

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

Petitioners,

v.

DYSON TECHNOLOGY LIMITED,
Patent Owner.

Case No. IPR2023-01322
U.S. Patent No. 10,433,687

**Declaration of Declaration of Joseph Fester in Support of Petition
for *Inter Partes* Review of U.S. Patent No. 10,433,687**

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I, Joseph Fester, declare as follows:

1. My name is Joseph Fester. I have been retained by the Petitioners to offer technical opinions related to U.S. Patent No. 10,433,687 (“the ’687 Patent”) (Ex. 1001). I understand that Petitioners are requesting that the Patent Trial and Appeal Board (“PTAB” or “Board”) institute *inter partes* review (“IPR”) of the ’687 Patent.

2. In this Declaration I give my opinions as to whether the claims of the ’687 Patent are valid. I provide technical bases for these opinions as appropriate.

3. This Declaration contains statements of my opinions formed to date and the bases and reasons for those opinions. I may offer additional opinions based on further review of materials in this case, including opinions and/or testimony of other expert witnesses. I make this Declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters contained herein.

I. BACKGROUND

A. Qualifications

4. I am over the age of 18 and am competent to write this Declaration. I have personal knowledge, or have developed knowledge of these technologies based upon education, training, or experience, of the matters set forth herein. This Section contains a summary of my educational background, career history, publications, and

other relevant qualifications. My full *curriculum vitae* is attached as Appendix A to this declaration.

5. I believe I am well qualified to serve as a technical expert in this matter based on my educational and work experience. As discussed below, in my career, I have been involved in the product development, prototyping, testing, and patenting of vacuum technology.

6. I received a Bachelor of Science degree in Mechanical Engineering in 1994 from Kettering University and a Master of Business Administration degree in 2002 from Grand Valley State University.

7. I have worked as an engineer in product development for over 25 years. I am currently a project manager at Dematic Corporation, a supplier of integrated supply chain technology, software, and services. Prior to joining Dematic, I served an eleven-year tenure with Bissell Homecare, Inc. At Bissell, I worked with dry vacuum cleaners, including handheld, robotic, canister, and upright models. As an engineer, I designed and developed both consumer and commercial products for North America, Europe and Australia. Cumulatively, I introduced ten vacuums to market between 2002 and 2013, which sold a total of 25 million units and brought in \$1.25 billion in revenue. In my work as an engineering manager, I was deeply involved with the planning and implementation of the embedded systems and modular designs across Bissell's vacuum line. With this modular approach, we were

able to offer maximum product differentiation with fewer platforms and reduced tooling capital.

8. I am a named inventor on 18 U.S. patents, three European patents and two Australian patents. Many of these patents involve vacuum cleaner technology.

B. Compensation

9. For my efforts in connection with the preparation of this Declaration, I have been compensated at my standard rate for this type of consulting activity of \$250 per hour. My compensation is in no way contingent on the results of these or any other proceedings relating to the above-captioned patent.

C. Materials and Other Information Considered

10. I have considered information from various sources in forming my opinions. I have reviewed and considered all exhibits listed in the attached Appendix B (Materials Considered) in forming my opinions.

II. UNDERSTANDING OF THE LAW

11. I am not an attorney. In forming my opinions in this Declaration, I applied the relevant legal principles provided to me by counsel, which are summarized in Appendix D.

III. TECHNOLOGY OF THE '687 PATENT

A. Background on Vacuum Cleaner Technology

12. By September 17, 2015, the earliest asserted priority date of the '687 Patent, the technology relevant to the '687 Patent was well developed. In this

Section, I present an overview of relevant aspects of the technology in the '687 Patent that would have been known and available to a person of ordinary skill in the art ("POSITA") as of around September 2015.

13. Ideas for using separator technology in floor cleaners have existed since the early 20th century. Effective bagless technology was designed into vacuums in the 1980's, most notably by Dyson using cyclone separator technology. Examples I am very familiar with include the Dyson DC07, DC14, and the "ball" DC15 upright vacuum cleaners.

14. Moreover, the use of the cyclone separator technology in handheld vacuums was common around the time of the invention. For example, the Dyson V6 (DC58 and DC59) was released in January 2014.¹ The Dyson DC59, shown below, is a handheld vacuum cleaner that used a cyclone separator and which had a handle configured like a pistol. The Dyson DC59 also had a dust bin that could be opened and closed by releasing a bottom wall.

¹ See, Business Insider, Dyson's Futuristic New Vacuum Runs Faster Than A Formula 1 Racecar, available at: <https://www.businessinsider.com/dyson-v6-vacuums-2014-1>



Dyson V6 (DC58) Handheld Vacuum Cleaner.

15. Known handheld vacuum cleaners around the time of the '687 Patent (including some of the models identified above) generally included the following features:

- a handle for supporting the vacuum cleaner during normal use, which may come in many shapes and configurations, including a “pistol grip configuration;”
- a cyclone for separating dirt from air;
- a dirt collector to retain dirt, and having open and closed configurations; and
- a motor to create suction.

Indeed, without many of these features, the cleaning device could not function as a handheld vacuum. For example, without a cyclone, a bag would be required for capturing dust, which had fallen out of favor with consumers as they required the

purchase of replacement bags. Similarly, without a suction source and a nozzle, the device would not function as a “vacuum.”

16. While popular at the time of the invention, a POSITA would have known that bagless cyclone-type vacuum cleaners were not easy to clean because dust and other particles in the dirt collector would be released into the air when the dirt collector is opened. For example, in an article by *Appliance Retailer*, published June 13, 2014, a representative from Miele commented that “[c]leaning bagless machines is also dirty business. Upon emptying bagless machines, plumes of dust that are visible as well as more hazardous fine particles that cannot be seen, are often breathed in.” See <https://www.applianceretailer.com.au/upright-upstanding-ultimate-guide-2014-vacuum-cleaner-market/>.

B. Overview of the ’687 Patent

17. As explained in the introductory sections of the patent, the ’687 Patent relates to a handheld vacuum with an allegedly improved mechanism for emptying its dirt collector. Ex. 1001 at 1:16-59.

18. The handheld vacuum cleaner described in the ’687 Patent is a handheld vacuum cleaner 2 with a handle 6, a cyclonic separating unit 8, and a suction generator 11. *Id.* at 2:45-60.

19. The handle 6 is arranged in a “pistol grip configuration,” and in particular, “the handle axis H is arranged at 110 degrees with respect to the

longitudinal axis X of the cyclonic separating unit 8,” as demonstrated by angle θ_1 .

Id. at 2:61-67; Fig. 2 (reproduced below).

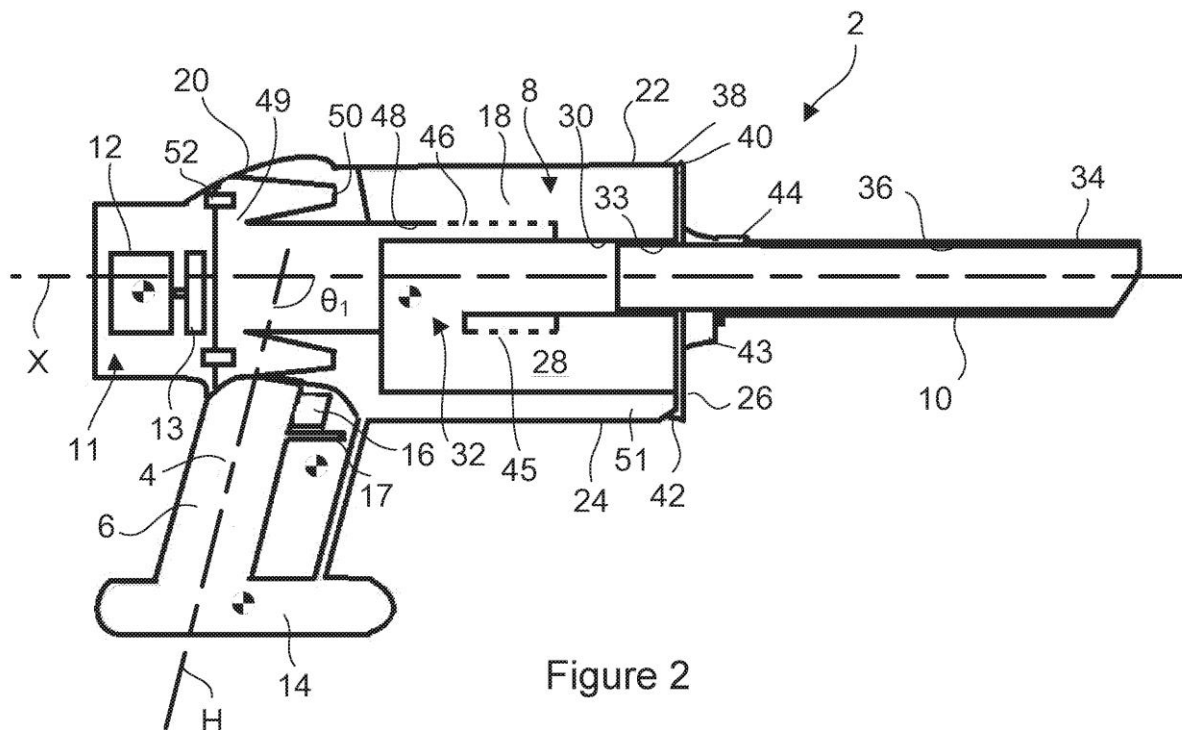


Figure 2

Ex. 1001, Fig. 2.

20. The handheld vacuum cleaner described in the '687 Patent also has a separator body 22, which has an outer wall 24 and an end wall 26 to define a dirt collector 38. *Id.* at 3:12-15. As shown in Figure 8 (reproduced below), the outer wall 26 pivots away from end wall 26 around pivot 40 to open. *Id.* at 3:56-61.

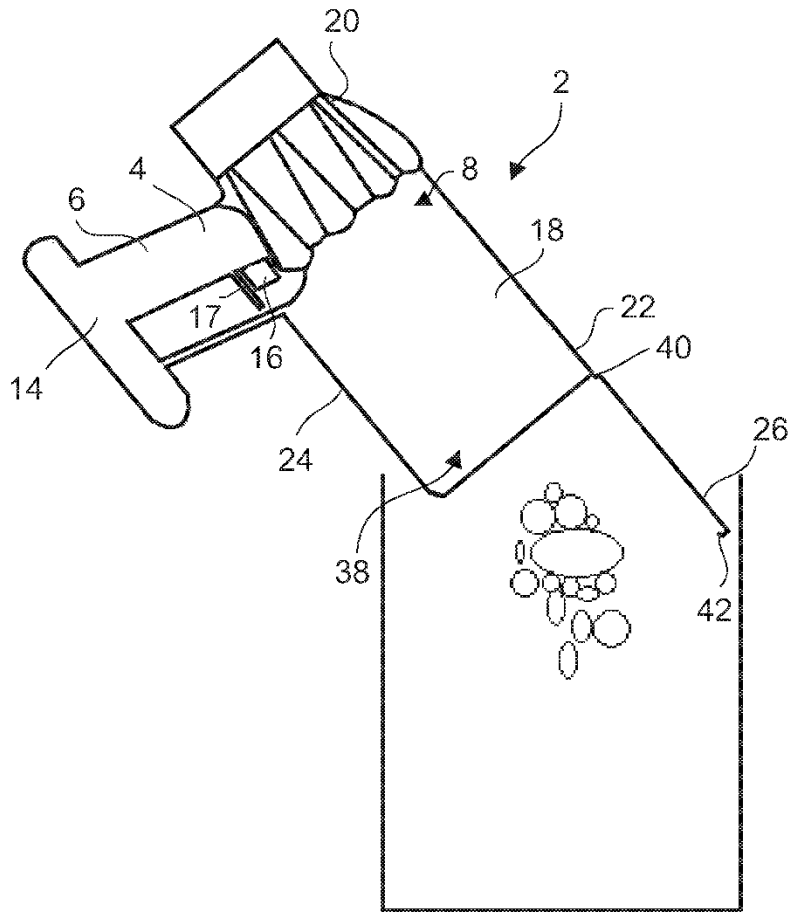


Figure 8

Ex. 1001, Fig. 8.

21. The '687 Patent has one independent claim (claim 1), which reads as follows:

1. A handheld vacuum cleaner comprising:

a handle by which the vacuum cleaner is supported during normal use;

a cyclonic separating unit having a longitudinal axis and a dirt collector at one end of the cyclonic separating unit, the cyclonic

separating unit comprising an end wall having a closed configuration in which dirt is retained within the dirt collector by the end wall and an open configuration for the removal of dirt from the dirt collector, wherein the end wall is movable relative to the longitudinal axis and, when the end wall is in the closed configuration, the longitudinal axis extends through a region bounded by a perimeter of the end wall, wherein the handle has a pistol grip configuration in which the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 85 degrees and not greater than 140 degrees between a handle axis and the longitudinal axis of the cyclonic separating unit, and wherein the handle axis and the longitudinal axis intersect within the vacuum cleaner.

Ex. 1001, cl. 1.

C. Prosecution History

22. Below is my understanding of the prosecution history of the '687 Patent.

23. The '687 Patent claims priority to a UK patent application filed September 17, 2015 and the '687 Patent issued from an application filed September 19, 2016.

24. I understand that the Examiner issued two Office Actions rejecting certain claims of the pending application. The first Office Action rejected certain claims as anticipated or obvious in view of U.S. Patent Publication No. 2017/0071426 to Krebs. Ex. 1002, 257-269. I also understand that the Examiner

found that Krebs discloses the handle configuration as it was claimed in the originally filed application. *Id.*, 260-261. The applicant amended the claims to overcome this rejection by further requiring the handle have two axes that intersect *within the vacuum cleaner*. *Id.*, 199.

25. The second Office Action rejected certain claims as anticipated or obvious in view of U.S. Patent Publication No. 2016/0174787 (“Conrad ’787”). *Id.*, 184-192. I also understand that the Examiner found that Conrad ’787 discloses the handle configuration with the additional limitation that was added in response to the first Office Action. *Id.*, 187-188. The applicant amended the claims to overcome this rejection by requiring a dustbin configuration, and specifically that: “at least part of the end portion moves across the longitudinal axis when the end portion moved from the closed configuration to the open configuration.” *Id.*, 176. The applicant’s amendment suggests that both the Examiner and the applicant agreed that the handle configuration as it was claimed did not overcome the art of record, such as Conrad ’787.

26. I understand that even with that amendment, the application was not in condition for allowance. Instead, the Examiner further amended the claims before issuing the application. *Id.*, 33-38. The Examiner amended claim 1 to recite: “wherein the end wall is movable relative to the longitudinal axis and, when the end wall is in the closed configuration, the longitudinal axis extends through a region

bounded by a perimeter of the end wall.” *Id.*, 34-35. This additional limitation appears to be an attempt to distinguish the claimed invention over the prior art.

D. Priority Date

27. I have been asked to assume that the ’687 Patent is entitled to claim priority to UK patent application filed September 17, 2015.

E. Challenged Claims

28. I understand that Petitioners are challenging the validity of claims 1–4, 8 and 10 of the ’687 Patent in the Petition for *Inter Partes* Review to which this Declaration will be attached. The claims being challenged are reproduced in Appendix C.

IV. SUMMARY OF THE INVALIDITY GROUNDS AND PRIOR ART

A. Invalidity Grounds

29. Based on my review and analysis of the materials cited herein, my opinions regarding the understanding of a POSITA in the 2015 timeframe, and my training and experience, it is my opinion that the challenged claims of the ’687 Patent are invalid based on at least the following grounds:

Grounds	Claims	Statutory Basis	Prior Art
1	1–4, 8 and 10	§ 103 (Obviousness)	Conrad ’630 (Ex. 1004) and Conrad ’787 (Ex. 1006)
2	1–4, 8 and 10	§ 103 (Obviousness)	Conrad ’630 (Ex. 1004) and Dyson (Ex. 1007)
3	1–4, 8 and 10	§ 103 (Obviousness)	Matsumoto (Ex. 1005) and Conrad ’787 (Ex. 1006)

4	1–4, 8 and 10	§ 103 (Obviousness)	Matsumoto (Ex. 1005) and Dyson (Ex. 1007)
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30. I reviewed the file history for the '687 Patent and its parent applications and am not aware of Conrad '630, Matsumoto, or Dyson discussed in any Office Action or in the prosecution history generally. Moreover, while Conrad '787 was discussed during prosecution, Ex. 1002, 184-192, it was discussed in a different context than it is here.

B. U.S. Patent Publication No. 2011/0314630 (“Conrad ’630”) (Ex. 1004)

31. Conrad '630 published on December 29, 2011.

32. Conrad '630 discloses a handheld vacuum cleaner 100 shown below. The handheld vacuum cleaner 100 has a with a handle 102, a cyclone 122 (yellow) with a dirt collection chamber 124 having a first portion 148 (green) and a front wall 158 (purple). Ex. 1004 at ¶¶ Abstract, 52, 70, 74, 76-77. Conrad '630 also explains that the handle 102 (shown below on the top of the vacuum) “may be provided elsewhere on the vacuum cleaner 100, for example at the rear 110 and may be of any design.” *Id.*, ¶52.

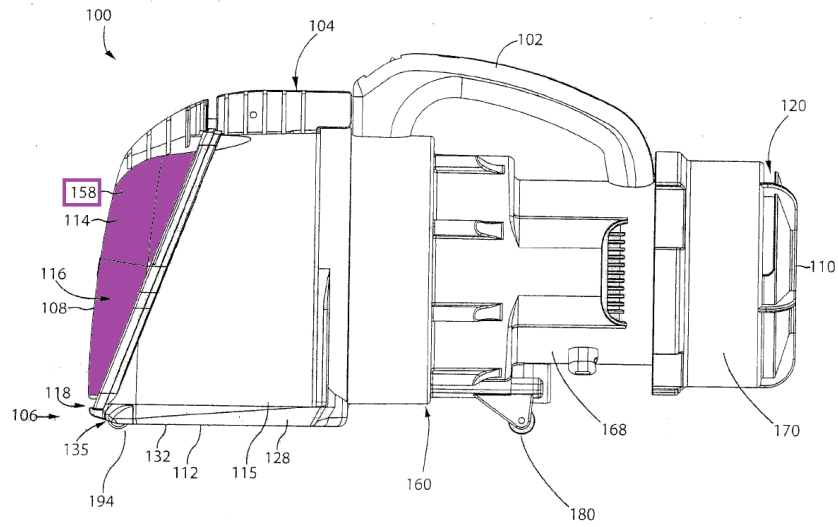


Fig. 1

Ex. 1004, Fig. 1 (annotated).

