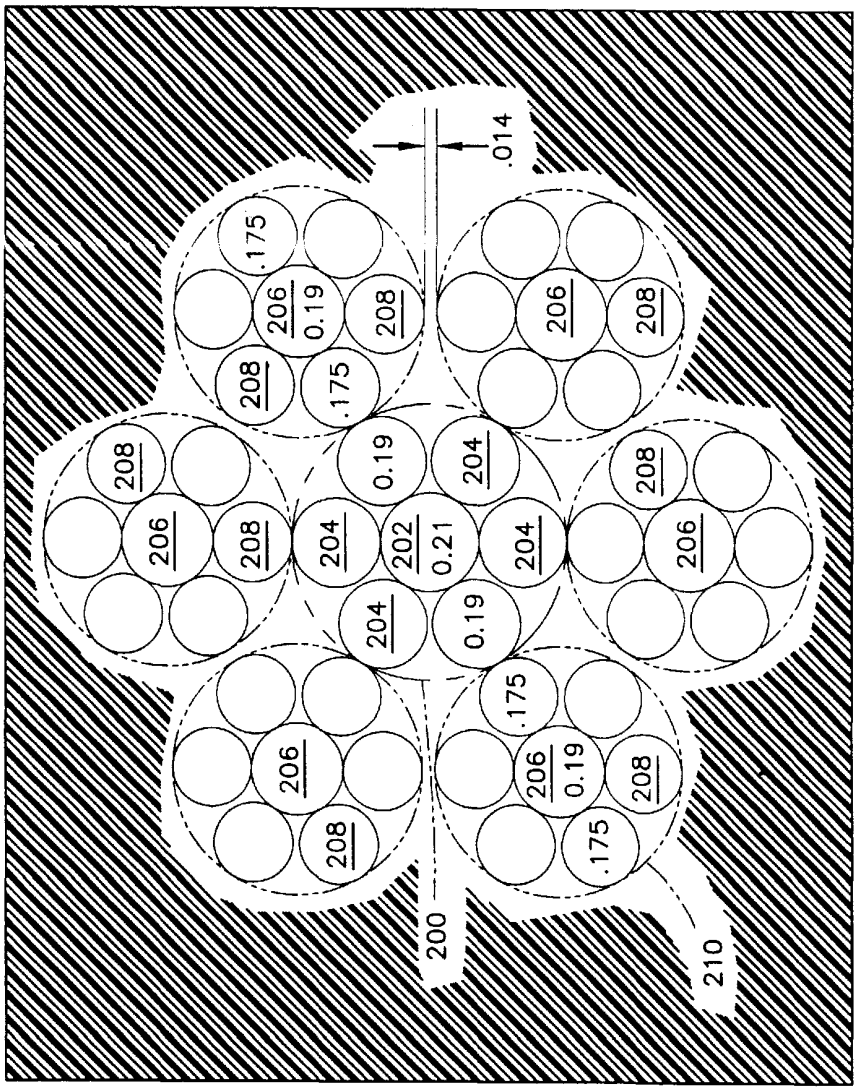

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FIG.8

TENSION MEMBER FOR AN ELEVATOR

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part of U.S. Ser. No. 09/031,108 filed Feb. 26, 1998, now U.S. Pat. No. 6,401,871 the entirety of which is incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to elevator systems, and more particularly to tension members for such elevator systems.

BACKGROUND OF THE INVENTION

A conventional traction elevator system includes a car, a counterweight, two or more ropes interconnecting the car and counterweight, a traction sheave to move the ropes, and a machine to rotate the traction sheave. The ropes are formed from laid or twisted steel wire and the sheave is formed from cast iron. The machine may be either a geared or gearless machine. A geared machine permits the use of higher speed motor, which is more compact and less costly, but requires additional maintenance and space.

Although conventional round steel ropes and cast iron sheaves have proven very reliable and cost effective, there are limitations on their use. One such limitation is the traction forces between the ropes and the sheave. These traction forces may be enhanced by increasing the wrap angle of the ropes or by undercutting the grooves in the sheave. Both techniques reduce the durability of the ropes, however, as a result of the increased wear (wrap angle) or the increased rope pressure (undercutting). Another method to increase the traction forces is to use liners formed from a synthetic material in the grooves of the sheave. The liners increase the coefficient of friction between the ropes and sheave while at the same time minimizing the wear of the ropes and sheave.

Another limitation on the use of round steel ropes is the flexibility and fatigue characteristics of round steel wire ropes. Elevator safety codes today require that each steel rope have a minimum diameter d (d_{min}=8 mm for CEN; d_{min}=9.5 mm (⅜") for ANSI) and that the D/d ratio for traction elevators be greater than or equal y ($D/d \geqq 40$), where D is the diameter of the sheave. This results in the diameter D for the sheave being at least 320 mm (380 mm for ANSI). The larger the sheave diameter D, the greater torque required from the machine to drive the elevator system.

Another drawback of conventional round ropes is that the higher the rope pressure, the shorter the life of the rope. Rope pressure (P_{rope}) is generated as the rope travels over the sheave and is directly proportional to the tension (F) in the rope and inversely proportional to the sheave diameter D and the rope diameter d ($P_{rope} \sim F/(Dd)$. In addition, the shape of the sheave grooves, including such traction enhancing techniques as undercutting the sheave grooves, further increases the maximum rope pressure to which the rope is subjected.

The above art notwithstanding, scientists and engineers under the direction of Applicants' Assignee are working to develop more efficient and durable methods and apparatus to drive elevator systems.

DISCLOSURE OF THE INVENTION

According to the present invention, a tension member for an elevator has an aspect ratio of greater than one, where aspect ratio is defined as the ratio of tension member width w to thickness t (Aspect Ratio~w/t).

A principal feature of the present invention is the flatness of the tension member. The increase in aspect ratio results in a tension member that has an engagement surface, defined by the width dimension, that is optimized to distribute the rope pressure. Therefore, the maximum pressure is minimized within the tension member. In addition, by increasing the aspect ratio relative to a round rope, which has an aspect ratio equal to one, the thickness of the tension member may be reduced while maintaining a constant cross-sectional area of the tension member.

According further to the present invention, the tension member includes a plurality of individual load carrying cords encased within a common layer of coating. The coating layer separates the individual cords and defines an engagement surface for engaging a traction sheave.

As a result of the configuration of the tension member, the rope pressure may be distributed more uniformly throughout the tension member. As a result, the maximum rope pressure is significantly reduced as compared to a conventionally roped elevator having a similar load carrying capacity. Furthermore, the effective rope diameter 'd' (measured in the bending direction) is reduced for the equivalent load bearing capacity. Therefore, smaller values for the sheave diameter 'D' may be attained without a reduction in the D/d ratio. In addition, minimizing the diameter D of the sheave permits the use of less costly, more compact, high speed motors as the drive machine without the need for a gearbox.

In a particular embodiment of the present invention, the individual cords are formed from strands of metallic material. By incorporating cords having the weight, strength, durability and, in particular, the flexibility characteristics of appropriately sized and constructed materials into the tension member of the present invention, the acceptable traction sheave diameter may be further reduced while maintaining the maximum rope pressure within acceptable limits. As stated previously, smaller sheave diameters reduce the required torque of the machine driving the sheave and increase the rotational speed. Therefore, smaller and less costly machines may be used to drive the elevator system.

In a further particular embodiment of the present invention, a traction drive for an elevator system includes a tension member having an aspect ratio greater than one and a traction sheave having a traction surface configured to receive the tension member. The tension member includes an engagement surface defined by the width dimension of the tension member. The traction surface of the sheave and the engagement surface are complementarily contoured to provide traction and to guide the engagement between the tension member and the sheave. In an alternate configuration, the traction drive includes a plurality of tension members engaged with the sheave and the sheave includes a pair of rims disposed on opposite sides of the sheave and one or more dividers disposed between adjacent tension members. The pair of rims and dividers perform the function of guiding the tension member to prevent gross alignment problems in the event of slack rope conditions, etc.

In a still further embodiment, the traction surface of the sheave is defined by a material that optimizes the traction forces between the sheave and the tension member and minimizes the wear of the tension member. In one configuration, the traction surface is integral to a sheave liner that is disposed on the sheave. In another configuration, the traction surface is defined by a coating layer that is

bonded to the traction sheave. In a still further configuration, the traction sheave is formed from the material that defines the traction surface.

Although described herein as primarily a traction device for use in an elevator application having a traction sheave, the tension member may be useful and have benefits in elevator applications that do not use a traction sheave to drive the tension member, such as indirectly roped elevator systems, linear motor driven elevator systems, or self-propelled elevators having a counterweight. In these applications, the reduced size of the sheave may be useful in order to reduce space requirements for the elevator system. The foregoing and other objects, features and advantages of the present invention become more apparent in light of the following detailed description of the exemplary embodiments thereof, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is perspective view of an elevator system having a traction drive according to the present invention;

FIG. **2** is a sectional, side view of the traction drive, showing a tension member and a sheave;

FIG. **3** is a sectional, side view of an alternate embodiment showing a plurality of tension members;

FIG. **4** is another alternate embodiment showing a traction sheave having an convex shape to center the tension member;

FIG. **5** is a further alternate embodiment showing a traction sheave and tension member having complementary contours to enhance traction and to guide the engagement between the tension member and the sheave;

FIG. **6** is a magnified cross sectional view of a single cord of the invention having six strands twisted around a central stand;

FIG. **7** is a magnified cross sectional view of an alternate single cord of the invention;

FIG. **8** is a magnified cross sectional view of another alternate embodiment of the invention; and

FIG. **9** is a schematic cross sectional view of a flat rope to illustrate various dimensional characteristics thereof.

BEST MODE FOR CARRYING OUT THE INVENTION

Illustrated in FIG. **1** is a traction elevator system **12**. The elevator system **12** includes a car **14**, a counterweight **16**, a traction drive **18**, and a machine **20**. The traction drive **18** includes a tension member **22**, interconnecting the car **14** and counterweight **16**, and a traction sheave **24**. The tension member **22** is engaged with the sheave **24** such that rotation of the sheave **24** moves the tension member **22**, and thereby the car **14** and counterweight **16**. The machine **20** is engaged with the sheave **24** to rotate the sheave **24**. Although shown as an geared machine **20**, it should be noted that this configuration is for illustrative purposes only, and the present invention may be used with geared or gearless machines.

The tension member **22** and sheave **24** are illustrated in more detail in FIG. **2**. The tension member **22** is a single device that integrates a plurality of cords **26** within a common coating layer **28**. Each of the cords **26** is formed from preferably seven twisted strands, each made up of seven twisted metallic wires. In a preferred embodiment of the invention a high carbon steel is employed. The steel is preferably cold drawn and galvanized for the recognized properties of strength and corrosion resistance of such processes. The coating layer is preferably a polyurethane material which is ether based and includes a fire retardant composition.

In a preferred embodiment, referring to FIG. **6**, each strand **27** of a cord **26** comprises seven wires with six of the wires **29** twisted around a center wire **31**. Each cord **26**, comprises one strand **27***a* which is centrally located and six additional outer strands **27***b* that are twisted around the central strand **27***a*. Preferably, the twisting pattern of the individual wires **29** that form the central strand **27***a* are twisted in one direction around central wire **31** of central strand **27***a* while the wires **29** of outer strands **27***b* are twisted around the central wire **31** of the outer strands **27***b* in the opposite direction. Outer strands **27***b* are twisted around central strand **27***a* in the same direction as the wires **29** are twisted around center wire **31** in strand **27***a*. For example, the individual strands in one embodiment comprise the central wire **31**, in center strand **27***a*, with the six twisted wires **29** twisting clockwise; the wires **29** in the outer strands **27***b* twisting counterclockwise around their individual center wires **31** while at the cord **26** level the outer strands **27***b* twist around the central strand **27***a* in the clockwise direction. The directions of twisting improve the characteristics of load sharing in all of the wires of the cord.

It is important to the success of the invention to employ wire **29** of a very small size. Each wire **29** and **31** are less than 0.25 millimeters in diameter and preferably is in the range of about 0.10 millimeters to 0.20 millimeters in diameter. In a particular embodiment, the wires are of a diameter of 0.175 millimeters in diameter. The small sizes of the wires preferably employed contribute to the benefit of the use of a sheave of smaller diameter. The smaller diameter wire can withstand the bending radius of a smaller diameter sheave (around 100 millimeters in diameter) without placing too much stress on the strands of the flat rope. Because of the incorporation of a plurality of small cords **26**, preferably about 1.6 millimeters in total diameter in this particular embodiment of the invention, into the flat rope elastomer, the pressure on each cord is significantly diminished over prior art ropes. Cord pressure is decreased at least as $n^{-1/2}$ with n being the number of parallel cords in the flat rope, for a given load and wire cross section.

In an alternate embodiment, referring to FIG. **7**, the center wire **35** of the center strand **37***a* of each cord **26** employs a larger diameter. For example, if the wires **29** of the previous embodiment (0.175 millimeters) are employed, the center wire **35** of the center strand only of all cords would be about 0.20–0.22 millimeters in diameter. The effect of such a center wire diameter change is to reduce contact between wires **29** surrounding wire **35** as well as to reduce contact between strands **37***b* which are twisted around strand **37***a*. In such an embodiment the diameter of cord **26** will be slightly greater than the previous example of 1.6 millimeters.