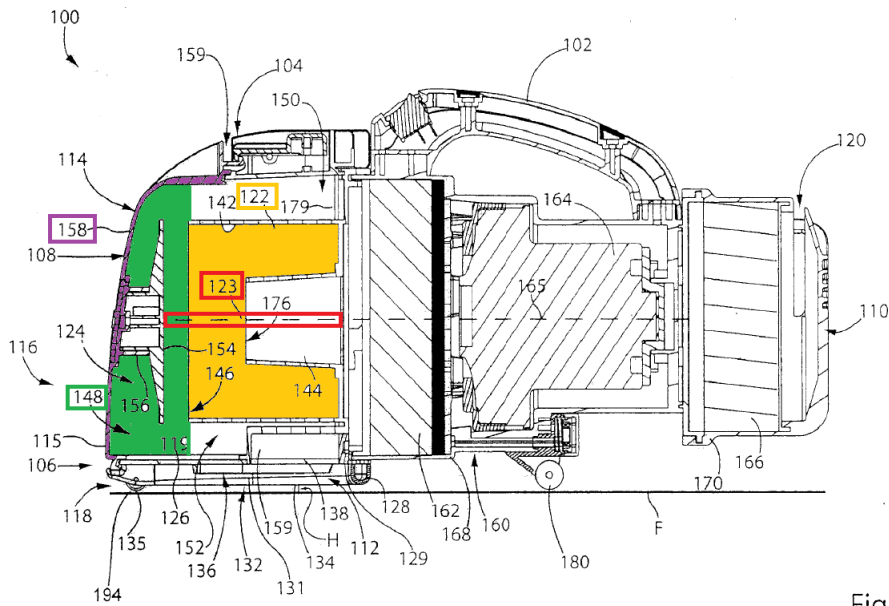


Fig. 6

Ex. 1004, Fig. 6 (annotated).

33. Handheld vacuum cleaner 100 also has a nozzle 112 with an opening 138 (green) positioned on the bottom thereof. *Id.*, ¶¶56, 69, Fig. 7a. The bottom thereof has optional wheels 135, which are arranged to be in contact with a surface

to be cleaned. *Id.*, ¶¶65, 67-70. During use of the vacuum cleaner 100, the person using the vacuum would push the vacuum cleaner 100 using handle 102 over the surface (*e.g.*, a floor, couch, bedding, etc.) to be cleaned.

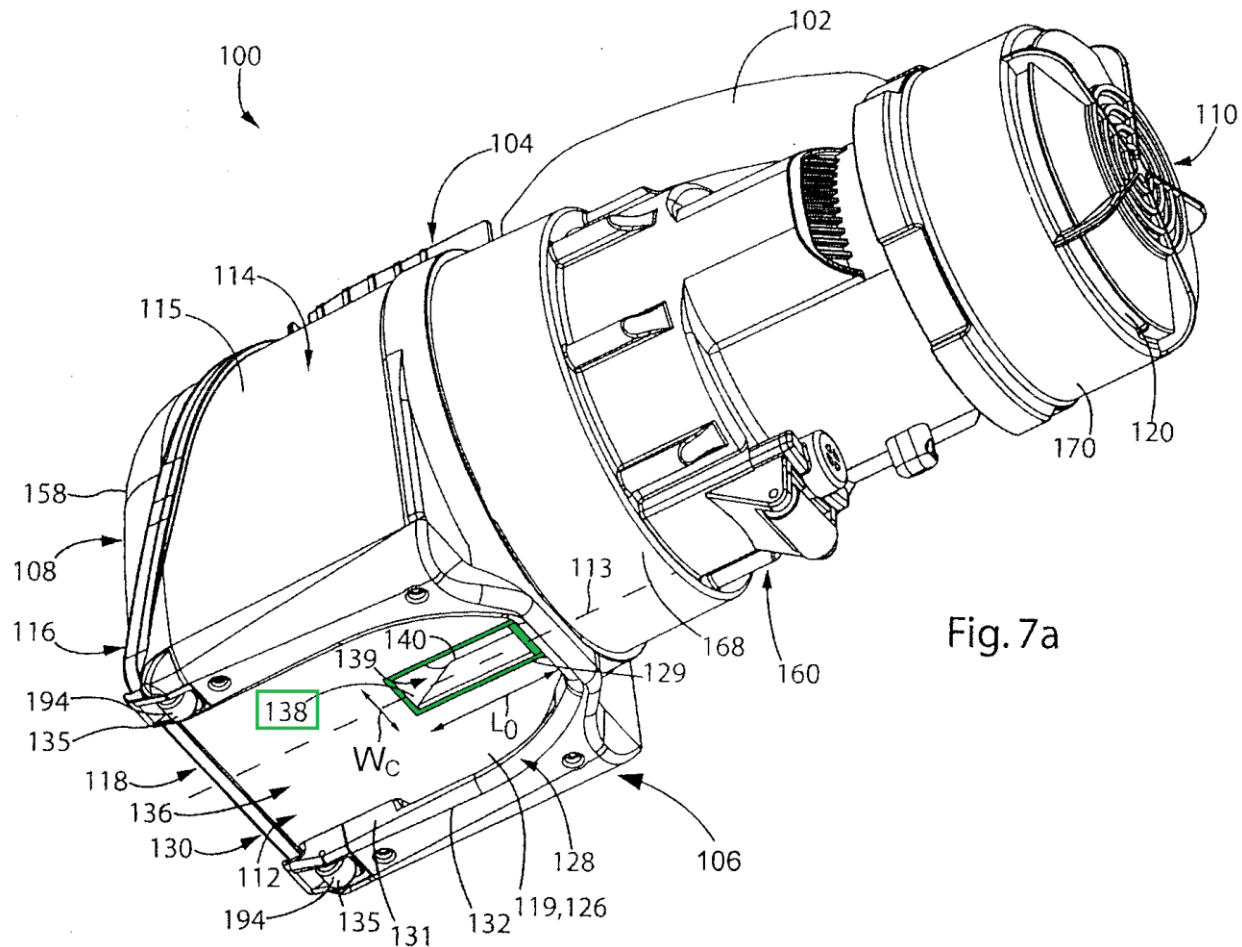


Fig. 7a

Ex. 1004, Fig. 7a (annotated).

34. The dirt collection chamber 124 of Conrad '630's vacuum cleaner can be emptied by pivoting front wall 158 (purple), as shown below. The front wall 158 is movable relative to the longitudinal axis (red). Ex. 1004, ¶¶ Abstract, 52, 70, 74, 76-77, Fig. 5.

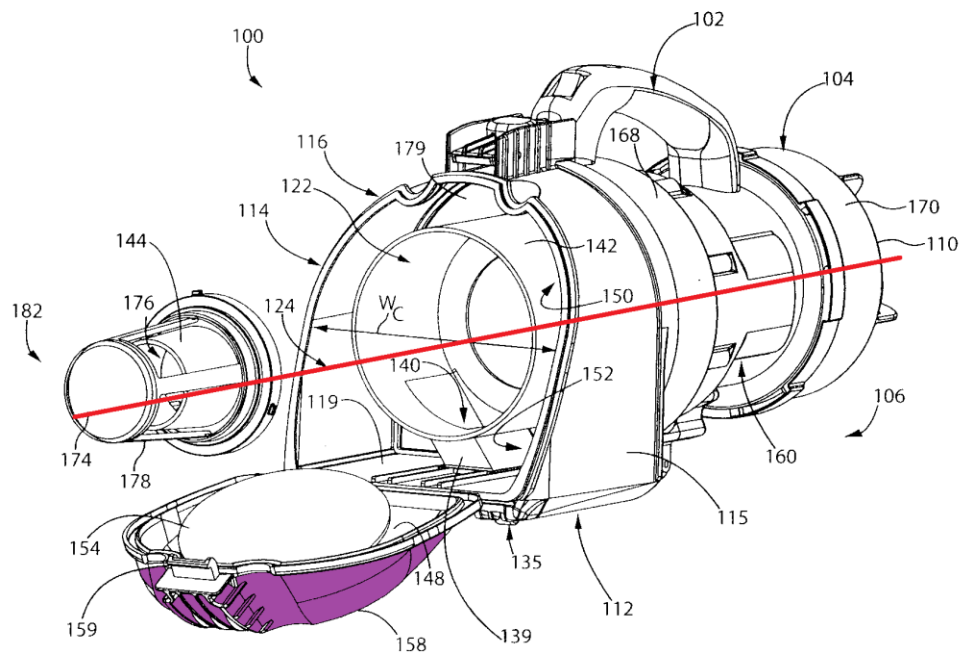


Fig. 5

Ex. 1004, Fig. 5 (annotated).

35. Conrad '630 explains some advantages associated with its dirt collection chamber, including:

According to one broad aspect, a hand surface cleaning apparatus is disclosed having a simplified structure for emptying the surface cleaning apparatus. The hand surface cleaning apparatus is preferably a cyclonic surface cleaning apparatus wherein the dirt chamber is removable as a sealed unit from the surface cleaning apparatus. The dirt chamber may be part of a cyclone (e.g., the lower portion of a cyclone chamber) and removable with the cyclone. Alternately, the dirt chamber may be external to the cyclone chamber and removable from the hand surface cleaning apparatus by itself. In either case, the dirt collection chamber is closed (other than, e.g., an air inlet, an air outlet,

a dirt outlet) when removed from the hand surface cleaning apparatus. The dirt chamber may be openable, such as by an openable or removable lid or door. Accordingly, dirt collected in the chamber may be transported to a disposal site (e.g., a garbage can) without the dirt being dispersed as the dirt collection chamber is conveyed to the disposal site.

A further advantage of this design is that the hand surface cleaning apparatus may have a simplified structure. By providing the nozzle as part of the dirt collection chamber, and preferably as part of a cyclone unit, such an assembly may be removably mounted to a motor housing. Accordingly, a skeleton or backbone to which individual components are mounted is not required and is preferably not used. Such a design may be lighter, permitting a user to use the hand surface cleaning apparatus for a longer continuous period of time.

Ex. 1004, ¶¶6, 19.

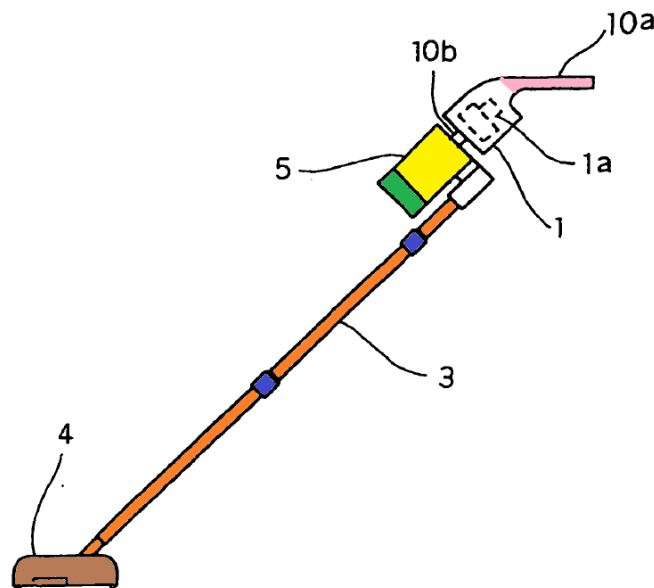
36. Having reviewed Conrad '630 in detail, it is my opinion that a POSITA would have been able to implement the disclosure of Conrad '630 with little or no experimentation. For example, Conrad '630 provides sufficient detail regarding its vacuum cleaner that a POSITA would have been able to construct the appliance without undue experimentation.

C. EP Publication No. 1,199,023 (“Matsumoto”) (Ex. 1004)

37. Matsumoto published on April 24, 2004.

38. Matsumoto discloses a vacuum cleaner, for example, as shown in Figure 25 below. The vacuum cleaner has a body 1 coupled to a handle 10a (pink) and a cyclone dust collecting part 5, having a first dust collecting chamber (yellow) and a second dust collecting chamber 8 (green). Ex. 1005, Figs. 25, 1, and 2, ¶60. The body is connected to a “suction port body 4” (brown) using a connection pipe 3 (orange). *Id.*, ¶¶25, 27. Suction air passes through a first dust collecting chamber 7 (yellow) of the cyclone 5. *Id.*, ¶43. Fine dust particles are separated and collected in dust collecting chamber 8 (green). *Id.*

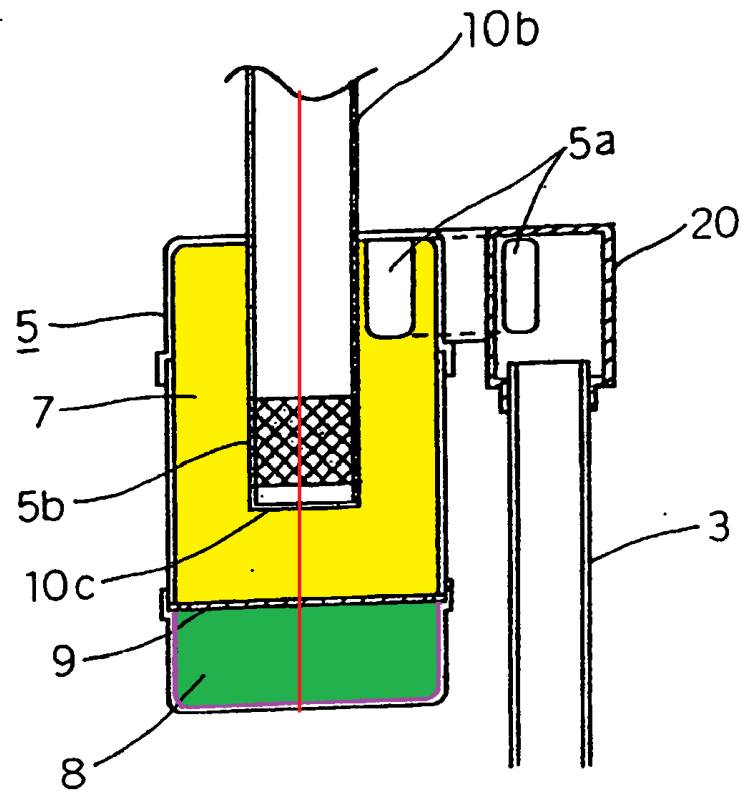
FIG. 25



Ex. 1005, Fig. 25 (annotated).

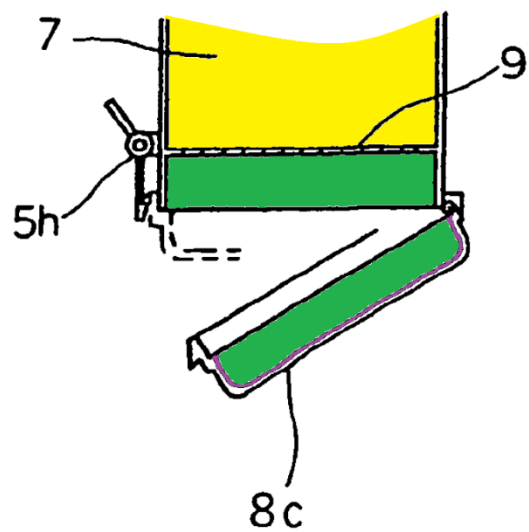
39. The dust collection chamber 8 (green) has a lid 8c (purple) which pivots open and closed, as shown below in Figures 3 and 18. This allows for cleaning the dust collecting chamber 8 (green). *Id.*, Figs. 3, 18, ¶45. The lid 8c moves relative to the longitudinal axis (shown in red) of the cyclone 5. This makes disposal of refuse easier. *Id.*, ¶46, see also, *id.*, ¶9, 17.

FIG. 3



Ex. 1005, Fig. 3 (annotated).

FIG. 18



Ex. 1005, Fig. 18 (annotated).

40. Having reviewed Matsumoto in detail, it is my opinion that a POSITA would have been able to implement the disclosure of Matsumoto with little or no experimentation. For example, Matsumoto provides sufficient detail regarding its vacuum cleaner that a POSITA would have been able to construct the vacuum without undue experimentation.

D. U.S. Patent Publication No. 2016/0174787 (“Conrad ’787”) (Ex. 1005)

41. Conrad ’787 published on June 23, 2016, from a non-provisional application filed on August 10, 2015.

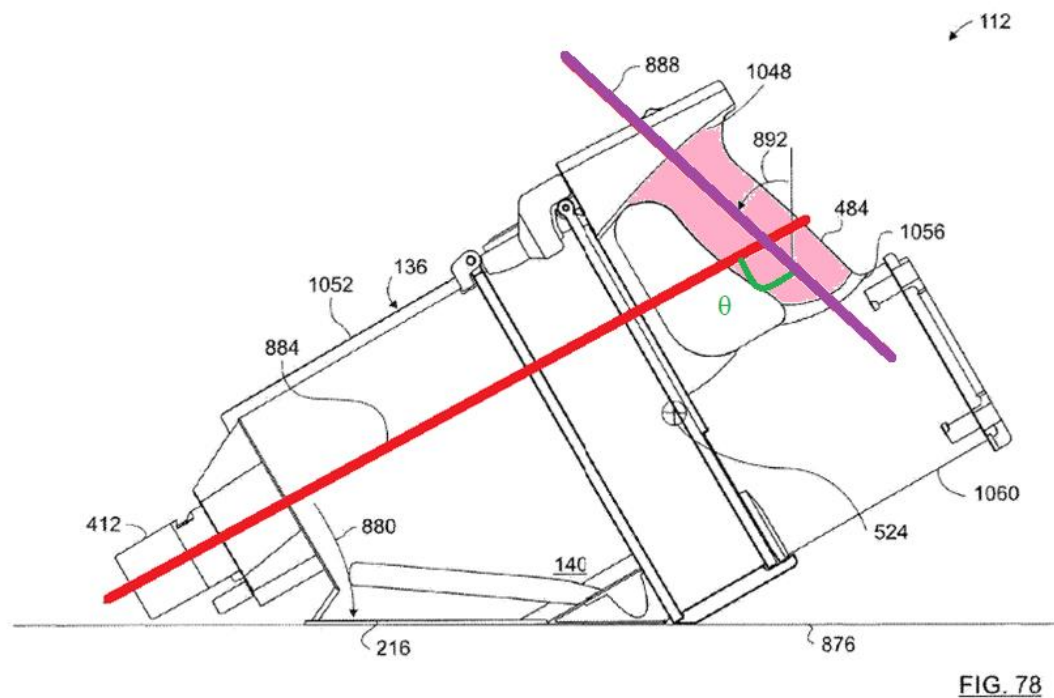
42. Conrad ’787 discloses a handheld vacuum 112 (referred to as handvac 112) that can be converted into an upright vacuum. Ex. 1006, ¶¶185-188, 312, 314, 317, 329, Figs. 1-21, 78 and 96. As shown in Figure 78 below, the handvac 112 has a handle 484 (pink) which is in a “pistol grip configuration,” like the handle of the ’687 patent. Handvac 112 has a cyclone 136 to separate dirt, and a dirt collection chamber to collect dirt. *Id.*, ¶191.