In a third embodiment of the invention, referring to FIG. **8**, the concept of the second embodiment is expanded to further reduce wire-to-wire and strand-to-strand contact. Three distinct sizes of wires are employed to construct the cords of the invention. In this embodiment the largest wire is the center wire **202** in the center strand **200**. The intermediate diameter wires **204** are located around the center wire **202** of center strand **200** and therefore makeup a part of center strand **200**. This intermediate diameter wire **204** is also the center wire **206** for all outer strands **210**. The smallest diameter wires employed are numbered **208**. These wrap each wire **206** in each outer strand **210**. All of the wires in the embodiment are still less than 0.25 mm in diameter.

In a representative embodiment, wires **202** may be 0.21 mm; wires **204** may be 0.19 mm; wires **206** may be 0.19 mm; and wires **208** may be 0.175 mm. It will be appreciated that in this embodiment wires **204** and **206** are of equivalent diameters and are numbered individually to provide locational information only. It is noted that the invention is not limited by wires **204** and **206** being identical in diameter. All of the diameters of wires provided are for example only and could be rearranged with the joining principle being that contact among the outer wires of the central strand is reduced; that contact among the outer wires of the outer strands is reduced and that contact among the outer strands is reduced. In the example provided, (only for purpose of example) the space obtained between the outer wires of outer strands is 0.014 mm.

The cords **26** are equal length, are approximately equally spaced widthwise within the coating layer **28** and are arranged linearly along the width dimension. The coating layer **28** is formed from a polyurethane material, preferably a thermoplastic urethane, that is extruded onto and through the plurality of cords **26** in such a manner that each of the individual cords **26** is restrained against longitudinal movement relative to the other cords **26**. Transparent material is an alternate embodiment which may be advantageous since it facilitates visual inspection of the flat rope. Structurally, of course, the color is irrelevant. Other materials may also be used for the coating layer **28** if they are sufficient to meet the required functions of the coating layer: traction, wear, transmission of traction loads to the cords **26** and resistance to environmental factors. It should further be understood that if other materials are used which do not meet or exceed the mechanical properties of a thermoplastic urethane, then the additional benefit of the invention of dramatically reducing sheave diameter may not be fully achievable. With the thermoplastic urethane mechanical properties the sheave diameter is reducible to 100 millimeters or less. The coating layer **28** defines an engagement surface **30** that is in contact with a corresponding surface of the traction sheave **24**.

As shown more clearly in FIG. **9**, the tension member **22** has a width w, measured laterally relative to the length of the tension member **22**, and a thickness t**1**, measured in the direction of bending of the tension member **22** about the sheave **24**. Each of the cords **26** has a diameter d and are spaced apart by a distance s. In addition, the thickness of the coating layer **28** between the cords **26** and the engagement surface **30** is defined as t**2** and between the cords **26** and the opposite surface is defined as t**3**, such that t**1**=t**2**+t**3**+d.

The overall dimensions of the tension member **22** results in a cross-section having an aspect ratio of much greater than one, where aspect ratio is defined as the ratio of width w to thickness t**1** or (Aspect Ratio=w/t**1**). An aspect ratio of one corresponds to a circular cross-section, such as that common in conventional round ropes. The higher the aspect ratio, the more flat the tension member **22** is in cross-section. Flattening out the tension member **22** minimizes the thickness t**1** and maximizes the width w of the tension member **22** without sacrificing cross-sectional area or load carrying capacity. This configuration results in distributing the rope pressure across the width of the tension member **22** and reduces the maximum rope pressure relative to a round rope of comparable cross-sectional area and load carrying capacity. As shown in FIG. **2**, for the tension member **22** having five individual cords **26** disposed within the coating layer **28**, the aspect ratio is greater than five. Although shown as having an aspect ratio greater than five, it is believed that benefits will result from tension members having aspect ratios greater than one, and particularly for aspect ratios greater than two.

The separation s between adjacent cords **26** is dependant upon the materials and manufacturing processes used in the tension member **22** and the distribution of rope stress across the tension member **22**. For weight considerations, it is desirable to minimize the spacing s between adjacent cords **26**, thereby reducing the amount of coating material between the cords **26**. Taking into account rope stress distribution, however, may limit how close the cords **26** may be to each other in order to avoid excessive stress in the coating layer **28** between adjacent cords **26**. Based on these considerations, the spacing may be optimized for the particular load carrying requirements.

The thickness t**2** of the coating layer **28** is dependent upon the rope stress distribution and the wear characteristics of the coating layer **28** material. As before, it is desirable to avoid excessive stress in the coating layer **28** while providing sufficient material to maximize the expected life of the tension member **22**.

The thickness t**3** of the coating layer **28** is dependant upon the use of the tension member **22**. As illustrated in FIG. **1**, the tension member **22** travels over a single sheave **24** and therefore the top surface **32** does not engage the sheave **24**. In this application, the thickness t**3** may be very thin, although it must be sufficient to withstand the strain as the tension member **22** travels over the sheave **24**. It may also be desirable to groove the tension member surface **32** to reduce tension in the thickness t**3**. On the other hand, a thickness t**3** equivalent to that of t**2** may be required if the tension member **22** is used in an elevator system that requires reverse bending of the tension member **22** about a second sheave. In this application, both the upper **32** and lower surface **30** of the tension member **22** is an engagement surface and subject to the same requirement of wear and stress.

The diameter d of the individual cords **26** and the number of cords **26** is dependent upon the specific application. It is desirable to maintain the thickness d as small as possible, as hereinbefore discussed, in order to maximize the flexibility and minimize the stress in the cords **26**.

Referring back to FIG. **2**, the traction sheave **24** includes a base **40** and a liner **42**. The base **40** is formed from cast iron and includes a pair of rims **44** disposed on opposite sides of the sheave **24** to form a groove **46**. The liner **42** includes a base **48** having a traction surface **50** and a pair of flanges **52** that are supported by the rims **44** of the sheave **24**. The liner **42** is formed from a polyurethane material, such as that described in commonly owned U.S. Pat. No. 5,112,933, or any other suitable material providing the desired traction with the engagement surface **30** of the coating layer **28** and wear characteristics. Within the traction drive **18**, it is desired that the sheave liner **42** wear rather than the sheave **24** or the tension member **22** due to the cost associated with replacing the tension member **22** or sheave **24**. As such, the liner **42** performs the function of a sacrificial layer in the traction drive **18**. The liner **42** is retained, either by bonding or any other conventional method, within the groove **46** and defines the traction surface **50** for receiving the tension member **22**. The traction surface **50** has a diameter D. Engagement between the traction surface **50** and the engagement surface **30** provides the traction for driving the elevator system **12**. The diameter of a sheave for use with the traction member described hereinabove is dramatically reduced from prior art sheave diameters. More particularly, sheaves to be employed with the flat rope of the invention may be reduced in diameter to 100 mm or less. As will be immediately recognized by those skilled in the art, such a diameter reduction of the sheave allows for the employment of a

much smaller machine. In fact, machine sizes may fall to ¼ of their conventional size in for example low rise gearless applications for a typical 8 passenger duty elevators. This is because torque requirements would be cut to about ¼ with a 100 mm sheave and the rpm of the motor would be increased. Cost for the machines indicated accordingly falls.