43. The handle 484 (pink) extends along a handle axis 888 (purple), and the cyclone extends along a nozzle axis 884 (red). The handle and the nozzle axes form an angle which is illustrated below in green.

44. Conrad ’787 also discloses that “[a]ngle 880 may be an acute angle which may be between 10 and 80 degrees, and preferably between 25 and 65

degrees, more preferably between 35 and 55 degrees or between 20 and 40 degrees,” and “angle 892 is an acute angle of between 10 and 80 degrees, more preferably between 20 and 70 degrees and most preferably between 30 and 60 degrees.” As I explain below (Ground 1, Element 1[d]), that angle range falls within the range claimed by the ’687 patent.

45. I also measured the angle (green) shown in Conrad ’787’s Figure 78 using a protractor and found it to be approximately 105 degrees.



Ex. 1006, Fig. 78 (annotated).

46. Conrad ’787 explains that this handle configuration can be “comfortably operated in an orientation that does not require an application of torque

by the user's hands when the handvac 112 is held by handle 484," because "the center of gravity 524 of the handvac 112 is aligned vertically below the user's hand." *Id.*, ¶314. Based on my experience, I believe that a POSITA would have recognized the shape and configuration of the handle 848 (pink) provides superior comfort, and a more balanced grip, as compared with the handles of the vacuums provided in Conrad '630 and Matsumoto.

47. Having reviewed Conrad '787 in detail, it is my opinion that a POSITA would have been able to implement the disclosure of Conrad '787 with little or no experimentation. For example, Conrad '787 provides sufficient detail regarding its vacuum cleaner that a POSITA would have been able to construct the vacuum without undue experimentation.

E. Int'l Publication No. WO 2008/009888 ("Dyson") (Ex. 1006)

48. Dyson published on January 24, 2008.

49. Dyson discloses a handheld vacuum 10 that has a cyclonic separating apparatus 18 (yellow) is in communication with the suction conduit 14 and the suction opening 16. Ex. 1007, 3:11-14; Fig. 2. The vacuum 10 also has a handgrip 28 (pink) for manipulating the vacuum during use. *Id.*, 3:23-25. A flowpath extends from the suction opening 16, through the suction conduit 14 and into the cyclonic separating apparatus 18 along a longitudinal axis Y-Y (red). *Id.*, 3:21-23.

50. As shown in Figure 2 below, Dyson explains the configuration of the handgrip 28 as having a handle with an axis X-X (purple). *Id.*, 4:9-11. Dyson explains that “the axis X-X is arranged at an angle to the longitudinal axis Y-Y which is close to 90°. This arrangement feels comfortable for a user.” *Id.*, 4:27-29.

51. I measured the angle (green) shown in Dyson’s Figure 2 using a protractor and found it to be approximately 95 degrees.

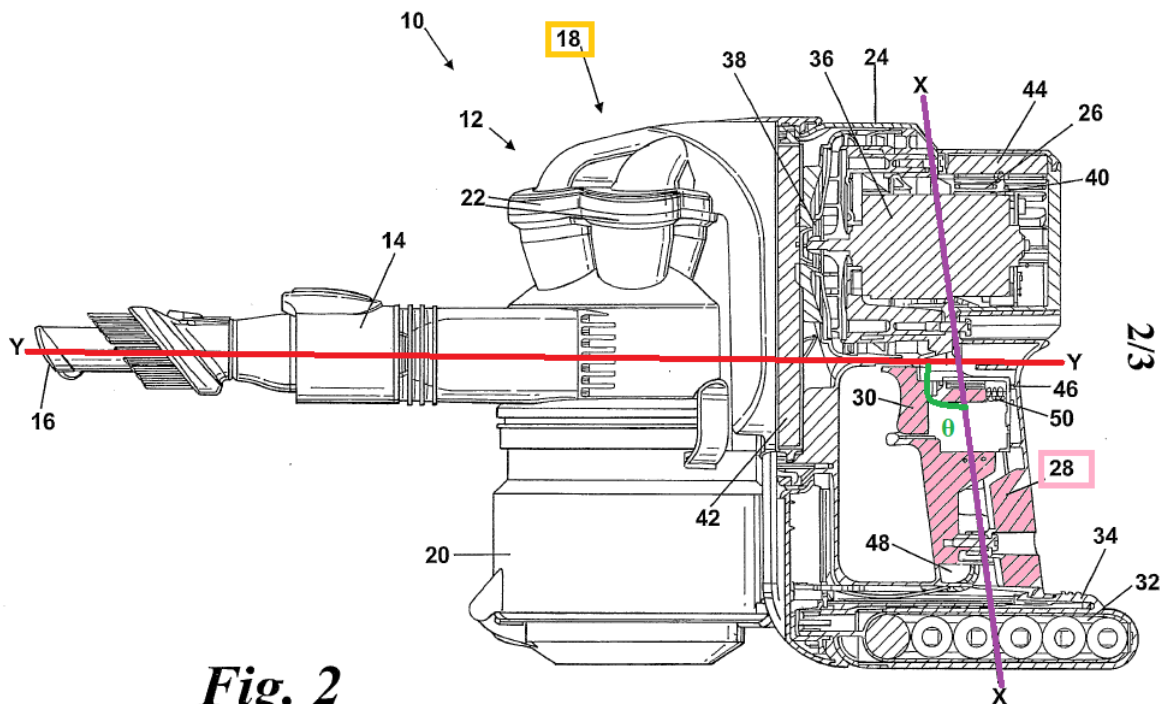


Fig. 2

Ex. 1007, Fig. 2 (annotated).

52. Dyson explains a number of advantages associated with its handgrip. For example, Dyson explains that:

- “In other words, the handgrip 28 is arranged to lie between the airflow generator 36 and the power source 32. In this embodiment, the axis X-X passes through at least a part of each of the airflow generator 36 and the power source 32. Further, the axis X-X of the handgrip 28 lies transverse to a longitudinal axis Y-Y of the suction conduit 12. The longitudinal axis Y-Y passes through the suction opening 16. In this embodiment, the axis X-X is arranged at an angle to the longitudinal axis Y-Y which is close to 90°. This arrangement feels comfortable for a user.” *Id.*, 4:21-29.
- “The transverse arrangement of the longitudinal axis Y-Y of the suction conduit 14 with respect to the axis X-X of the handgrip 28 results in the suction conduit 12 forming a substantially straight extension of the user's forearm when the user's wrist is essentially straight. This arrangement feels comfortable for the user, especially when the hand held vacuum cleaner 10 is used for a period of time. Further, the location of the longitudinal axis Y-Y of the suction conduit 14 close to the centre of the hand-held vacuum cleaner 10 means that the longitudinal axis Y-Y of the suction conduit 14 will be coincident, or close to, the longitudinal axis of rotation of the user's forearm. This results in little or no axial displacement of the suction opening 14 when the hand-held vacuum cleaner 10 is rotated.” *Id.*, 6:13-23.

- “In use, a user grips the handgrip 28 to manipulate the hand-held vacuum cleaner 10 in use. When the user squeezes the trigger switch 30, the airflow generator 36 operates. The user must maintain pressure on the trigger switch 30 in order to keep the airflow generator 36 operating. This means that the user is likely to release the trigger switch 30 when he or she does not require a cleaning action, e.g. when moving from one room to another. If the user releases the trigger switch 30, the spring 50 will bias the trigger switch 30 to the off position and operation of the airflow generator 36 will cease. This reduces unnecessary use of the airflow generator 36 and results in a saving of battery life and motor life.” *Id.*, 6:4-11.

53. Moreover, Dyson discloses specific ranges for angle θ' (blue), which is equal to $180 - \text{Angle } \theta$ (green). Ex-1007, 2:21-23 (“Preferably, the elongate handle lies at an angle to the longitudinal axis in the range of 80 to 90°. More preferably, the elongate handle lies at an angle to the longitudinal axis which is close to a right angle.”); 4:25-28 (“The longitudinal axis Y-Y passes through the suction opening 16. In this embodiment, the axis X-X is arranged at an angle to the longitudinal axis Y-Y which is close to 90°. This arrangement feels comfortable for a user.”). Accordingly, Dyson discloses that angle θ (green) is preferably in the range of 100 to 90 degrees. As explained below (Ground 2, Claim Element 1[d]), Dyson discloses a range for angle θ (green) that falls within the range claimed in claims 1 and 2.

54. Like with Conrad '787, based on my experience, I believe that a POSITA would have recognized the shape and configuration of the handgrip 28 (pink) provides superior comfort, and a more balanced grip, as compared with the handles of the vacuums provided in Conrad '630 and Matsumoto.

55. Having reviewed Dyson in detail, it is my opinion that a POSITA would have been able to implement the disclosure of Dyson with little or no experimentation. For example, Dyson provides sufficient detail regarding its vacuum cleaner that a POSITA would have been able to construct the vacuum without undue experimentation.

V. LEVEL OF ORDINARY SKILL IN THE ART

56. I have analyzed the '687 Patent and determined that the field of the patent is vacuum cleaners. See Ex. 1001, Abstract. In my opinion, and based on my experience, a POSITA in the field of vacuum cleaners around September 2015, would have had a Bachelor's degree in Mechanical Engineering (or an equivalent discipline) or equivalent work experience, and at least one year's worth of experience in research, design and/or development related to vacuum cleaners (or other comparable mechatronic appliances or devices or industrial design). A POSITA may also have more education than a Bachelor's degree and less experience, or may have less education than a Bachelor's degree and more experience.

57. In the year 2015 timeframe, a POSITA would have known and had the skills necessary to:

- Design or implement a handheld vacuum cleaner system, including its known subparts such as a housing, a cyclonic separation system, a suction source, a dustbin, and a handle;
- Implement known techniques for improving comfort of the vacuum during use.
- Validate through standardized testing a wide variety of performance and reliability measures common for vacuum cleaners.

58. Based on my education and experience, I would have been at least one of ordinary skill in the art around October 2015.

VI. CLAIM CONSTRUCTION

59. For purposes of this *inter partes* review, I have considered the claim language, specification, and portions of the prosecution history, to determine the meaning of the claim language as it would have been understood by a POSITA at the time of the invention in the '687 Patent. I have applied the plain and ordinary meaning to a POSITA, in view of the specification, of each of the terms in the claims of the '687 Patent.

VII. INVALIDITY

60. Based on my review and analysis of the materials cited herein, my opinions regarding the knowledge and understanding of a POSITA in the 2015 timeframe, and my training and experience, it is my opinion that a POSITA would have found the challenged claims invalid in view of the references and combinations of references discussed below. The reasons for my conclusions are explained more fully below.

A. Ground 1: Claims 1–4, 8, and 10 Are Rendered Obvious by Conrad '630 in View of Conrad '787

61. As I explain below, Conrad '630 shows a handheld vacuum cleaner that has the dirt collector as was claimed in the '687 patent. Conrad '630 also discloses that the handle for its vacuum can be at the back of the vacuum. Ex. 1004,

¶52. Moreover, while Conrad '630 discloses one embodiment where handle 102 is mounted on an upper portion of vacuum cleaner 100 and further teaches that “handle 102 may be provided elsewhere on the vacuum cleaner 100, for example at the rear 110 and may be of any design,” it does not explicitly disclose a “pistol grip configuration” as claimed. Ex. 1004, ¶52. On the other hand, Conrad '787 discloses a handheld vacuum cleaner with a handle as claimed in the '687 patent.

62. In my opinion, a POSITA would have been motivated to combine Conrad '630 with Conrad '787. Both references show handheld vacuum cleaners by the same inventor. Moreover, Conrad '630 specifically says that its handle can be at the back of its vacuum, just like in Conrad '787.

63. In my opinion, as I explain below, the combination of Conrad '630 and Conrad '787 renders obvious claims 1–4, 8, and 10 of the '687 patent.

1. Motivation to Combine Conrad '630 and Conrad '787

64. A POSITA would have been motivated to combine Conrad '630 with Conrad '787. Specifically, a POSITA would have been motivated to use Conrad '787's handle with Conrad '630's vacuum.

65. *First*, a POSITA reviewing Conrad '630 would have been motivated to explore alternative handle configurations because of Conrad '630's expressed disclosure to move the handle 101 to other locations. Ex. 1004, ¶52 (explaining that “handle 102 may be provided elsewhere on the vacuum cleaner 100, for example at

the rear 110 and may be of any design.”). Moreover, a POSITA would have known in 2015 that since the date of Conrad ’630 in 2010, handle configurations that offered improved comfort were commonplace.

66. *Second*, a POSITA would have been motivated to combine the two references in a way that incorporate Conrad ’787’s handle 484 to the rear 110 of Conrad ’630’s handheld vacuum for a number of reasons, as explained below.

67. Conrad ’787, which is by the same inventor as Conrad ’630, discloses a handvac 112 with a handle “at the rear.” Ex. 1006, Fig. 78. Conrad ’787 also discloses that its handle is more comfortable. The advantages associated with Conrad ’787’s handle—such as improved comfort—would motivate the combination. For example, Conrad ’787 explains that:

- Its handle configuration allows a user to “operate handvac 112 during cleaning.” Ex. 1006, ¶314.
- This handle configuration can be “comfortably operated in an orientation that does not require an application of torque by the user’s hands when the handvac 112 is held by handle 484,” because “the center of gravity 524 of the handvac 112 is aligned vertically below the user’s hand.” *Id.* This is important for use of Conrad ’630 vacuum to clean surfaces that are not horizontal (*e.g.*, a drapery or upholstered furniture). Since the vacuum of Conrad ’630 is a handheld, it is more likely to be used to clean surfaces other than floors.

- Conrad '787 further explains that in “the illustrated embodiment, handle axis 888 of handle 484 extends at a (non-zero) forward angle 892 to the vertical (e.g., e.g. when bottom wall 216 is horizontal). This may provide a comfortable handle alignment for grasping by a user when picking up handvac 112, and when using handvac 112 for cleaning surfaces below the user’s elbows.” *Id.* at ¶317.

68. A POSITA would have therefore sought to take advantage of the improved handle configuration provided in Conrad '787 while retaining the advantages of Conrad '630's design, including its improved dustbin configuration. *See e.g.*, Ex. 1004, ¶¶6, 7; *see also* Section IV.B.

69. A POSITA would have also recognized that both handheld vacuums are designed to be used with attachments, like crevice tools. These were very common at the time. For example, the Dyson V6 pictured below was released before the claimed invention date and is shown with an attachment.



Dyson V6 (DC58) Handheld Vacuum Cleaner.

70. For example, Conrad '787 discloses that “handvac 112 may include an electrical connector 1116 for providing power to an upstream attachment (e.g. a surface cleaning head).” Ex. 006, ¶331.

71. Conrad '630 does not explicitly disclose its use with an attachment. However, another reference by the same inventor, showing exactly the same handheld vacuum as Conrad '630 shows how it can be used with an attachment. Ex. 1008, Fig. 3b (showing flexible hose 124 attached to attachment member 120 of a handheld vacuum cleaner 400), 11:50-52 (“[F]lexible hose 124 serves as an extended cleaning attachment for the hand vacuum cleaner 400.”), 12:7-12 (“In addition to the auxiliary or accessory cleaning tool 112, the nozzle 412 may be directly connected to any one of a number of cleaning tools that have been provided with the an

appropriate attachment member, including wands, brushes, crevasse tools and other hoses.”); *see also* Figs. 6-10.

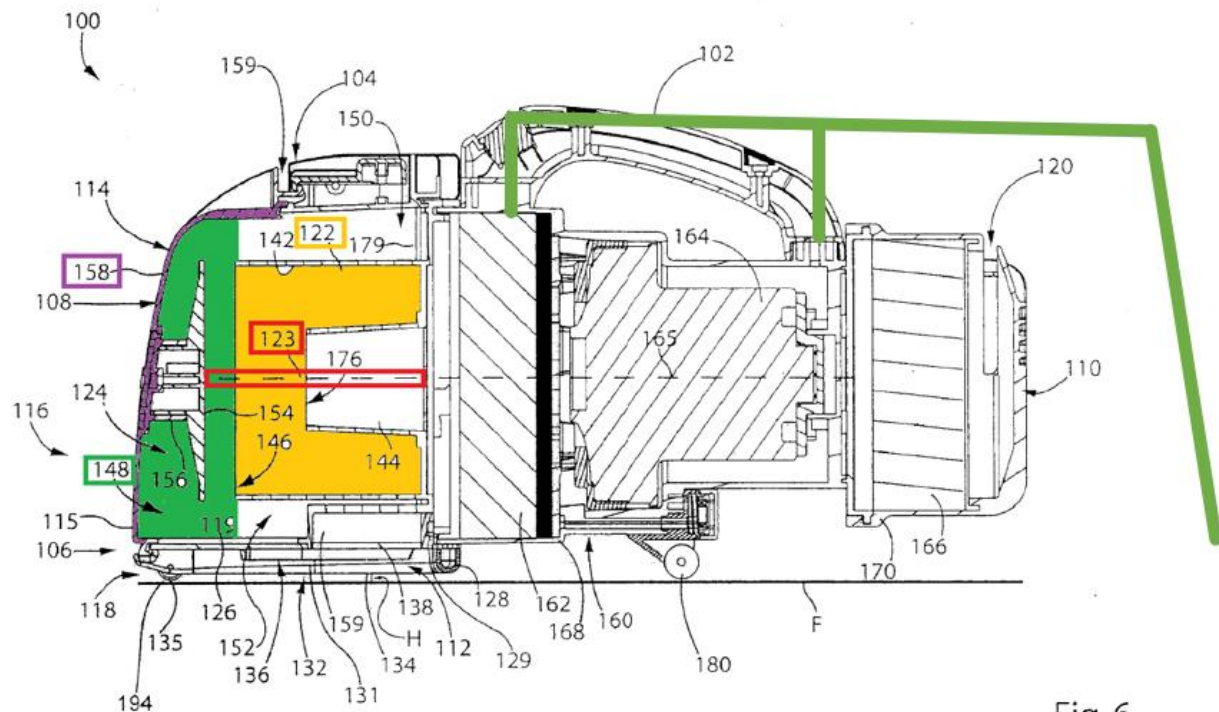
72. As such, both vacuums are designed to be used with attachments. A POSITA would have recognized additional advantages associated with providing the handle at the rear, including that the user will have a better grip and more comfort when using the handheld vacuum with an attachment, which would allow more flexibility in using the handheld vacuum with an attachment for different types of cleaning.