Although illustrated as having a liner **42**, it should be apparent to those skilled in the art that the tension member **22** may be used with a sheave not having a liner **42**. As an alternative, the liner **42** may be replaced by coating the sheave with a layer of a selected material, such as polyurethane, or the sheave may be formed or molded from an appropriate synthetic material. These alternatives may prove cost effective if it is determined that, due to the diminished size of the sheave, it may be less expensive to simply replace the entire sheave rather than replacing sheave liners.

The shape of the sheave **24** and liner **42** defines a space **54** into which the tension member **22** is received. The rims **44** and the flanges **52** of the liner **42** provide a boundary on the engagement between the tension member **22** and the sheave **24** and guide the engagement to avoid the tension member **22** becoming disengaged from the sheave **24**.

An alternate embodiment of the traction drive **18** is illustrated in FIG. **3**. In this embodiment, the traction drive **18** includes three tension members **56** and a traction sheave **58**. Each of the tension members **56** is similar in configuration to the tension member **22** described above with respect to FIGS. **1** and **2**. The traction sheave **58** includes a base **62**, a pair of rims **64** disposed on opposite side of the sheave **58**, a pair of dividers **66**, and three liners **68**. The dividers **66** are laterally spaced from the rims **64** and from each other to define three grooves **70** that receive the liners **68**. As with the liner **42** described with respect to FIG. **2**, each liner **68** includes a base **72** that defines a traction surface **74** to receive one of the tension members **56** and a pair of flanges **76** that abut the rims **64** or dividers **66**. Also as in FIG. **2**, the liner **42** is wide enough to allow a space **54** to exist between the edges of the tension member and the flanges **76** of the liner **42**.

Alternative construction for the traction drive **18** are illustrated in FIGS. **4** and **5**. FIG. **4** illustrates a sheave **86** having a convex shaped traction surface **88**. The shape of the traction surface **88** urges the flat tension member **90** to remain centered during operation. FIG. **5** illustrates a tension member **92** having a contoured engagement surface **94** that is defined by the encapsulated cords **96**. The traction sheave **98** includes a liner **100** that has a traction surface **102** that is contoured to complement the contour of the tension member **92**. The complementary configuration provides guidance to the tension member **92** during engagement and, in addition, increases the traction forces between the tension member **92** and the traction sheave **98**.

Use of tension members and traction drives according to the present invention may result in significant reductions in maximum rope pressure, with corresponding reductions in sheave diameter and torque requirements. The reduction in maximum rope pressure results from the cross-sectional area of the tension member having an aspect ratio of greater than one. The calculation for approximate maximum rope pressure (slightly higher due to discreteness of individual cords) is determined as follows:

$$P_{max}=(2F/Dw)$$

Where F is the maximum tension in the tension member. For a round rope within a round groove, the calculation of maximum rope pressure is determined as follows:

$$P_{max}=(2F/Dd)(4/\pi)$$

The factor of $(4/\pi)$ results in an increase of at least 27% in maximum rope pressure, assuming that the diameters and tension levels are comparable. More significantly, the width w is much larger than the cord diameter d, which results in greatly reduced maximum rope pressure. If the conventional rope grooves are undercut, the maximum rope pressure is even greater and therefore greater relative reductions in the maximum rope pressure may be achieved using a flat tension member configuration. Another advantage of the tension member according to the present invention is that the thickness t**1** of the tension member may be much smaller than the diameter d of equivalent load carrying capacity round ropes. This enhances the flexibility of the tension member as compared to conventional ropes.

Although the invention has been shown and described with respect to exemplary embodiments thereof, it should be understood by those skilled in the art that various changes, omissions, and additions may be made thereto, without departing from the spirit and scope of the invention.

What is claimed is:

1. A tension member for providing lifting force to a car of an elevator system, comprising:

a plurality of discrete cords, constructed from a plurality of individual wires, wherein all wires are less than 0.25 millimeters in diameter, said plurality of cords being arranged side-by-side;

a coating layer substantially enveloping said plurality of cords and having an aspect ratio defined as the ratio of width w relative to thickness t, greater than one.

2. A tension member according to claim **1** wherein said plurality of wires are in a twisted pattern creating strands of several wires and a center wire.

3. A tension member according to claim **2** wherein said several wires and said center wire is seven wires.

4. A tension member according to claim **2** wherein said strand pattern is defined as said several wires twisted around said one center wire.

5. A tension member according to claim **4**, wherein the coating layer is formed from an elastomer.

6. A tension member according to claim **4** wherein said several wires is six wires.

7. A tension member according to claim **4** wherein said plurality of cords are each in a pattern comprising several strands around a center strand.

8. A tension member according to claim **7** wherein said plurality of cords each comprise seven strands.

9. A tension member according to claim **7** wherein said cord pattern is several outer strands twisted around said center strand.

10. A tension member according to claim **9** wherein said center strand comprises said several wires twisted around said one center wire in a first direction and said outer strands each comprise said several wires twisted around said one center wire in a second direction and said outer strands are twisted around said center strand in said first direction.

11. A tension member according to claim **9** wherein said center wire in said center strand is of a larger diameter than all other wires in each cord of said plurality of cords.

12. A tension member according to claim **9** wherein each said center wire of each strand is larger than all wires twisted therearound.

13. A tension member according to claim **12** wherein said center wire of said center strand is larger than said center wire of each said outer strands.

14. A tension member according to claim **9** wherein said cord pattern is six strands twisted around said center strand.

15. A tension member according to claim **14** wherein said center wire of each strand is larger than all wires twisted therearound.

16. A tension member according to claim **14** wherein said center wire of said center strand is larger than said center wire of each of said six strands.

17. A tension member according to claim **1** wherein said wires diameters are less than 0.20 millimeters.

18. A tension member according to claim **1** wherein said cords are arranged in spaced relation to each other.

19. A tension member according to claim **1** wherein the aspect ratio is greater than or equal to two.

20. A tension member according to claim **1** wherein said coating layer is an elastomer.

21. A tension member according to claim **20** wherein said elastomer is a thermoplastic urethane.

22. A tension member according to claim **21** wherein said urethane is transparent.

23. A tension member according to claim **1** wherein said cords are steel.

24. A tension member according to claim **1**, wherein the sheave includes an engagement surface, and wherein the engagement surface of the tension member is contoured to complement the engagement surface of the sheave.

25. A tension member according to claim **1** wherein said coating layer defines a single engagement surface for the plurality of individual cords.

26. A tension member according to claim **25** wherein said coating layer extends widthwise such that the engagement surface extends about the plurality of individual cords.

27. A tension member according to claim **25** wherein said engagement surface is shaped by an outer contour of said plurality of cords.

28. A tension member according to claim **25**, wherein said engagement surface is contoured to complement an engagement surface of a sheave.

* * * * *

EXHIBIT B

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Pedro S. Baranda et al.