73. Moreover, a POSITA would wish to retain the advantages of Conrad ’630’s design, such as its improved dustbin configuration. Ex. 1004, ¶¶6, 7.

74. As such, a POSITA would have therefore been motivated to combine the two references in a way that incorporates the teachings of Conrad ’787’s about its handle 484 and relocating the handle to the rear 110 of Conrad ’630’s handheld vacuum. That means a POSITA would have considered Conrad ’787’s teachings about the shape and angle of the handle and used those teachings to design a handle for the vacuum shown in Conrad ’630.

75. *Third*, a POSITA would have had a reasonable expectation of success in relocating the handle to the back of vacuum cleaner 100. A POSITA would simply attach Conrad ’787’s handle 484 (pink) to the rear of Conrad ’630, as instructed by Conrad ’630. Ex. 1004 at ¶52. This location would allow the user to

push the vacuum cleaner forward over the surface to be cleaned easily. Specifically, the vacuum cleaner would be well suited for surfaces like couches and bedding, which are more easily cleaned using a handheld vacuum as opposed to a stick or upright vacuum. Moreover, while Conrad '630 explains that “clean air outlet 120 is preferably at the rear 110 of the cleaner 100,” (*id.*, ¶54), the clean air outlet 120 is on top of the vacuum 100 towards the rear (*id.*, Fig. 4) and would not interfere with the new location of the handle. In any event, it would have been a simple design choice for a POSITA to add additional air outlets on the side towards the rear of the vacuum to direct airflow away from the location of the new handle. For example, a POSITA could have designed a handle that attaches to the vacuum cleaner of Conrad '630 at the same location that the current handle attaches, and which extends to the rear of the vacuum cleaner and then forms a pistol shaped handle, which is sloped relative to the longitudinal axis 123 (red) at an angle consistent with the teachings of Conrad '787 (which is within the range claimed by claims 1 and 2 of the '687 patent. As an example, a quick sketch that shows such a handle arrangement is provided below.



Mockup of Figure 6 of Conrad '630 to show an alternative design of the handle consistent with the teachings of Conrad '630 and Conrad '787.

76. A POSITA could have designed other handles that attach to the vacuum cleaner of Conrad '630 and which incorporate the teachings of Conrad '787. Such vacuum cleaners would also fall within the scope of the challenged claims. A few additional sketches showing alternative designs are shown below.

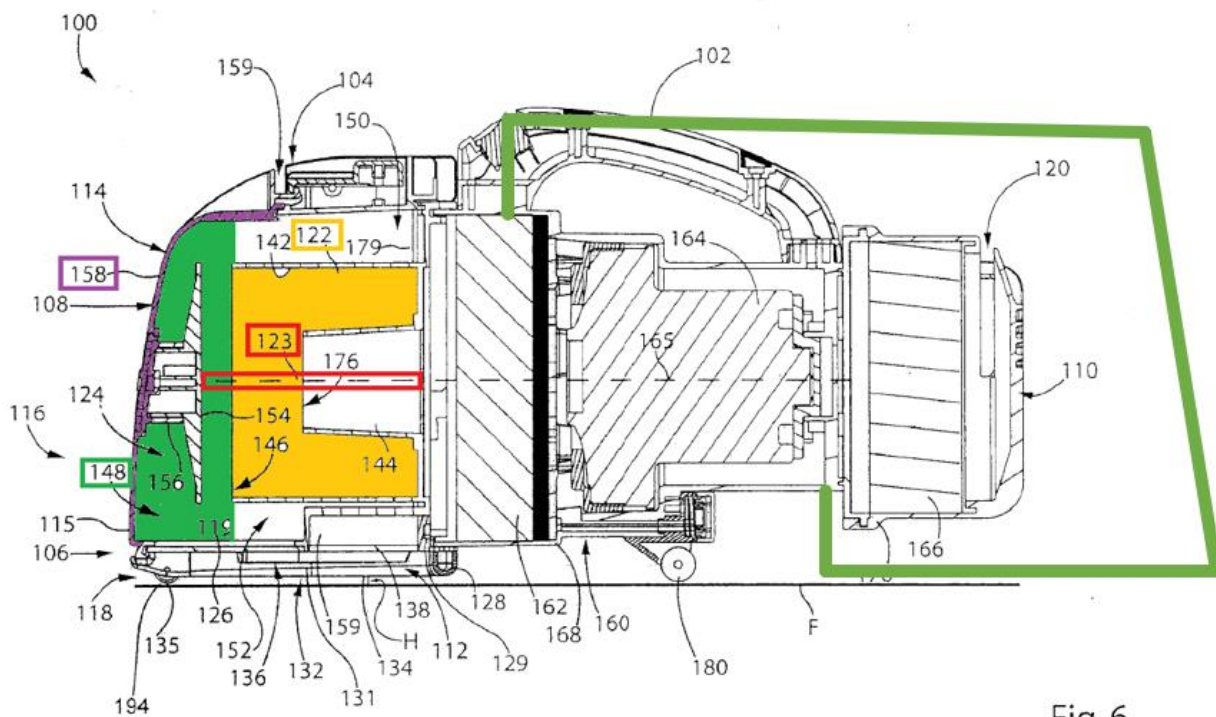


Fig. 6

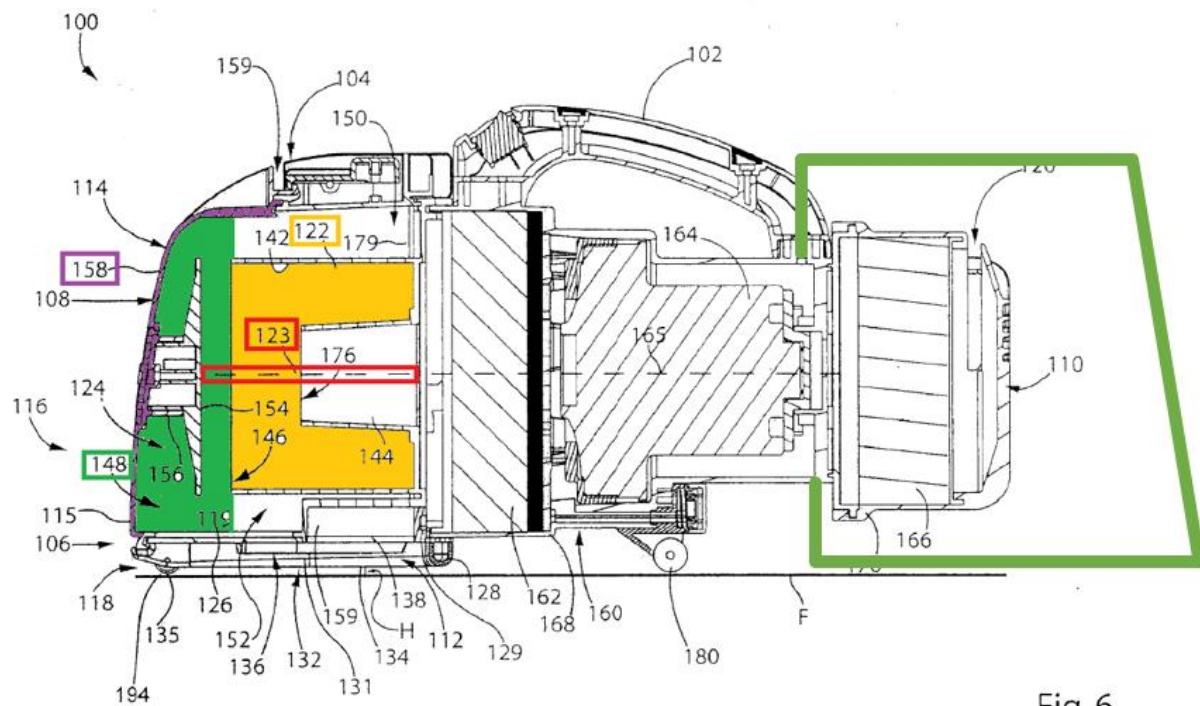
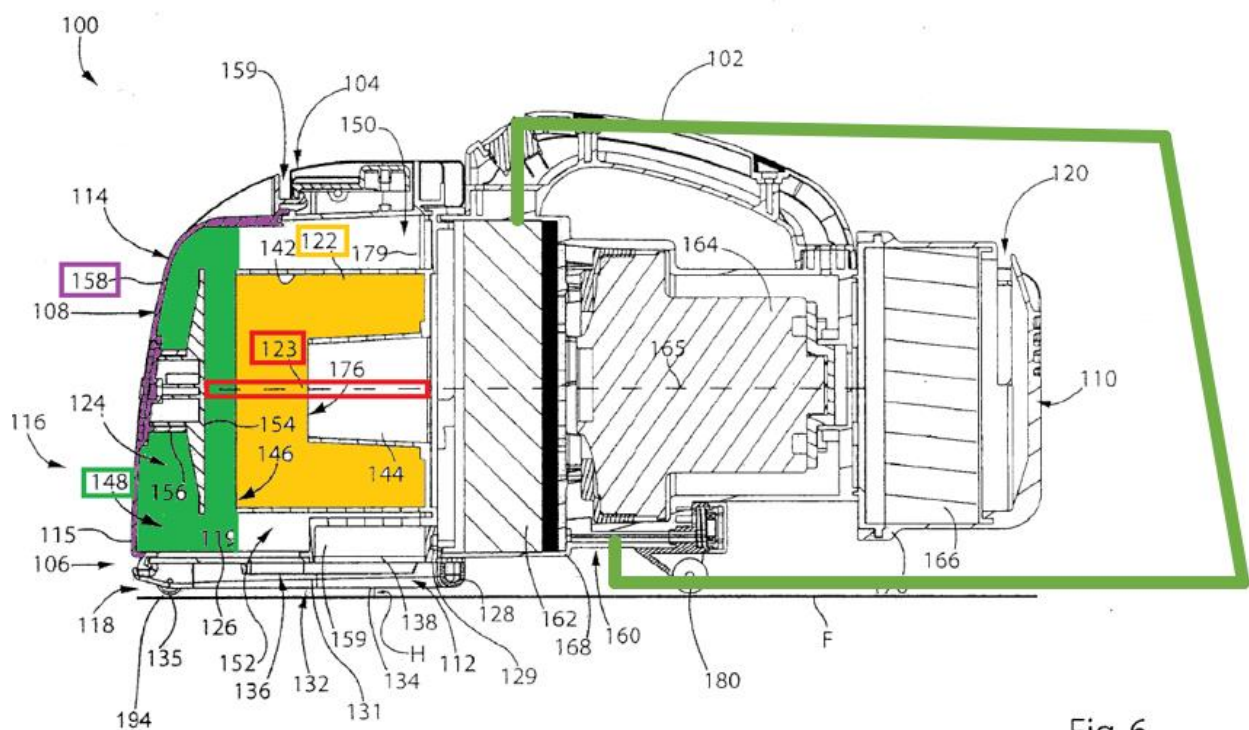


Fig. 6



2. Independent Claim 1

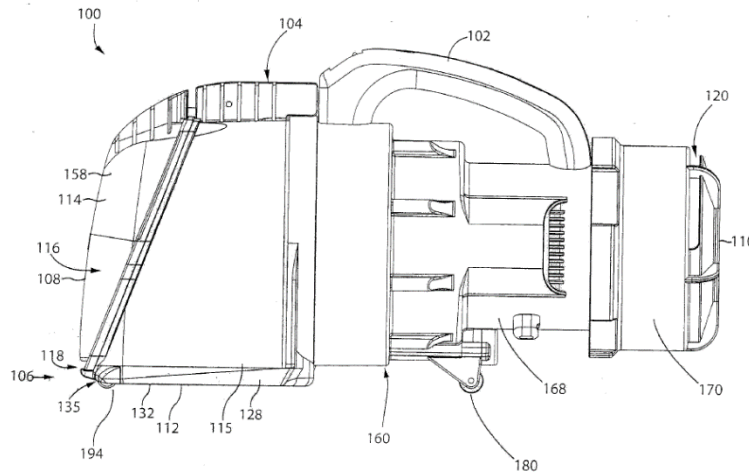
77. It is my opinion that limitations of claim 1 are rendered obvious by Conrad '630 in view of Conrad '787.

1[pre] “A handheld vacuum cleaner, comprising”

78. I understand that a preamble generally does not state a claim limitation. However, to the extent the preamble limits claim 1, it is my opinion that the limitation is disclosed and taught by Conrad '630.

79. Conrad '630 discloses a handheld vacuum cleaner 100. Ex. 1004, Abstract; ¶6 (“According to one broad aspect, a hand surface cleaning apparatus is disclosed having a simplified structure for emptying the surface cleaning

apparatus.”); ¶52 (“The vacuum cleaner 100 is a hand vacuum cleaner, and is movable along a surface to be cleaned by gripping and maneuvering handle 102.”); Figs. 1-8.



Ex. 1004, Fig. 1.

80. Similarly, Conrad '787 discloses a handheld vacuum cleaner, referred to as “handvac 122” having a handle 484. Ex. 1006, ¶¶185, 312, 314, 316, Figs. 78, 96.

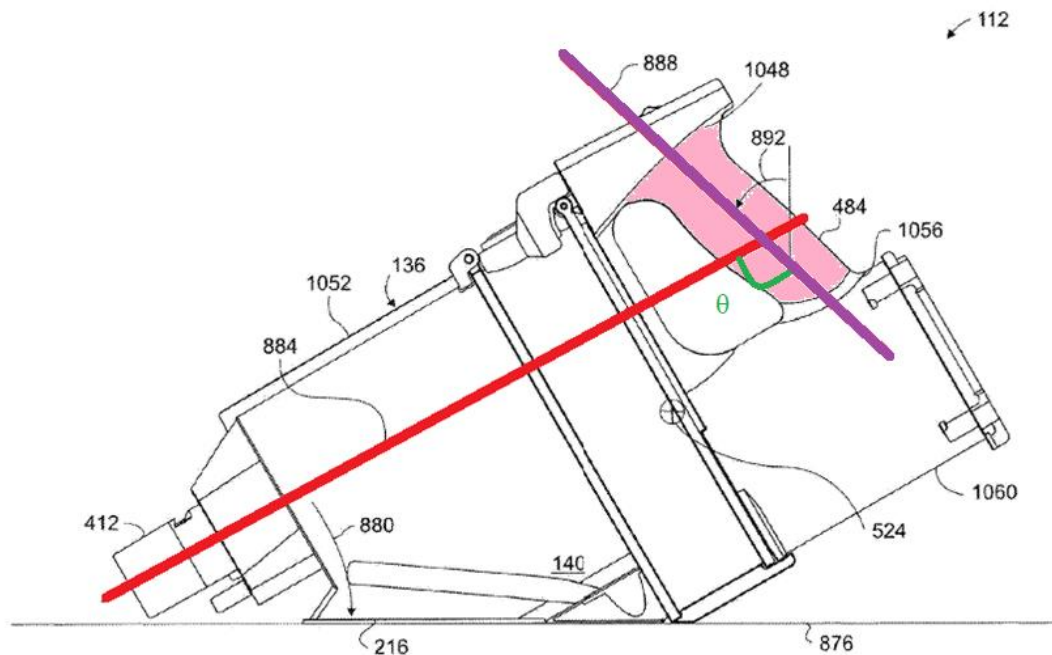


FIG. 78

Ex. 1006, Fig. 78 (annotated).

[1a] “a handle by which the vacuum cleaner is supported during normal use;”

81. It is my opinion that Conrad '630 discloses this limitation.

82. Conrad '630 discloses that vacuum 100 is supported by handle 102 during normal use. Ex. 1004, ¶52 (“The vacuum cleaner 100 is a hand vacuum cleaner, and is movable along a surface to be cleaned by gripping and maneuvering handle 102. . . In the example shown, handle 102 is provided at the upper portion 104. In alternate examples, handle 102 may be provided elsewhere on the vacuum cleaner 100, for example at the rear 110 and may be of any design.”); Figs. 1-8.

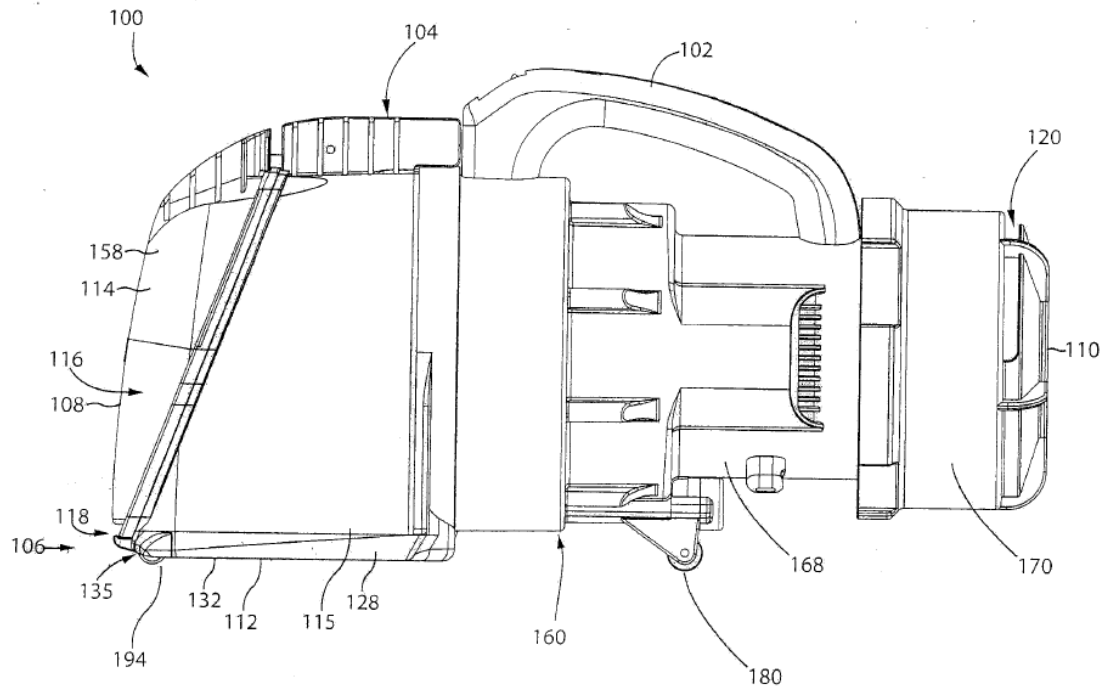


Fig. 1

Ex. 1004, Fig. 1.