Serial No.: 09/218,990

Filing Date: December 22, 1998

Title: TENSION MEMBER FOR AN ELEVATOR

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Docket No.: OT-4355

Date: December 18, 2000

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Group Art Unit: 3652

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Signature

12/19/00
Date

AMENDMENT A

Please amend the claims as follows:

a1

1. A tension member for providing lifting force to a car of an elevator system, comprising:

a plurality of discrete cords, constructed from a plurality of individual wires, wherein all wires are [including wires] less than .25 millimeters in diameter, said plurality of cords being arranged side-by-side;

a coating layer substantially enveloping said plurality of cords and having an aspect ratio defined as the ratio of width w relative to thickness t, greater than one.

Please delete Claim 4.

a2

10. A tension member according to claim 1 wherein said wires diameters are less than [in the range of about .10 millimeters to about] .20 millimeters.

23. ~~A tension member according to claim 1 wherein said~~ cords are [wire is] metallic.

24. A traction drive for an elevator system, the elevator system including a car and a counterweight, the traction drive including a traction sheave driven by a machine and a tension member interconnecting the car and counterweight, the tension member having a width w, a thickness t measured in the bending direction, said tension member having a plurality of cords therein, said cords formed from a plurality of [including] wires of less than .25 millimeters in diameter, said tension member further having an engagement surface defined by the width dimension of the tension member, wherein the tension member has an aspect ratio, defined as the ratio of width w relative to thickness t, of greater than one, the traction sheave including a traction surface configured to receive the engagement surface of the tension member such that the traction between the sheave and tension member moves the car and counterweight.

32. A traction drive for an elevator system, the elevator system including a car and a counterweight, the traction drive including a traction sheave driven by a machine and a tension member interconnecting the car and counterweight, the tension member having a width w, a thickness t measured in the bending direction, said tension member having a plurality of cords therein including wires of less than .25 millimeters in diameter, said tension member further having an engagement surface defined by the width dimension of the tension member, wherein the tension member has an aspect ratio, defined as the ratio of width w relative to thickness t, of greater than one, the traction sheave including a traction surface configured to receive the engagement surface of the tension member such that the traction between the sheave and tension member moves the car and counterweight, the [The] traction drive [according to Claim 24,] further including a guidance device disposed proximate to the traction sheave, the guidance device engaged with the tension member to position the tension member for engagement with the traction sheave.

35. The traction drive according to Claim 24 [29], wherein the cords are formed from a plurality of wires arranged in a plurality of strands, each strand having seven wires with six wires twisted around one center wire.

REMARKS

This amendment is in response to the Office Action mailed August 16, 2000. Claims 1-15, 18, 20-25 and 29-50 were rejected in the Office Action. After amendment, Claims 1-3, 5-15, 18, 20-25 and 29-50 remain pending and reconsideration of the rejection of these claims is respectfully requested.

It was noted in the Office Action that the Oath/Declaration was missing the statement that this Application is a continuation in part of co-pending application number 09/031,108. A new Declaration is being prepared for execution and will be submitted in the near future.

Applicants noted that on the Office Action Summary sheet, Claims 1-15, 18, 20-25 and 29-50 were identified as rejected. In the Detailed Action, however, only claims 1-3, 5-21, 23-31, 34, 37, 38, 40-42 and 47-49 were listed in the detailed discussion of the rejections. In addition, Claim 21 was mentioned in the body of one of the rejections. Thus, Claims 4, 22, 32, 33, 35, 36, 43-46 and 50 were not discussed in the Detailed Action. Therefore, it is not understood if these claims were rejected and, if they were, on what basis.

Claims 10 and 23 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 10 and 23 have been amended to clarify that which is claimed. Reconsideration of the rejection of Claims 10 and 23 is respectfully requested.

Claims 1-3, 5-9, 11-15, 18, 20, 23 and 47-49 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP '811 in view of Bruyneel et al.

Applicants respectfully disagree with this rejection. First, the combination is not proper as JP '811 is directed to a balance or compensation rope. This is clear from a review of the full translation (provided herewith). Although the term 'hoist rope' is used once, the description of the rope is of a type of "ribbon form rope". Further, this rope is described as one that 'hangs in the lower portion for connecting elevators that may be

ascending/descending alternately", i.e., a balance or compensation rope. Still further, the main objective of this invention is to make a rope the is flexible enough to overcome the tendancy to bulge and make contact with the walls. Tension members that provide lifting force to an elevator car are loaded and do not exhibit this tendency to 'bulge'. Therefore, it is obvious that the rope described in JP '811 is not a lifting rope, but is a compensation or balancing rope. The single use of the term 'hoist rope' is the result of the translation and clearly is not meant to imply that this rope is used as a tension member for providing lifting force to an elevator car.

As a result, there is no motivation to combine JP '811 with the fine wire elements of Bruyneel et al. Balance ropes, such as those described in JP '811, are used to shift weight between two moving elements (adjacent cars or a car and counterweight). There is no need to make the wires of a small diameter as claimed since this will add cost and complexity for no purpose. The balance ropes of JP '811 are used as mass and therefore having less expensive large diameter wires is sufficient for this purpose.

Second, the combination, even if proper, does not result in the invention as claimed. JP '811 is a balance rope and not a tension member as discussed above. In addition, Bruyneel et al. describes a rope having wire in a range from 0.15mm to 1.2 mm. The two examples in Bruyneel et al. have filaments in the range of 0.57 to 0.85 mm (example 1) and 0.20 to 0.29 mm (example 2). There is no disclosure or suggestion within Bruyneel et al. of a tension member formed from cords having all wires with a diameter less than 0.25 mm, as claimed in Claim 1. This feature ensures that the tension member will have sufficient flexibility for the elevator application, which requires repeated and frequent flexing as the tension member travels over sheaves. This element of the claim is not disclosed in either reference and the benefits of this element are not recognized or suggested. Therefore, the combination of JP '811 and Bruyneel et al. does not result in the claimed invention of Claim 1.

Applicants respectfully request reconsideration of this rejection of Claim 1 and Claims 2-3, 5-9, 11-15, 18, 20, 23 and 47-49, which depend from Claim 1.

As for Claim 21, which is discussed along with this rejection although not listed among the rejected claims under this rejection, the use of urethane is discussed in the specification. The coating layer must perform the required functions of traction, wear, transmission of traction loads and resistance to environmental factors. While other elastomers, such as natural rubber, may perform some of these functions, urethane has been found by the Applicants to be particularly effective, especially for its wear properties when it is used as the coating layer for a tension member in an elevator system. Many elastomers, such as rubber, provide adequate traction but do not provide adequate wear when subjected to the shear loads applied by the cords in an elevator application. Therefore, it is not a simple matter of design choice in selecting a material for the coating layer that will provide traction with the sheave while transmitting the traction loads to the cords and resisting wear and environmental factors in an elevator system.

Claims 1-3, 5-9, 11-15, 18, 20, 23-25, 29-31, 34, 37, 38, 40-42 were rejected under 35 U.S.C. 103(a) as being unpatentable over GB '209 in view of Bruyneel et al.