83. Similarly, Conrad '787 discloses that handvac 122 has a handle 484 (pink). Ex. 1006, ¶¶185, 312, 314, 316, Figs. 78, 96. Thus, in my opinion, the combination of Conrad '630 and Conrad '787 also teaches the use of a handle in a handheld vacuum.

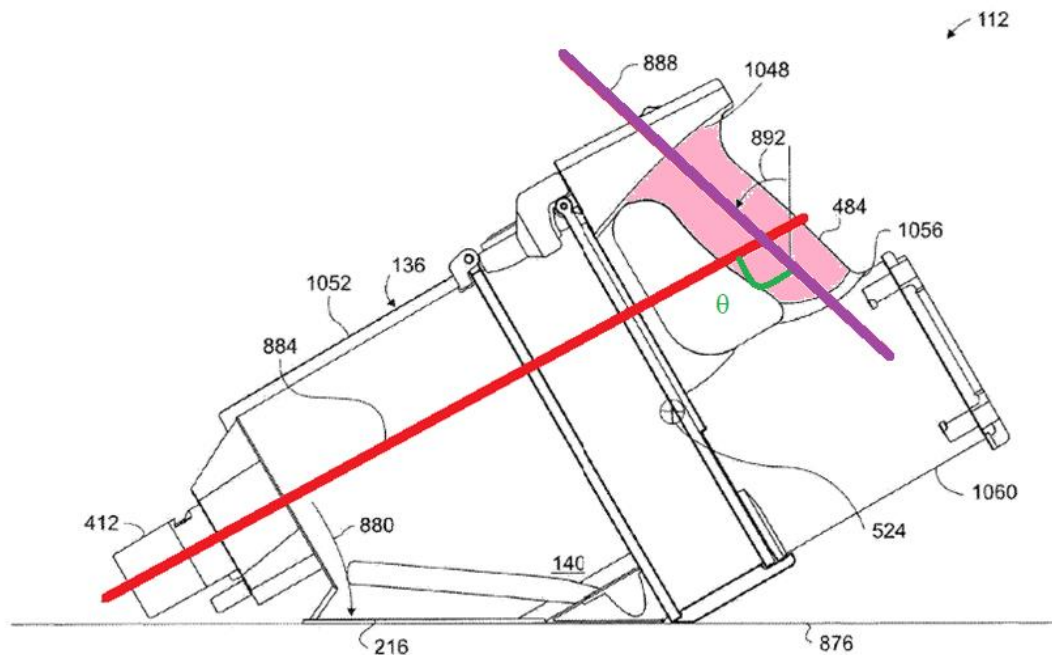


FIG. 78

Ex. 1006, Fig. 78 (annotated).

[1b] “a cyclonic separating unit having a longitudinal axis and a dirt collector at one end of the cyclonic separating unit,”

84. It is my opinion that Conrad '630 discloses this limitation.

85. Conrad '630 discloses a cyclone unit 114 with a cyclone 122 (yellow) (the claimed “cyclonic separating unit”) having a longitudinal axis 123 (red) and a dirt collector (i.e., the first portion 148 (green) of dirt collection chamber 124) at one end of the cyclone unit 114. Ex. 1004, Fig. 6 (annotated below); see also, *id.*, ¶70 (“The cyclone 122 extends along an axis 123, which, in the example shown, is preferably parallel to the nozzle axis, and preferably extends generally horizontally when cleaner 100 is in use and wheels 135 are seated on a surface.”); ¶74 (“In the

example shown, dirt collection chamber 124 preferably comprises two portions. A first portion 148 is provided immediately adjacent the dirt outlet 146, and is at the front 108 of the cleaner 100. A second portion 150 is concentric with the cyclone 122. A lower portion 152 of the second portion 150 is below the cyclone. As exemplified, nozzle 112 is positioned below first portion 148, and lower portion 152. Accordingly, dirt chamber 124 may comprise an annular chamber surrounding the cyclone 122.”).

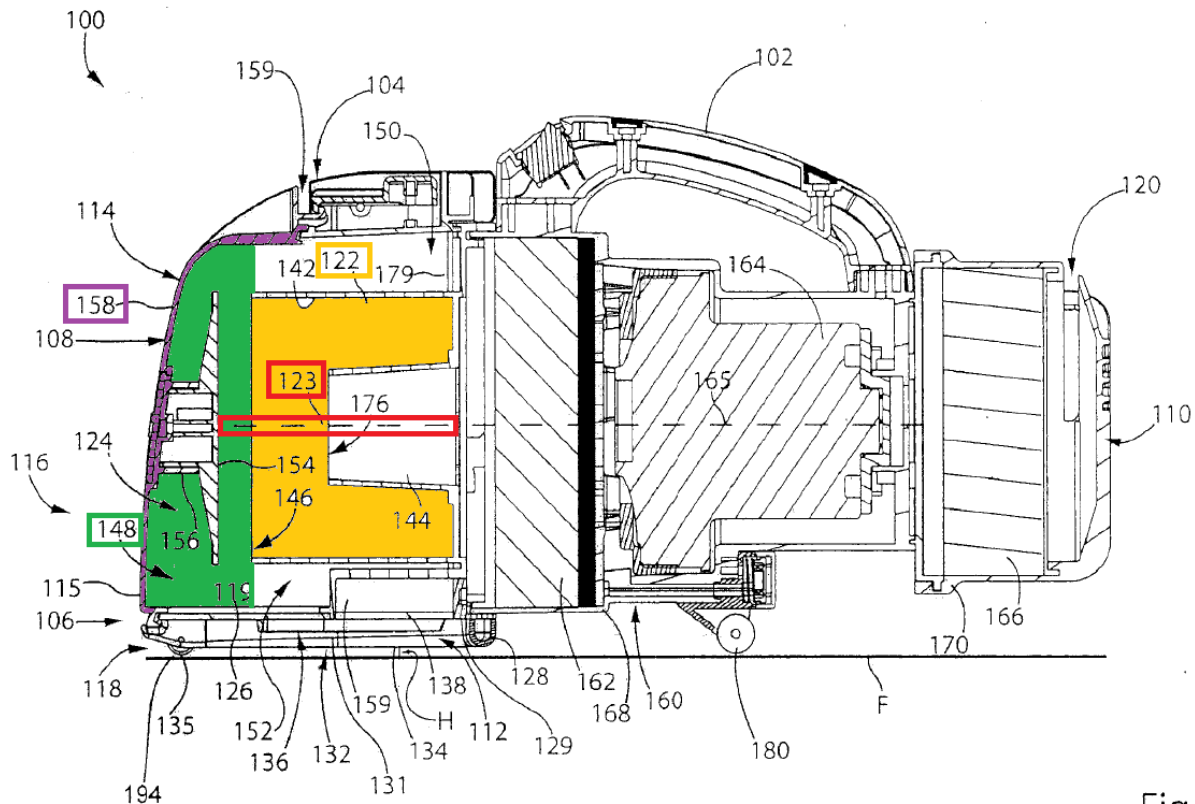


Fig. 6

Ex. 1004, Fig. 6 (annotated).

[1c] “the cyclonic separating unit comprising an end wall having a closed configuration in which dirt is retained within the dirt collector by the end wall and an open configuration for the removal of dirt from the dirt collector, wherein the end wall is movable relative to the longitudinal axis and, when the end wall is in the closed configuration, the longitudinal axis extends through a region bounded by a perimeter of the end wall,”

86. It is my opinion that Conrad '630 discloses this limitation.

87. Conrad '630 discloses that cyclone unit 114 having a cyclone 122 (yellow) (the claimed “cyclonic separating unit”) and comprising an end wall 158 (referred to in Conrad '630 as front wall 158) (purple) having a closed configuration (Ex. 1004, Figs. 1 and 6) in which dirt is retained within dirt collection chamber 124 (green) (the claimed “dirt collector”) by the end wall 158 (purple) and an open configuration (*id.*, Fig. 5) for the removal of dirt from the dirt collector, wherein the end wall 158 (purple) is movable relative to the longitudinal axis 123 (red) and, when the end wall is in the closed configuration, the longitudinal axis 123 (red) extends through a region bounded by a perimeter of the end wall (*id.*). The perimeter of the end wall is shown in purple below. *See also id.*, ¶76 (“Cyclone unit 114 may be emptied by any means known in the art. For example, one of the ends of the cyclone unit 114 may be openable. For example, one of the ends of the cyclone unit 114 may be openable. In an embodiment, an openable door may be positioned at the front end of the vacuum cleaner and preferably comprises a front wall thereof. . . . The door may be openably mounted to the cyclone unit, dirt collection chamber 124 or another

portion of vacuum cleaner 100 by any means known in the art. For example, one or more latches 159 may secure the door in position. Alternately, the door may be opened, e.g., pivoted open, and then optionally removable.”); ¶77 (“As exemplified in FIGS. 4 and 5, front wall 158 is pivotally mounted to the cyclone unit wall 115 and serves as an openable door of the dirt chamber 124, such that dirt collection chamber 124 is openable, and dirt collection chamber 124 may be emptied. The dirt collection chamber is therefore preferably openable both when the dirt collection chamber is mounted to the hand vacuum cleaner, or when it is removed, as will be described hereinbelow. When front wall 158 is pivoted away from the remainder of the cyclone unit 114, separation plate 154 and arm 156 also pivot away from the remainder of the cyclone unit. A latch 159 is provided, which secures front wall 158 to wall 115.”).

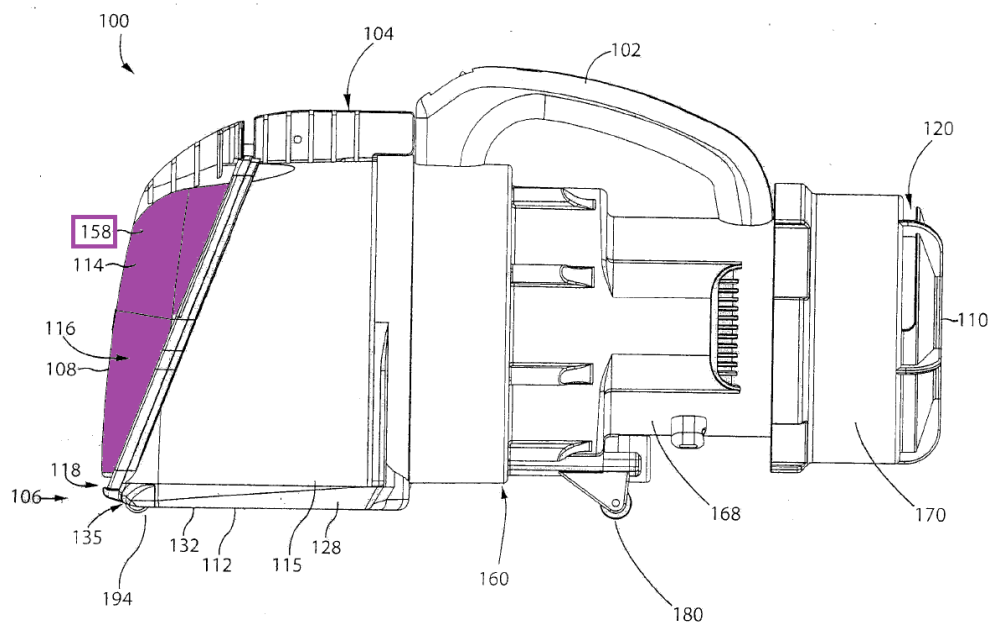


Fig. 1

Ex. 1004, Fig. 1 (annotated).

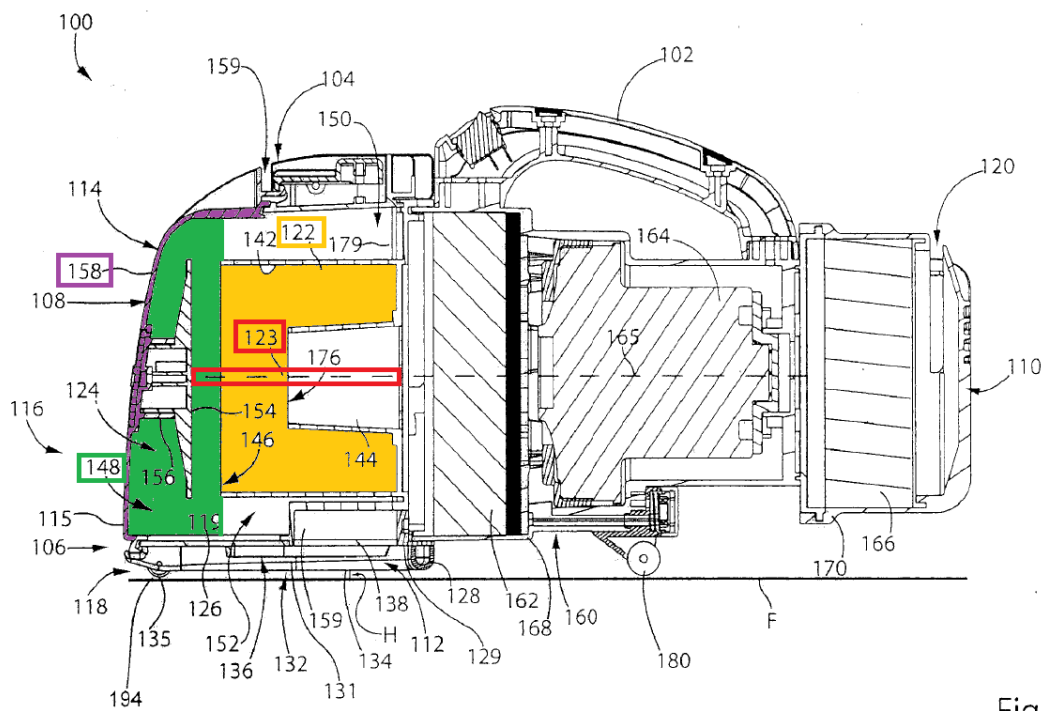


Fig. 6

Ex. 1004, Fig. 6 (annotated).

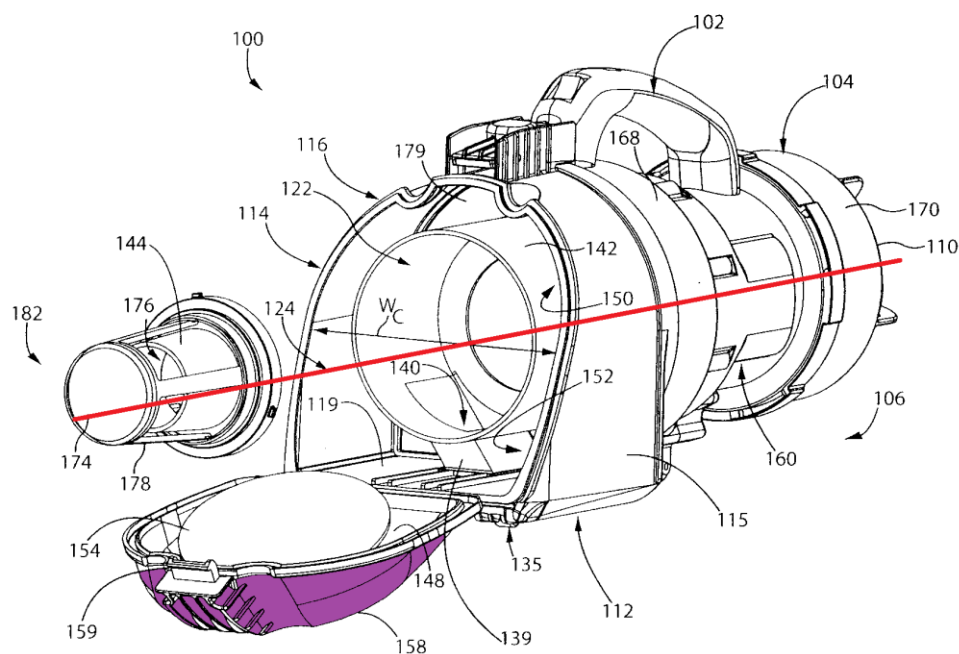


Fig. 5

Ex. 1004, Fig. 5 (annotated).