Applicants respectfully disagree with this rejection for similar reasons as discussed in response to the previous rejection. Claims 1 and 24 include the element of having the wires of the cords have diameters less than 0.25 mm. While Bruyneel et al. discloses that ropes could be made with wire diameters of a variety of sizes in a large range, it does not disclose or suggest having all of the wires with a minimum diameter for the purpose of improving flexibility. In addition, GB '209 discloses having a drive wheel that is approximately 100 times the diameter of the rope passing over it. While this may suggest having a thin rope, it does not recognize or suggest a motivation for making such a rope from small diameter wires. In fact, since the controlling parameter in GB '209 is the rope diameter, this reference teaches away from the claimed invention.

Therefore, Applicants respectfully request reconsideration of this rejection of Claims 1-3, 5-9, 11-15, 18, 20, 23-25, 29-31, 34, 37, 38, 40-42.

As mentioned previously, Claims 4, 22, 32, 33, 35, 36, 43-46 and 50 were not addressed in the detailed discussion of the rejections and therefore there is no response to the alleged rejection of these claims.

Inasmuch as neither the structure nor function of Applicants' invention has been anticipated or made obvious, Applicants respectfully request reconsideration and allowance of Claims 1-3, 5-15, 18, 20-25 and 29-50.

Please charge any deficiency in fees associated with filing this response to our Deposit Account No. 15-0750, Order No. OT-4355.

Respectfully submitted,

PEDRO S. BARANDA, et al.

By _____
Randy G. Henley
Registration No. 35,188

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EXHIBIT C

OIPE JC64
JAN 15 2002
PATENT & TRADEMARK OFFICE

#208 ws
1-22-02
gp 3652
7/2/02

Patent Application

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	Docket No.: OT-4355
Pedro S. Baranda et al.	:	Date: October 29, 2001
Appln. No.: 09/218,990	:	Examiner: T. Tran
Filing Date: December 22, 1998	:	Group Art Unit: 3652

Title: TENSION MEMBER FOR AN ELEVATOR

RECEIVED
JAN 22 2002
GROUP 3600

Commissioner for Patents
Washington, D.C. 20231

AMENDMENT B

In response to the Office Action dated August 1, 2001, please amend the subject application as follows.

IN THE CLAIMS:

Please amend claims 23 and 50 to read as follows:

B1

23. (Twice Amended) A tension member according to claim 1 wherein said cords are steel.

B2

50. (Amended) A tension member according to claim 48 wherein said center wire of said center strand is larger than said center wire of each of said six strands.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Director of Patents and Trademarks, Washington, D.C. 20231 on

October 29, 2001

Mary Force
Signature

October 29, 2001
Date

REMARKS

Applicants request reconsideration of the subject application in view of the foregoing amendments and the following remarks.

Claims 1-3 and 5-50 remain pending. On the Office Action Summary sheet, claims 16, 17, 19 and ***23-46*** were indicated as withdrawn (and claims 1-3, 5-15, 18, 20-22 and 47-50 were identified as rejected). In the Detailed Action, however, claims 16, 17, 19 and ***24-44*** were indicated as withdrawn, and claims 45-50 were indicated as being rejoined (and claims 1-3, 5-15, 18, 20, 22, 23 and 47-50 were listed among the rejections). Since claim 23 was rejected (and objected to) in the Detailed Action, Applicants understand that this claim has not been withdrawn. However, along with claim 21, claims 45 and 46 were not discussed in the Detailed Action. Therefore, it is not understood if these claims were withdrawn or rejected and, if the latter, on what basis.

It was noted in the Office Action that the Oath/Declaration was missing the acknowledgement of the duty to disclose material information the became available between the filing dates of co-pending application number 09/031,108 and this continuation in part application. A new Declaration is being prepared for execution and will be submitted in the near future.

Claim 23 is objected to under 37 CFR 1.75(c) as allegedly being of improper dependent form. Applicants believe that the foregoing amendment to claim 23 addresses this objection, and request withdrawal thereof.

Claim 50 was rejected under 35 U.S.C. 112, second paragraph, as allegedly having insufficient antecedent basis. Applicants believe that the foregoing amendment to claim 50 corrects the antecedent basis, and request withdrawal of this rejection.

Claims 1-3, 5-15, 18, 20, 23 and 47-50 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Bruyneel et al. Claims 22 and 23 (Applicants believe the intended claims are 21 and 22) stand rejected under §103(a) as allegedly being unpatentable over Bruyneel et al., further in view of Schuerch. These rejections are respectfully traversed.

As correctly noted in the Office Action, Bruyneel et al. describes a rope having wires in a range from 0.15mm to 1.2 mm. The two examples in Bruyneel et al. have "filaments" in the range of 0.57 to 0.85 mm (example 1) and 0.20 to 0.29 mm (example 2). There is no disclosure or suggestion within Bruyneel et al. of a tension member formed from cords having all wires with a diameter less than 0.25 mm, as claimed in claim 1.

The importance of this distinguishing feature to the subject invention is noted in the paragraph beginning at page 6, line 6, of the subject specification:

> It is important to the success of the invention to employ wire 29 of a very small size. Each wire 29 and 31 are less than .25 millimeters in diameter and preferably is in the range of about .10 millimeters to .20 millimeters in diameter. … The small sizes of the wires preferably employed contribute to the benefit of the use of a *sheave of smaller diameter*. The smaller diameter wire can *withstand the bending radius* of a smaller diameter sheave (around 100 millimeters in diameter) *without placing too much stress* on the strands of the flat rope.

[Emphasis added.]

Not only is this feature important to the claimed invention, but there is no recognition in Bruyneel et al. of the desirability to withstand a smaller bending radius (permitting use of a smaller diameter sheave), much less the importance of keeping all wire diameters small to achieving that goal. Without such a motivating factor, there would have been no reason to use (especially in an elevator tension member) all smaller wires which, as Bruyneel et al. recognizes (col. 5, lines 30-33), generally have lower tensile strength. Thus, it would not have been obvious from the disclosure of Bruyneel et al. to so restrict the wire size.

Therefore, Bruyneel et al. does not disclose or suggest each feature of the invention claimed in claim 1.

Schuerch, which is cited for its disclosure regarding a thermoplastic coating layer, does not overcome the above-noted deficiencies in the teachings of Bruyneel et al.

Applicants respectfully request reconsideration of this rejection of claim 1, as well as claims 2-3, 5-15, 18, 20-23 and 47-50, which depend from claim 1.

Applicants respectfully request reconsideration and allowance of the subject application.

Please charge any deficiency in fees associated with filing this response to our Deposit Account No. 15-0750, Order No. OT-4355.

Respectfully submitted,

PEDRO S. BARANDA, et al.

By _____

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Application No. 09/218,990
Attachment to AMENDMENT B

VERSION SHOWING
CLAIM AMENDMENTS

Claims 23 and 50 have been amended as follows:

23. (Twice Amended) A tension member according to claim 1 wherein said cords are steel [metallic].

50. (Amended) A tension member according to claim 48 [45] wherein said center wire of said center strand is larger than said center wire of each of said six [outer] strands.

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EXHIBIT D

10/07/02

 #24

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	Docket No.: OT-4355
Pedro S. Baranda et al.	:	Date: September 25, 2002
Appln. No.: 09/218,990	:	Examiner: T. Tran
Filing Date: December 22, 1998	:	Group Art Unit: 3652

Title: TENSION MEMBER FOR AN ELEVATOR

Commissioner for Patents
Box AF
Washington, D.C. 20231

APPEAL TO THE BOARD OF PATENT APPEALS AND INTERFERENCES PURSUANT TO 37 C.F.R.§1.191

1. REAL PARTY IN INTEREST

The real party in interest is Otis Elevator Company. The assignment of assignor's interest was recorded on May 28, 1999 at reel 9981, frame 970.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to appellant, the appellant's legal representative, or assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

3. STATUS OF CLAIMS

Claims 1-3, 5-15, 18, 20, 23 and 45-50 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 5,461,850 (Bruyneel et al.).

Claims 21 and 22 stand rejected under §103(a) as allegedly being unpatentable over Bruyneel et al., further in view of U.S. Patent No. 4,534,163 (Schuerch).

Claim 4 has been canceled. Claims 16, 17, 19 and 24-44 stand withdrawn from consideration as being drawn to a non-elected species/invention.

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4. **STATUS OF AMENDMENTS**

No amendments were filed subsequent to the rejection.

5. **SUMMARY OF INVENTION**

Claim 1, the sole independent claim that is pending and under consideration in the present application, is directed to a tension member for providing lifting force to a car of an elevator system. The tension member comprises a plurality of discrete cords and a coating layer substantially enveloping said plurality of cords. The cords are constructed from a plurality of individual wires, wherein all wires are less than .25 millimeters in diameter, and the plurality of cords are arranged side-by-side. The coating layer has an aspect ratio, defined as the ratio of width w relative to thickness t, greater than one.

Support for the invention claimed in claim 1 is found throughout the specification, for example in the paragraph beginning at page 6, line 6 and in the paragraph beginning at page 8, line 8.

As noted in the subject specification, the claimed aspect ratio results in distributing the rope pressure across the width of the tension member and reduces the maximum rope pressure relative to a round rope of comparable cross-sectional area and load carrying capacity. The maximum rope pressure is significantly reduced as compared to a conventionally roped elevator having a similar load carrying capacity. Also, the effective rope diameter 'd' (measured in the bending direction) is reduced for the equivalent load bearing capacity. Therefore, smaller values for the sheave diameter 'D' may be attained without a reduction in the D/d ratio. A smaller sheave diameter reduces the required torque and increases the rotational speed of the machine driving the sheave, thus permitting the use of less costly, more compact, high-speed motors without the need for a gearbox.

The importance of the claimed wire diameter feature, as noted in the subject specification, is that the smaller diameter wire can *withstand the bending radius* of a smaller diameter sheave (around 100 millimeters in diameter) *without placing too much stress* on the strands of the flat rope. Thus, the smaller wire diameter is critical to maximizing the above-noted benefits of the use of a sheave of smaller diameter.

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(6) **ISSUE(S)**

(a) Whether claim 1 is unpatentable under §103(a) over Bruyneel et al.

(7) **GROUPING OF CLAIMS**

For the purposes of this Appeal, all pending claims under consideration (1-3, 5-15, 18, 20-23 and 45-50) will be grouped together.

(8) **ARGUMENT(S)**

(a) Whether claim 1 is unpatentable under §103(a) over Bruyneel et al.

According to the Final Rejection, claims 1-3, 5-15, 18, 20, 23 and 45-50 are unpatentable under §103(a) over Bruyneel et al., and claims 21 and 22 are unpatentable under §103(a) over Bruyneel et al., further in view of Schuerch.

The Final Rejection states that Figure 9 of Bruyneel et al. discloses a tension member comprising a plurality of discrete cords arranged side-by-side and constructed from a plurality of individual wires having a diameter range of 0.15 to 1.20 mm. The Final Rejection further states that Bruyneel et al. discloses a coating layer that envelopes the cords and has an aspect ratio (width/thickness) of greater than two. The Final Rejection goes on to indicate that it would have been an obvious choice, based upon the application and design preferences of the constructor, to have all of the wires having a diameter of less than 0.20 mm.

Applicants respectfully submit that the Examiner has not met the burden of proof required to support a rejection under 35 U.S.C. §103. When an application is submitted to the Patent and Trademark Office, case law dictates that 35 U.S.C. §103 places the burden of proof on the PTO to establish a prima facie case of obviousness.[1] Once the prima facie case has been established, then the burden of going forward with the evidence to rebut the prima facie case shifts to the applicant.

[1] In re Fritch, 23 U.S.P.Q. 2d. 1780 (Fed. Cir. 1992), In re Piasecki, 745 F.2d. 1468, 1471-1472, 223 U.S.P.Q. 785, 787-788 (Fed. Cir. 1984).

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Only the burden of going forward with evidence to rebut shifts to the applicant, however. The burden of persuasion remains with the PTO.

In this instance, a prima facie case would necessarily have to first establish that the present invention would be obvious in view of the cited prior art. In order to support a prima facie obviousness type rejection, the Examiner must take into account all the limitations in the rejected claim,[2] including any limitations expressed using functional language.[3] Further, the obviousness must be determined based on the claimed subject matter as a whole, including any results and advantages produced by the claimed subject matter.[4] Further, to establish a prima facie case of obviousness, there must be some teaching, suggestion or incentive to support the specific combination of references.[5]

As correctly noted in the Final Rejection, Figure 9 of Bruyneel et al. describes a coating layer that envelopes a plurality of side-by-side cords and that has an aspect ratio of greater than two. However, that Figure illustrates a conveyor belt, and not a tension member for providing lifting force to a car of an elevator system, as recited in claim 1. Although Bruyneel et al. does also discuss using rubberized cord as a hoisting cable for mines or elevators, it does so in connection with the round rubberized cord of Figure 2 of that patent. There is no disclosure or suggestion within Bruyneel et al. of a tension member for providing lifting force to a car of an elevator system that has the claimed side-by-side cords or aspect ratio.