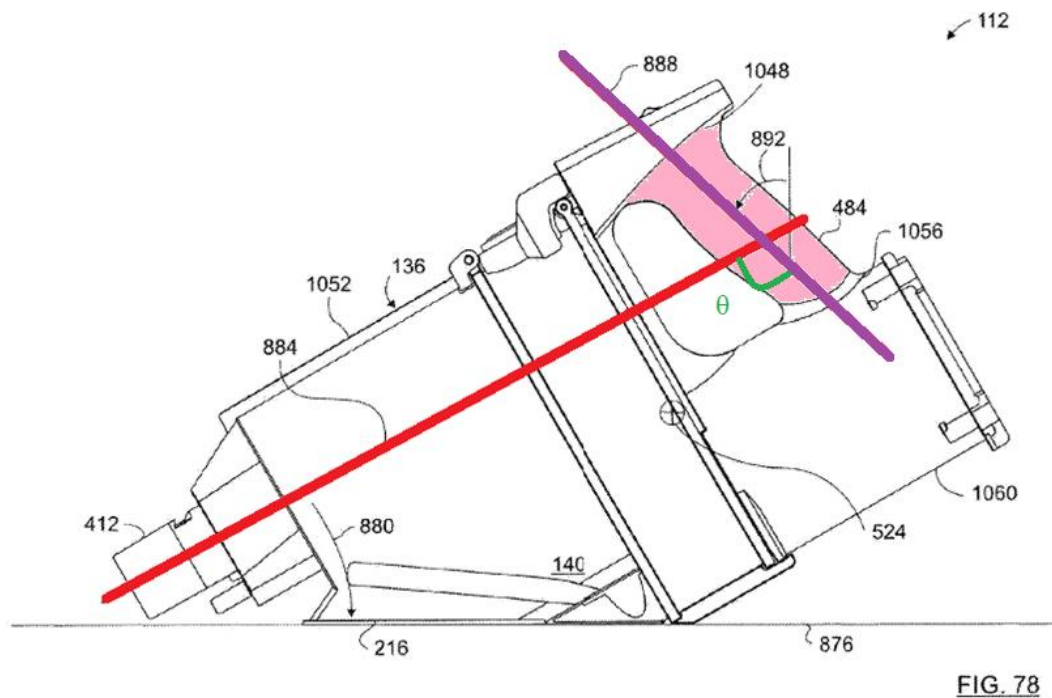
[1d] “wherein the handle has a pistol grip configuration in which the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 85 degrees and not greater than 140 degrees between a handle axis and the longitudinal axis of the cyclonic separating unit, and wherein the handle axis and the longitudinal axis intersect within the vacuum cleaner.”

88. Conrad ’630 discloses one embodiment where handle 102 is mounted on an upper portion of vacuum cleaner 100 and also teaches that handle 102 may be moved such that “handle 102 may be provided elsewhere on the vacuum cleaner 100, for example at the rear 110 and may be of any design,” but does not explicitly disclose a “pistol grip configuration” as claimed. Ex. 1004, ¶52.

89. It is my opinion that Conrad ’787 discloses this limitation.

90. Conrad '787 discloses this limitation. Conrad '787 discloses a handle 484 (pink) that has the claimed pistol grip configuration. Ex. 1006, Fig. 78. The handle 484 is inclined with respect to the cyclonic separating unit 184 to form an angle θ (green) of not less than 85 degrees and not greater than 140 degrees between a handle axis 888 (purple) and a longitudinal axis 884 (red) of the cyclonic separating unit 184. *Id.*, Figs. 78, 96, ¶¶312, 314, 317, 329.

91. As illustrated in Figures 78 and 96, based on my measurement of angle θ (green), it is approximately 105 degrees. Moreover, the handle axis 888 (purple) and the longitudinal axis 884 (red) intersect within the vacuum cleaner, as illustrated in the annotated Figure 78 below. *Id.*, Fig. 78.



Ex. 1006, Fig. 78 (annotated).

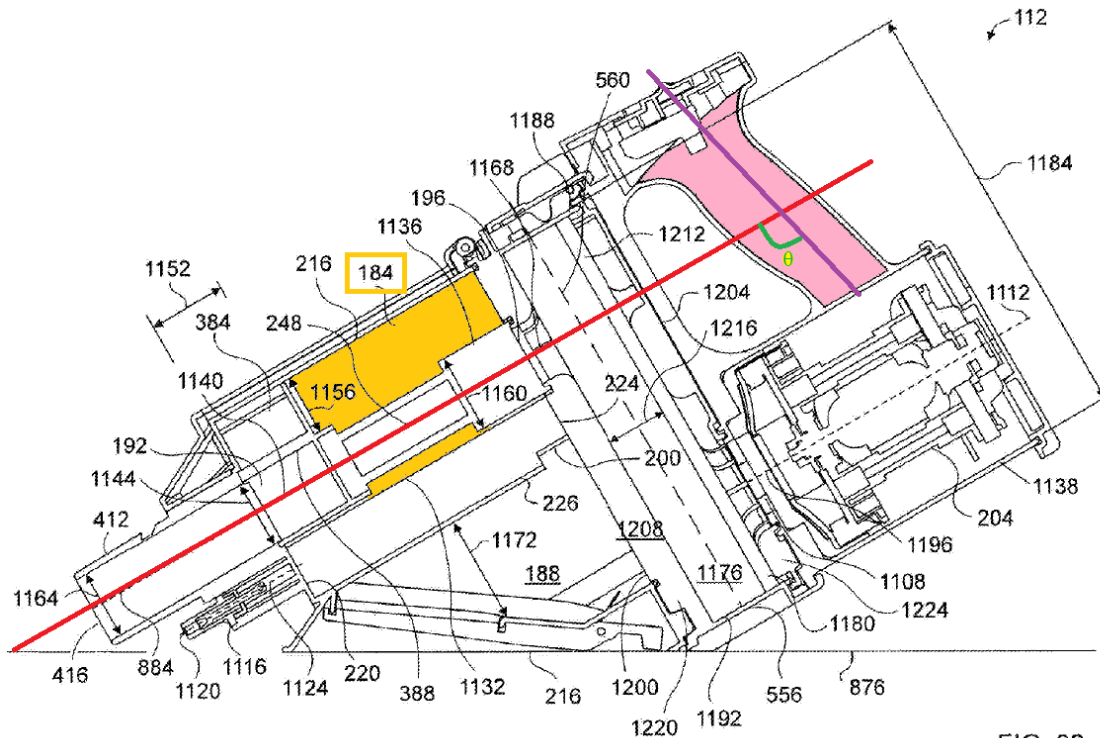


FIG. 96

Ex. 1006, Fig. 96 (annotated).

92. Conrad '787 also discloses specific ranges for angles 880 and 892 (shown in Figure 78), which in turn dictate the specific range for angle θ (green). *Id.*, ¶¶312, 317.

93. In particular, Conrad '787 discloses that “[a]ngle 880 may be an acute angle which may be between 10 and 80 degrees, and preferably between 25 and 65 degrees, more preferably between 35 and 55 degrees or between 20 and 40 degrees,” and “angle 892 is an acute angle of between 10 and 80 degrees, more preferably between 20 and 70 degrees and most preferably between 30 and 60 degrees.” *Id.* Given the geometry, the relationship between angle θ (green) and angles 880 and 892 is:

$$\text{Angle } \theta \text{ (green)} = \text{Angle } 892 - \text{Angle } 880 + 90^\circ$$

94. Angle θ (green) corresponds to the claimed “angle . . . between a handle axis and the longitudinal axis of the cyclonic separating unit.”

95. As shown below,

- $\text{Angle } \theta = \text{Angle } \theta a + \text{Angle } \theta b$ [Splitting up Angle θ into two components, divided by yellow line]
- Moreover, Angle θb and Angle 892 are the same
- Given that the triangle formed below between the horizontal 876, axis 884 (red) and vertical annotation (yellow) is a right-angle triangle,
 - $90^\circ = \theta a + \text{Angle } 880$
 - $\theta a = 90^\circ - \text{Angle } 880$
- Thus, $\text{Angle } \theta = 90^\circ - \text{Angle } 880 + \text{Angle } 892$

96.

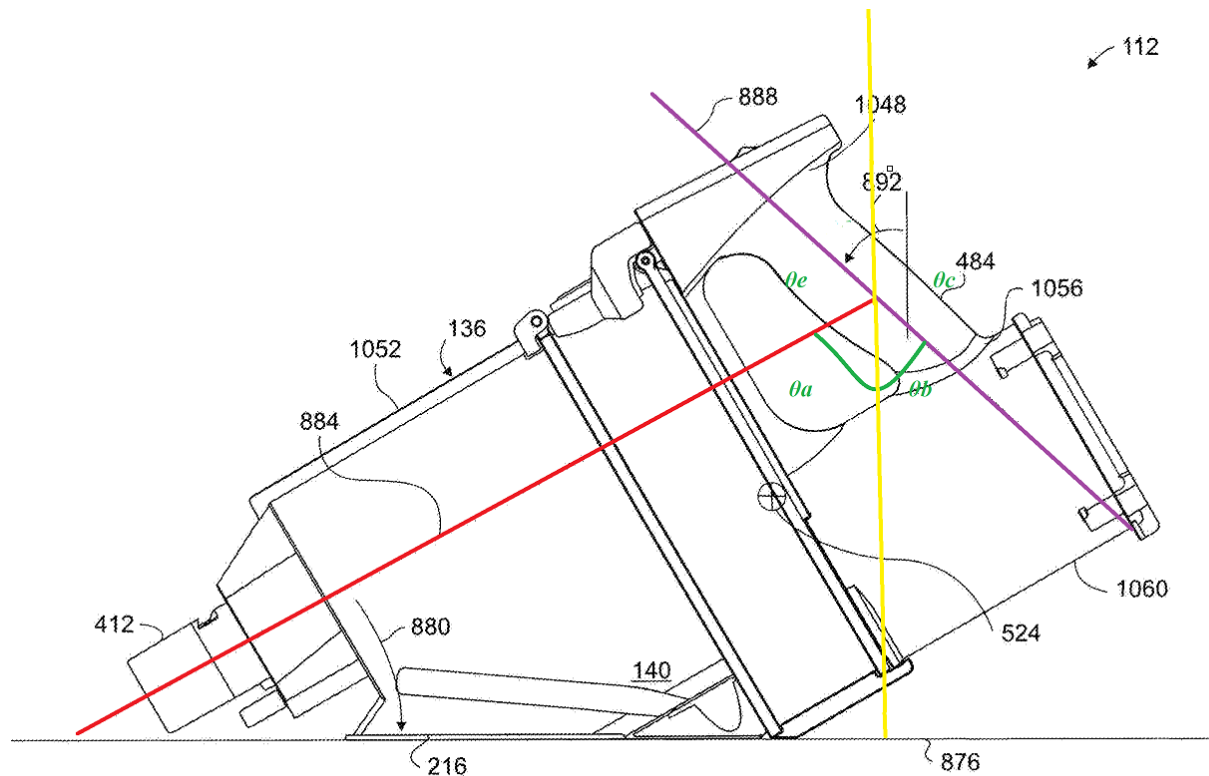


FIG. 78

97. Given Conrad '787's disclosure of the ranges of angles 880 and 892, and the relationship between the three angles, angle θ (green) falls within the claimed range of 85 degrees to 140 degrees.

98. Conrad '787 further explains that the specific angles disclosed for angle 892 and 880 ensure that the configuration "provide[s] a comfortable handle alignment for grasping by a user when picking up handvac 112, and when using handvac 112 for cleaning surfaces below the user's elbows," and provides "a center of gravity 524 vertically aligned with or between the support elements for stability . . ." *Id.* Conrad '787 also explains this is a "comfortable in-use orientation[]" of handvac 112." *Id.*, ¶314.

99. As, as I explained above (Section VII.A.1), a POSITA would have been motivated to combine Conrad '630 and Conrad '787 and would have had a reasonable expectation of success in making the combination.

100. A POSITA would have considered Conrad '787's specific teachings as to the specific range for angle θ (green) and the shape of the handle 484 and incorporated those design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Conrad '787's handle described above are attributable to those design elements, and would have therefore sought to incorporate such design elements into the combined handheld vacuum. As such, the POSITA would have designed a combined handheld vacuum that has a handle on the rear (as taught by Conrad '630), and which handle was shaped in a pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Conrad '787, which falls within the claimed range of claim 1.

101. As discussed above, Section VII.A.1, a POSITA would have been motivated to combine Conrad '630 and Conrad '787, and would have had a reasonable expectation of success, and would have achieved the claimed range of 85 degrees to 140 degrees.

3. Dependent Claim 2

102. It is my opinion that Conrad '787 discloses the elements of this claim.

[2] The handheld vacuum cleaner of claim 1, wherein the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 100 degrees and not greater than 125 degrees between the handle axis and the longitudinal axis of the cyclonic separating unit.

103. It is my opinion that Conrad '787 discloses this limitation.

104. As explained above in connection with Limitation [1d], I measured angle θ (green) to be approximately 105 degrees, which falls within the claimed range in claim 2. Ex. 1006, Figs. 78, 96, ¶¶312, 314, 317, 329. Moreover, given that $\text{Angle } \theta \text{ (green)} = \text{Angle } 892 - \text{Angle } 880 + 90^\circ$, and Conrad '787's disclosure that that "[a]ngle 880 may be an acute angle which may be between 10 and 80 degrees, and preferably between 25 and 65 degrees, more preferably between 35 and 55 degrees or between 20 and 40 degrees," and "angle 892 is an acute angle of between 10 and 80 degrees, more preferably between 20 and 70 degrees and most preferably between 30 and 60 degrees," *Id.*, ¶¶312, 317, Conrad '787 specifically discloses embodiments where the $\text{Angle } \theta \text{ (green)}$ is within the claimed range of 100 degrees to 125 degrees.

105. A POSITA would have considered Conrad '787's specific teachings as to the specific range for angle θ (green) incorporated that design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Conrad '787's handle described above are attributable to that design elements, and would have therefore sought to incorporate such design element into

the combined handheld vacuum. As such, the POSITA would have designed a combined Conrad '630/Conrad '787 handheld vacuum that has a handle on the rear (as taught by Conrad '630), and which handle was shaped in a pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Conrad '787, which falls within the claimed range of claim 2.

106. As discussed above, Section VII.A.1 and Section VII.A.2.[1d], a POSITA would have been motivated to combine Conrad '630 and Conrad '787, and would have had a reasonable expectation of success, and would have achieved the claimed range of 100 degrees to 125 degrees.

4. Dependent Claim 3

107. It is my opinion that Conrad '630 discloses the elements of this claim.

[3] The handheld vacuum cleaner of claim 1, wherein the end wall comprises an end wall of the cyclonic separating unit.

108. It is my opinion that Conrad '630 discloses this limitation.

109. Conrad '630 discloses that the handheld vacuum cleaner 100 has a cyclone unit 114 with a cyclone 122 (yellow) which comprises a front wall 158 (which is the claimed end wall) (purple). The front wall 158 (purple) forms an end wall of the cyclone unit 114. Ex. 1004, Figs. 1, 5, and 6; *see also* Section IV.A.2.[1c] (incorporated herein by reference).

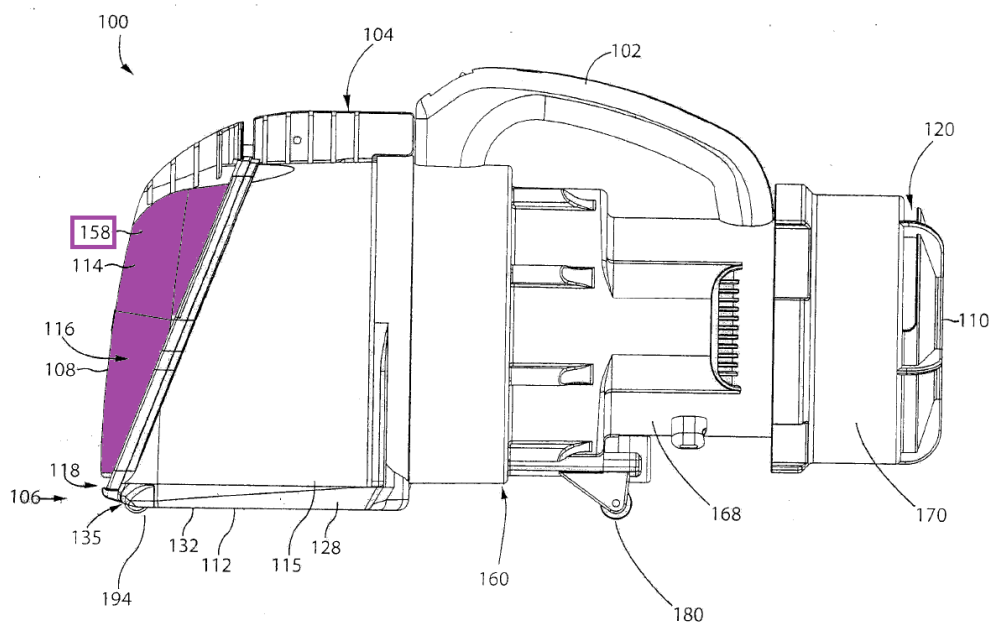


Fig. 1

Ex. 1004, Fig. 1 (annotated).

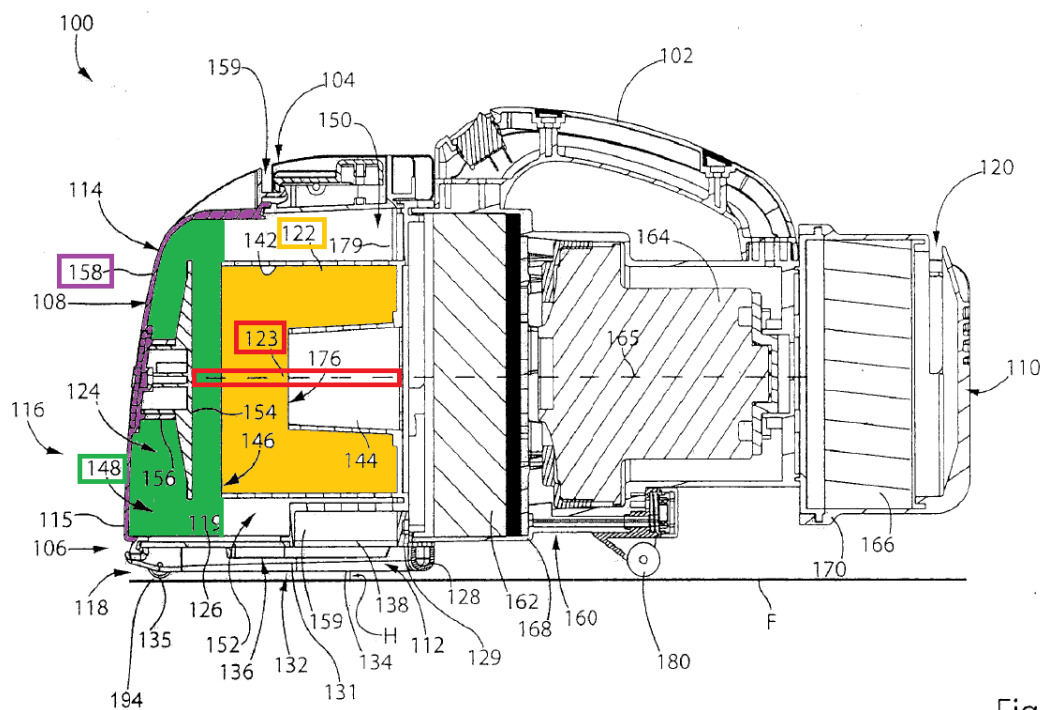


Fig. 6

Ex. 1004, Fig. 6 (annotated).

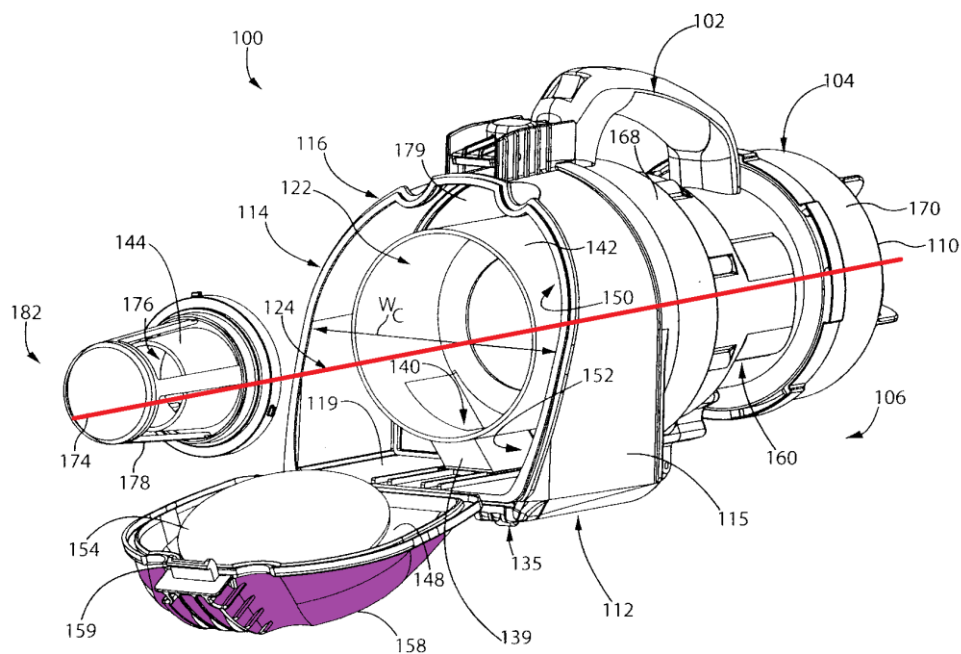


Fig. 5

Ex. 1004, Fig. 5 (annotated).

5. Dependent Claim 4

110. It is my opinion that Conrad '630 discloses the elements of this claim.

[4] The handheld vacuum cleaner of claim 1, wherein the end wall is arranged to pivot between the closed configuration and the open configuration.

111. It is my opinion that Conrad '630 discloses this limitation.

112. Conrad '630 discloses that the handheld vacuum cleaner 100 has a front wall 158 (purple) (the claimed end wall) that is arranged to pivot between the closed configuration (Ex. 1004, Figs. 1, 2, 6) and the open configuration (*id.*, Fig. 4, 5). *See also id.*, ¶76 (“Alternately, the door may be opened, e.g., pivoted open, and then optionally removable.”); ¶77 (“As exemplified in FIGS. 4 and 5, front wall 158 is

pivotally mounted to the cyclone unit wall 115 and serves as an openable door of the dirt chamber 124, such that dirt collection chamber 124 is openable, and dirt collection chamber 124 may be emptied. The dirt collection chamber is therefore preferably openable both when the dirt collection chamber is mounted to the hand vacuum cleaner, or when it is removed, as will be described hereinbelow. When front wall 158 is pivoted away from the remainder of the cyclone unit 114, separation plate 154 and arm 156 also pivot away from the remainder of the cyclone unit. A latch 159 is provided, which secures front wall 158 to wall 115.”); Section IV.A.2.[1c]; incorporated herein by reference).

6. Dependent Claim 8

113. It is my opinion that Conrad ’630 discloses the elements of this claim.

[8] The handheld vacuum cleaner of claim 1, wherein the dirt collector is disposed forward of the handle.

114. It is my opinion that Conrad ’630 discloses this limitation.

115. Conrad ’630 discloses that the handheld vacuum cleaner 100 has a dirt collector (*i.e.*, the first portion 148 (green) of dirt collection chamber 124) that is disposed forward of the handle 102. Ex. 1004, Figs. 5-6; *see also id.*, ¶94, Fig. 8 (illustrating airflow from nozzle 812 to the dirt collector 824, and further illustrating that the air flows from the dirt collector 824 in the direction of the handle 802). A POSITA would have understood the location of Conrad ’630’s dirt collector (*i.e.*, the dirt collection chamber 124) to be “forward of the handle,” as claimed, because

the dirt collection chamber is in front of the handle 102 when the vacuum is in use. Additionally, Conrad '630 references “the openable front door ... being at the front of the hand surface cleaning apparatus,” *id.*, ¶139. Given this establishment of front, the dirt collector 824 is clearly in front of the handle 802.

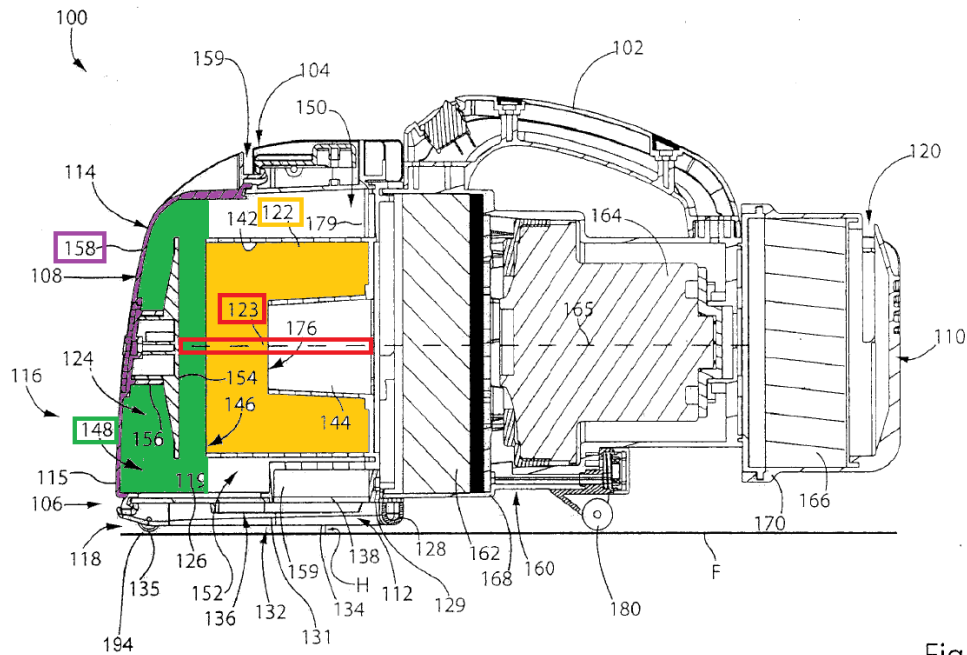


Fig. 6

Ex. 1004, Fig. 6 (annotated).

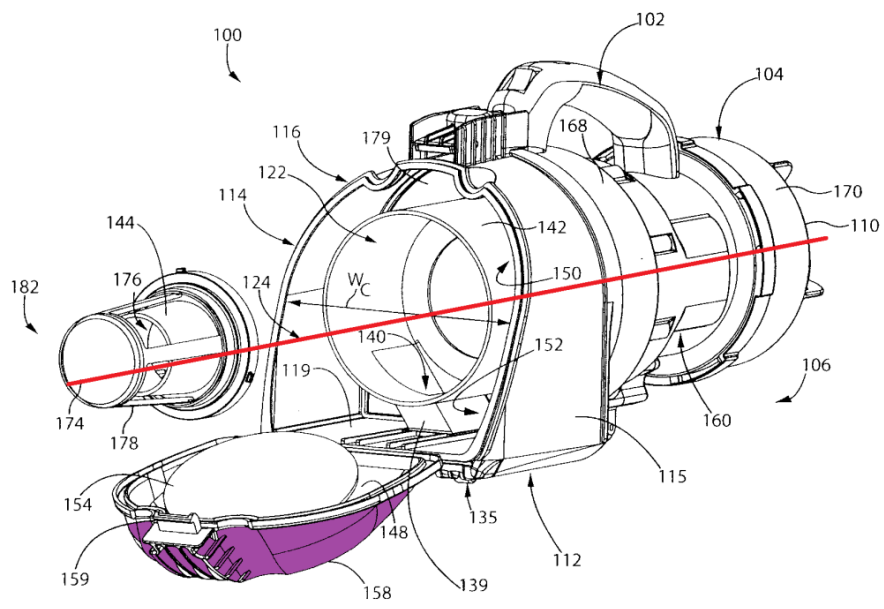


Fig. 5

Ex. 1004, Fig. 5 (annotated).

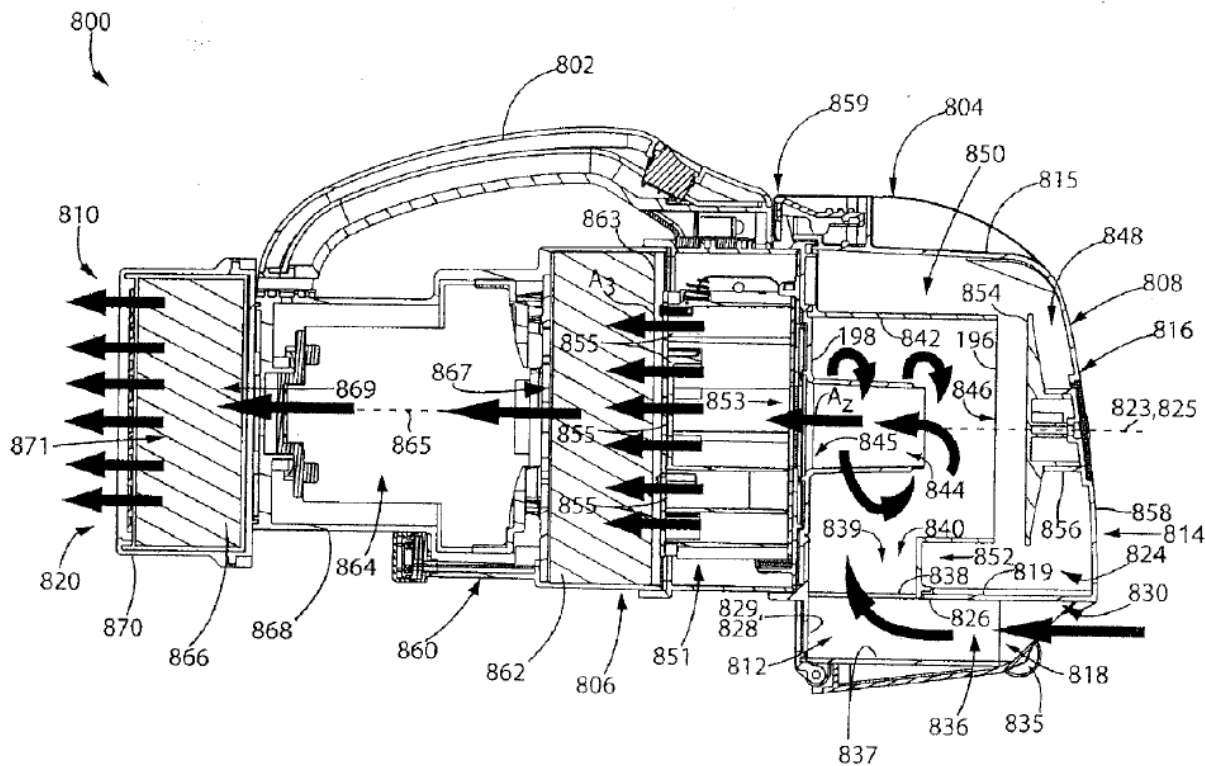


Fig.8

Ex. 1004, Fig. 8 (annotated).

116. Moreover, the combined Conrad '630 / Conrad '787 vacuum would also have a dirt collector disposed forward of the handle.

7. Dependent Claim 10

117. It is my opinion that Conrad '630 discloses the elements of this claim.

[10] The handheld vacuum cleaner of claim 1, wherein the cyclonic separating unit comprises a cyclonic separator having an axis that defines the longitudinal axis of the cyclonic separating unit.

118. It is my opinion that Conrad '630 discloses this limitation.

119. Conrad '630 discloses a cyclone unit 114 with a cyclone 122 (yellow) having a longitudinal axis 123 (red). Ex. 1004, Fig. 6. Longitudinal axis 123 defines the longitudinal axis of the cyclonic separating unit. *Id.*; see also Section IV.A.2.[1c]; incorporated herein by reference).

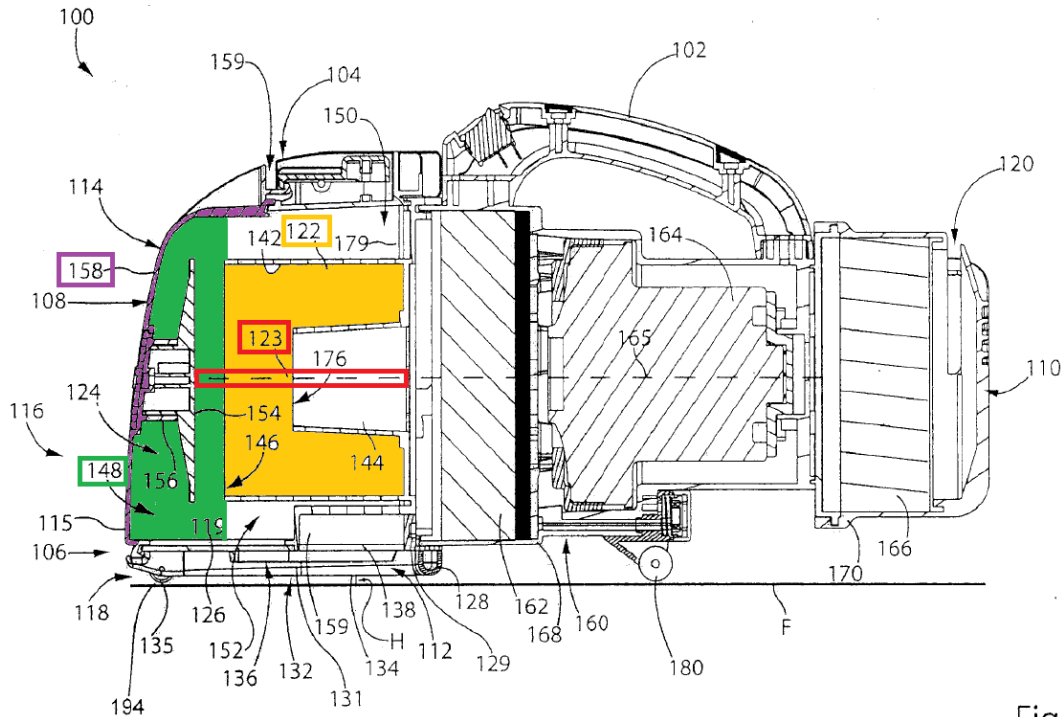


Fig. 6

Ex. 1004, Fig. 6 (annotated).

B. Ground 2: Claims 1–4, 8, and 10 Are Rendered Obvious by Conrad '630 in View of Dyson

120. As I explained above, Conrad '630 shows a handheld vacuum cleaner that has the dirt collector as was claimed in the '687 patent. Conrad '630 also discloses that the handle for its vacuum can be at the back of the vacuum. Ex. 1004,

¶52. Moreover, while Conrad '630 discloses one embodiment where handle 102 is

mounted on an upper portion of vacuum cleaner 100 and further teaches that “handle 102 may be provided elsewhere on the vacuum cleaner 100, for example at the rear 110 and may be of any design,” it does not explicitly disclose a “pistol grip configuration” as claimed. Ex. 1004, ¶52. On the other hand, Dyson discloses a handheld vacuum cleaner with a handle as claimed in the ’687 patent.

121. In my opinion, a POSITA would have been motivated to combine Conrad ’630 with Dyson. Both references show handheld vacuum cleaners. Moreover, Conrad ’630 specifically says that its handle can be at the back of its vacuum, just like in Dyson.

122. In my opinion, as I explain below, the combination of Conrad ’630 and Dyson renders obvious claims 1–4, 8, and 10 of the ’687 patent.

1. Motivation to Combine Conrad ’630 and Dyson

123. A POSITA would have been motivated to combine Conrad ’630 with Dyson. Specifically, a POSITA would have been motivated to use Dyson’s handgrip with Conrad ’630’s vacuum.

124. *First*, a POSITA reviewing Conrad ’630 would have been motivated to explore alternative handle configurations because of Conrad ’630’s express disclosure to move the handle 101 to other locations. Ex. 1004, ¶52 (explaining that “handle 102 may be provided elsewhere on the vacuum cleaner 100, for example at the rear 110 and may be of any design.”). A POSITA would have known in 2015

that since the date of Conrad '630 in 2010, handle configurations that offered improved comfort were commonplace.

125. *Second*, a POSITA would have been motivated to combine the two references in a way that incorporate Dyson's handle 28 to the rear 110 of Conrad '630's handheld vacuum for a number of reasons, as explained below.

Dyson discloses a handheld vacuum 10 with a handle "at the rear." Ex. 1007, Fig. 2. Dyson also discloses that its handle is more comfortable. For example, Dyson explains that "[t]his arrangement feels comfortable for a user," and allows the user to "maintain a comfortable wrist position and movement of the hand-held vacuum cleaner feels comfortable." *Id.*, 2:17-19, 4:27-29. A POSITA would have therefore sought to take advantage of the improved handle configuration provided in Dyson while retaining the advantages of Conrad '630's design, including its improved dustbin configuration. *See e.g.*, Ex. 1004, ¶¶6, 7; *see also* Section IV.B.

126. A POSITA would have also recognized that both the handheld vacuums of Conrad '630 and Dyson are designed to be used with various attachments, as was commonplace as the time of the '687 patent, as explained above (See Ground 1, VII.A.1).