The recitation of a tension member for providing lifting force to a car of an elevator system describes and limits the claimed invention. Although appearing in the preamble of the claim, the recitation in question does not simply refer to the prior art or to a possible use, and therefore must be taken into consideration when determining the scope of claim 1.[6] Therefore, since Bruyneel et al. does not disclose or suggest a tension member for providing lifting force to

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[2] Carl Schenck, A.G. v. Nortron Corp., 713 F.2d 782, 218 U.S.P.Q. 698 (Fed. Cir. 1983); Carman Industries v. Wahl, 724 F.2d 932, 220 U.S.P.Q. 481 (Fed. Cir. 1983).
[3] Lewmar Marine, Inc. v. Barient, Inc., 827 F.2d 744, 3 U.S.P.Q.2d 592 (Fed. Cir. 1983).
[4] Diversitech Corp. v. Century Steps, Inc., 850 F.2d 675, 7 U.S.P.Q.2d 1315 (Fed. Cir. 1988); In re Chupp, 816 F.2d 643, 2 U.S.P.Q.2d 1437 (Fed. Cir. 1987); Fromson v. Advanced Offset Plate, 755 F.2d 1549, 225 U.S.P.Q. 26 (Fed. Cir. 1985).
[5] In re Geiger, 815 F.2d 686, 2 U.S.P.Q.2d 1276 (Fed. Cir. 1987); ACS Hospital Systems Inc. v. Montefiore Hospital, 732 Fed.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984).
[6] *See* Karsten Manufacturing Corp. v. Cleveland Golf Co., 242 F.3d 1376, 58 U.S.P.Q.2d 1286 (Fed. Cir. 2001); Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 51 U.S.P.Q.2d 1161 (Fed. Cir. 1999).

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a car of an elevator system that has the claimed side-by-side cords or aspect ratio, the invention recited in claim 1 would not have been obvious in view of Bruyneel et al.

Additionally, the Final Rejection also correctly notes that Bruyneel et al. describes a rope having wires in a range from 0.15mm to 1.2 mm. The two examples in Bruyneel et al. have "filaments" in the range of 0.57 to 0.85 mm (example 1) and 0.20 to 0.29 mm (example 2). There is no disclosure or suggestion within Bruyneel et al. of a tension member formed from cords having all wires with a diameter less than 0.25 mm, as claimed in claim 1.

As noted above, this feature is critical to the claimed invention, in that it permits maximizing the use of a sheave of smaller diameter. There is no recognition in Bruyneel et al. of the desirability to withstand a smaller bending radius (permitting use of a smaller diameter sheave), much less the importance of keeping all wire diameters small to achieving that goal. Without such a motivating factor, there would have been no objective reason to use (especially in an elevator tension member) all smaller wires, which generally have lower tensile strength. Thus, it would not have been obvious from the disclosure of Bruyneel et al. to so restrict the wire size.[7]

Therefore, Bruyneel et al. does not disclose or suggest each feature of the invention claimed in claim 1.

Schuerch, which is cited for its disclosure regarding a thermoplastic coating layer, does not overcome the above-noted deficiencies in the teachings of Bruyneel et al.

Therefore, with respect to the rejection of claims 1-3, 5-15, 18, 20-23 and 45-50, the Examiner has failed to meet his burden to establish a prima facie case of obviousness under 35 U.S.C. § 103 because the cited art does not disclose or suggest all of the features recited in independent claim 1, and it would not have been obvious to modify the prior art rope to include such features.

[7] In re Geiger, 815 F.2d 686, 2 U.S.P.Q.2d 1276; ACS Hospital Systems Inc, 732 Fed.2d 1572, 221 U.S.P.Q. 929.

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(9) **OATH/DECLARATION**

It was noted in the Office Action that the Oath/Declaration was missing the acknowledgement of the duty to disclose material information that became available between the filing dates of co-pending application number 09/031,108 and this continuation in part application. A new Declaration has been executed and will be submitted separately.

Conclusion

As Applicants have traversed each and every rejection raised by Examiner, it is respectfully requested that the rejections be reversed and the rejected claims be passed to issue.

Please charge any deficiency in fees associated with filing this response to our Deposit Account No. 15-0750, Order No. OT-4355.

Respectfully submitted,

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9. **APPENDIX**

Claims involved in the Appeal:

1. (Amended) A tension member for providing lifting force to a car of an elevator system, comprising:

a plurality of discrete cords, constructed from a plurality of individual wires, wherein all wires are less than .25 millimeters in diameter, said plurality of cords being arranged side-by-side;

a coating layer substantially enveloping said plurality of cords and having an aspect ratio defined as the ratio of width w relative to thickness t, greater than one.

2. A tension member according to claim 1 wherein said plurality of wires are in a twisted pattern creating strands of several wires and a center wire.

3. A tension member according to claim 2 wherein said strand pattern is defined as said several wires twisted around said one center wire.

5. A tension member according to claim 3 wherein said plurality of cords are each in a pattern comprising several strands around a center strand.

6. A tension member according to claim 5 wherein said cord pattern is several outer strands twisted around said center strand.

7. A tension member according to claim 6 wherein said center strand comprises said several wires twisted around said one center wire in a first direction and said outer strands each comprise said several wires twisted around said one center wire in a second direction and said outer strands are twisted around said center strand in said first direction.

8. A tension member according to claim 6 wherein each said center wire of each strand is larger than all wires twisted therearound.

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9. A tension member according to claim 8 wherein said center wire of said center strand is larger than said center wire of each said outer strands.

10. (Amended) A tension member according to claim 1 wherein said wires diameters are less than .20 millimeters.

11. A tension member according to claim 6 wherein said center wire in said center strand is of a larger diameter than all other wires in each cord of said plurality of cords.

12. A tension member according to claim 1 wherein said cords are arranged in spaced relation to each other.

13. A tension member according to claim 1 wherein the aspect ratio is greater than or equal to two.

14. A tension member according to claim 1 wherein said coating layer defines a single engagement surface for the plurality of individual cords.

15. A tension member according to claim 14 wherein said coating layer extends widthwise such that the engagement surface extends about the plurality of individual cords.

18. A tension member according to claim 3, wherein the coating layer is formed from an elastomer.

20. A tension member according to claim 1 wherein said coating layer is an elastomer.

21. A tension member according to claim 20 wherein said elastomer is a thermoplastic urethane.

22. A tension member according to claim 21 wherein said urethane is transparent.

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23. (Twice Amended) A tension member according to claim 1 wherein said cords are steel.

45. A tension member according to claim 2 wherein said several wires and said center wire is seven wires.

46. A tension member according to claim 3 wherein said several wires is six wires.

47. A tension member according to claim 5 wherein said plurality of cords each comprise seven strands.

48. A tension member according to claim 6 wherein said cord pattern is six strands twisted around said center strand.

49. A tension member according to claim 48 wherein said center wire of each strand is larger than all wires twisted therearound.

50. (Amended) A tension member according to claim 48 wherein said center wire of said center strand is larger than said center wire of each of said six strands.

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CERTIFICATE OF SERVICE

I hereby certify that on February 28, 2011 I caused the attached **SCHINDLER ELEVATOR CORPORATION'S FIRST AMENDED COMPLAINT – REVISED REDACTED VERSION** to be served upon each interested party in this action in accordance with the electronic filing procedures of the United States District Court for the District of New Jersey.

Dated: February 28, 2011

/s/Pierre R. Yanney

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