127. A POSITA would have been motivated to combine the two references in a way that incorporates Dyson's teachings concerning the handle 28, including the shape and angle arrangement taught by Dyson. First, Conrad '630's express

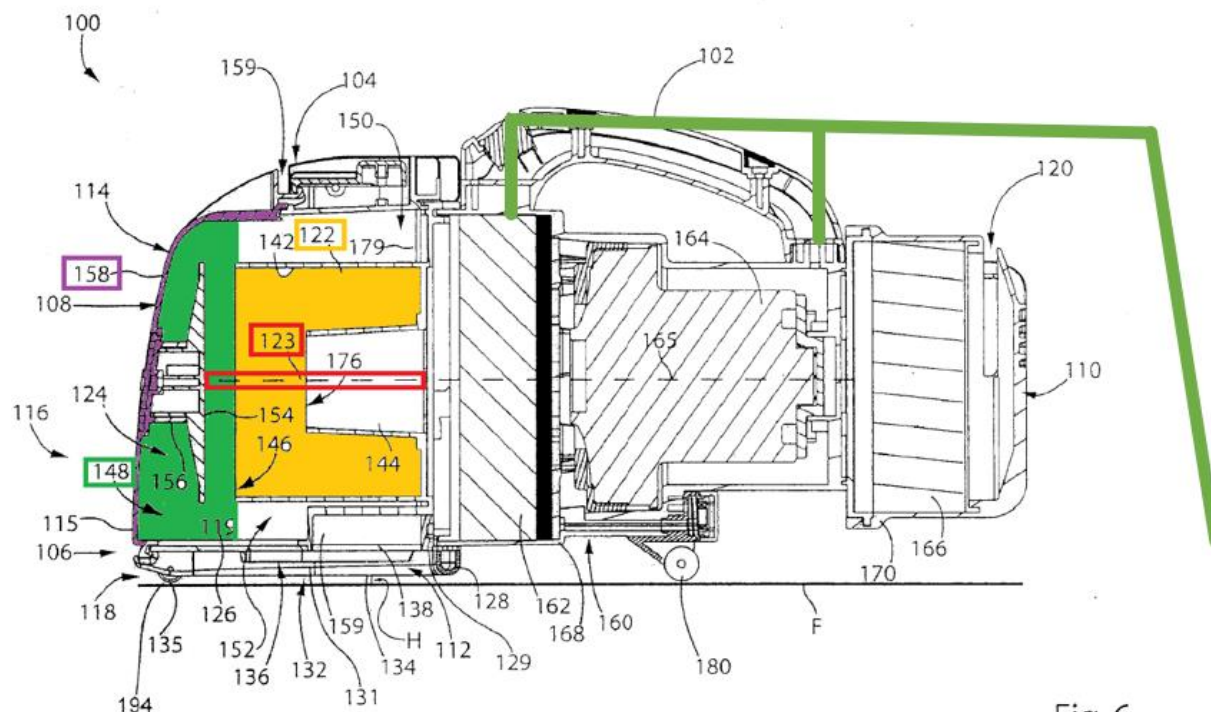
teaching that the handle 102 may be provided “at the rear 110” is an explicit statement that would encourage a POSITA to explore alternative locations. Second, because both vacuums are designed to be used with attachments, a POSITA would have recognized additional advantages associated with providing the handle at the rear, including that the user will have a better grip and more comfort when using the handheld vacuum with an attachment. Third, the advantages associated with Dyson’s handle—such as improved comfort—would further motivate the combination. Ex-1007, 2:17-19, 4:27-29. Fourth, a POSITA would wish to retain the advantages of Conrad ’630’s design, including its improved dustbin configuration. Ex-1004, ¶¶6, 7.

128. As such, a POSITA would have been motivated to combine the two references in a way that incorporate Dyson’s handle 28 to the rear 110 of Conrad ’630’s handheld vacuum.

129. *Third*, a POSITA would have had a reasonable expectation of success in incorporating a handle to the back of vacuum cleaner 100 that conforms with Dyson’s teachings, including its shape and angle. Such a handle would not interfere with the vacuum’s components. While Conrad ’630 explains that “clean air outlet 120 is preferably at the rear 110 of the cleaner 100,” (*id.*, ¶54), the clean air outlet 120 is on top of the vacuum 100 towards the rear (*id.*, Fig. 4) and would not interfere with the new location of the handle. In any event, it would have been a simple design

choice for a POSITA to add additional air outlets on the side towards the rear of the vacuum to direct airflow away from the location of the new handle, as disclosed in Dyson. Ex. 1007, Figs. 1, 3 (illustrating exhaust vents 26 on the sides of vacuum 10), 3:21-23, 5:26-6:2.

130. For example, a POSITA could have designed a handle that attaches to the vacuum cleaner of Conrad '630 at the same location that the current handle attaches, and which extends to the rear of the vacuum cleaner and then forms a pistol shaped handle, which is sloped relative to the longitudinal axis 123 (red) at an angle consistent with the teachings of Dyson (which is within the range claimed by claims 1 and 2 of the '687 patent. As an example, a quick sketch that shows such a handle arrangement is provided below.



Mockup of Figure 6 of Conrad '630 to show an alternative design of the handle consistent with the teachings of Conrad '630 and Dyson.

131. A POSITA could have designed other handles that attach to the vacuum cleaner of Conrad '630 and which incorporate the teachings of Dyson. Such vacuum cleaners would also fall within the scope of the challenged claims. A few additional sketches showing alternative designs are shown below.

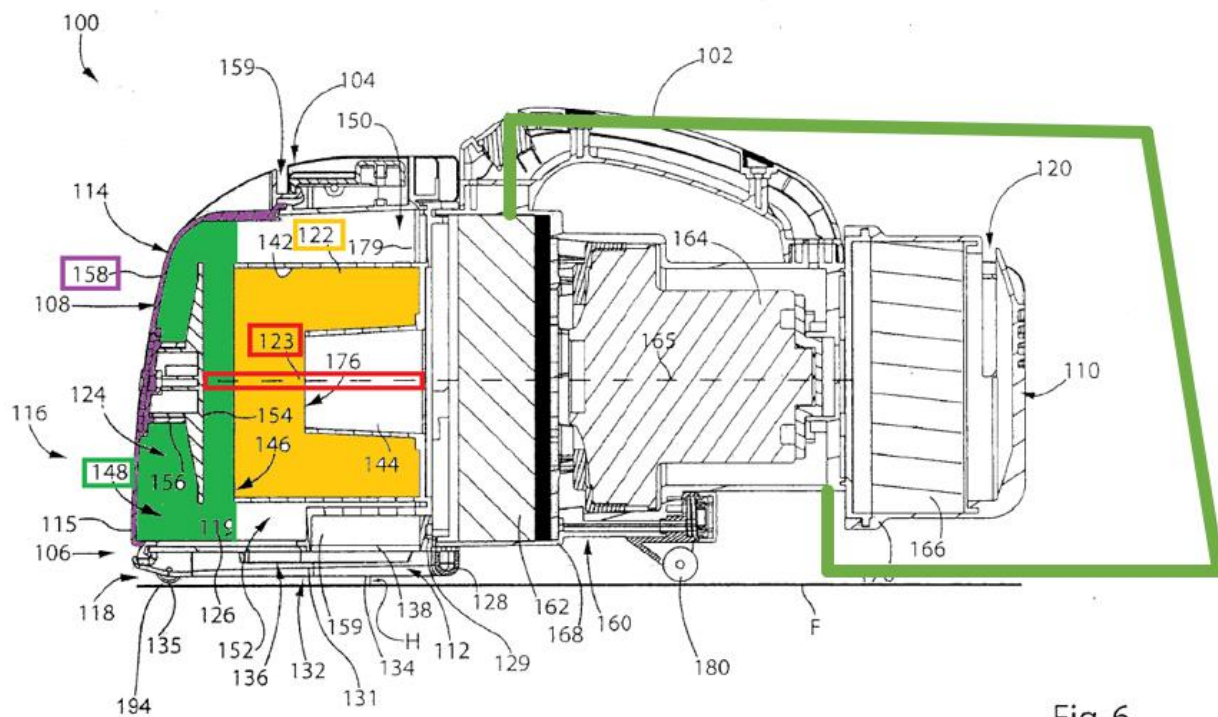


Fig.6

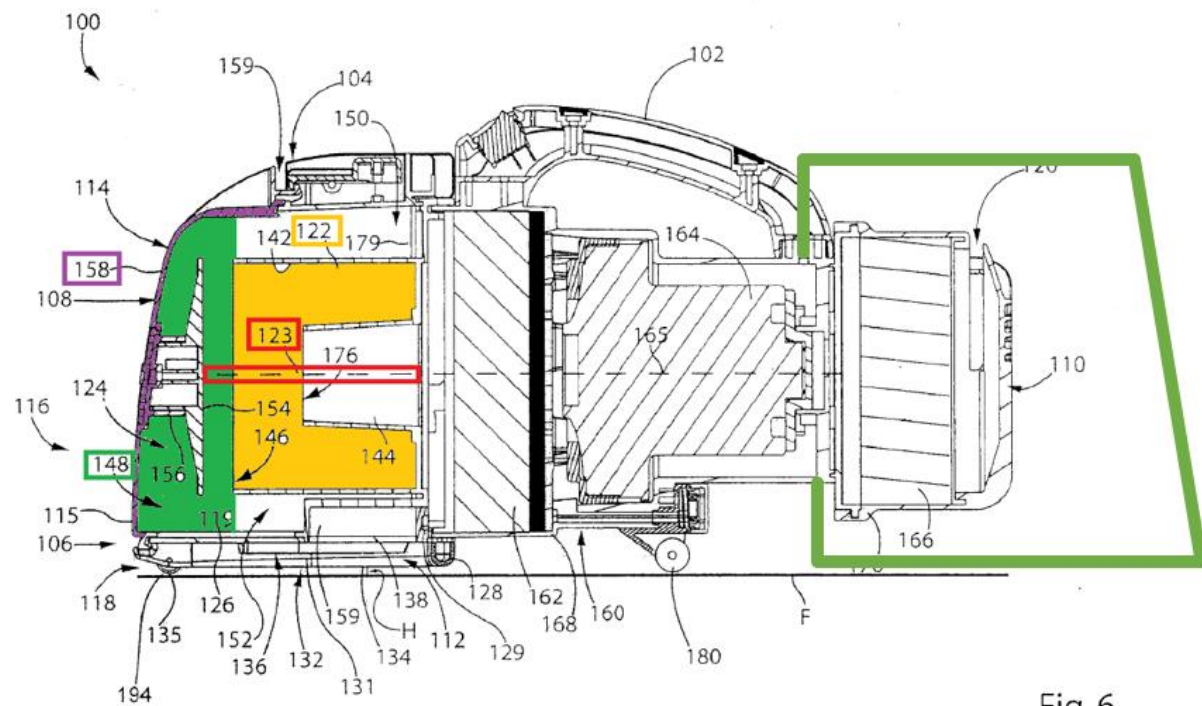
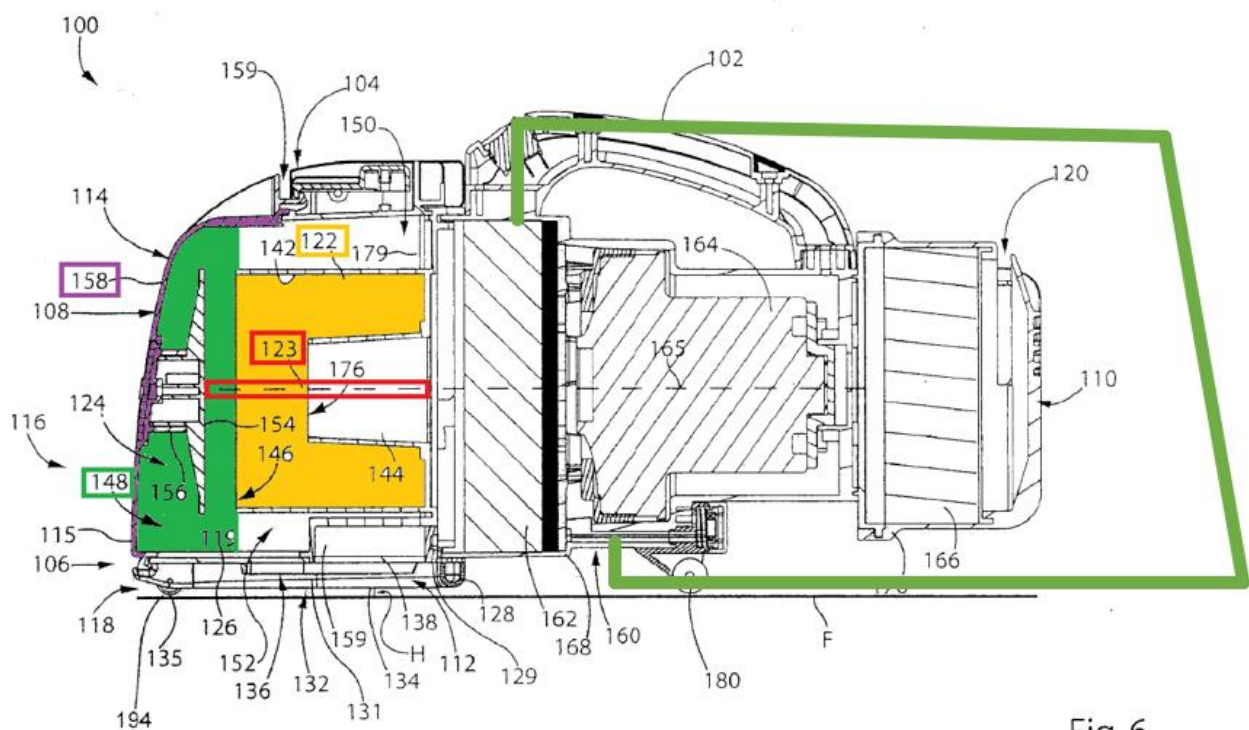


Fig.6



132. In use, the modified vacuum cleaner 100, would be pushed by a user using the handle 28 (pink) over the surface to be cleaned. This arrangement would allow the user to push the vacuum cleaner forward over the surface to be cleaned easily. Specifically, the vacuum cleaner would be well suited for surfaces like couches and bedding, which are typically cleaned using a handheld vacuum as opposed to a stick or upright vacuum. It would also allow for more flexibility in using the handheld vacuum with an attachment for different types of cleaning.

2. Independent Claim 1

133. It is my opinion that limitations of claim 1 are rendered obvious by Conrad '630 in view of Dyson.

1[pre] “A handheld vacuum cleaner, comprising”

134. I understand that a preamble generally does not state a claim limitation. However, to the extent the preamble limits claim 1, it is my opinion that the limitation is disclosed and taught by Conrad '630. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference.

135. Also, I note that Dyson discloses a handheld vacuum cleaner 10. Ex. 1007, Fig. 2.

[1a] “a handle by which the vacuum cleaner is supported during normal use;”

136. It is my opinion that Conrad '630 discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference.

137. Also, I note that Dyson discloses a handgrip 28 (pink) by which the vacuum cleaner 10 is supported during normal use. Ex. 1007, Fig. 2.

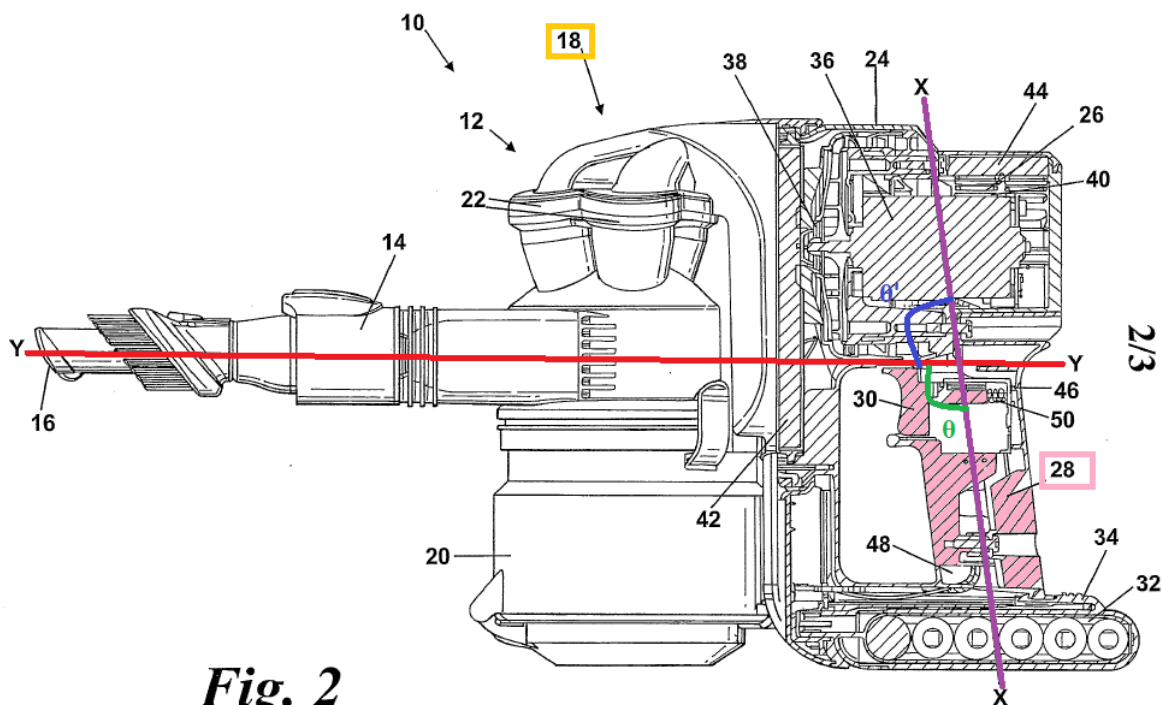


Fig. 2

Ex. 1007, Fig. 2 (annotated).

[1b] “a cyclonic separating unit having a longitudinal axis and a dirt collector at one end of the cyclonic separating unit,”

138. It is my opinion that Conrad '630 discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference.

[1c] “the cyclonic separating unit comprising an end wall having a closed configuration in which dirt is retained within the dirt collector by the end wall and an open configuration for the removal of dirt from the dirt collector, wherein the end wall is movable relative to the longitudinal axis and, when the end wall is in the closed configuration, the longitudinal axis extends through a region bounded by a perimeter of the end wall,”

139. It is my opinion that Conrad '630 discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference.

[1d] “wherein the handle has a pistol grip configuration in which the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 85 degrees and not greater than 140 degrees between a handle axis and the longitudinal axis of the cyclonic separating unit, and wherein the handle axis and the longitudinal axis intersect within the vacuum cleaner.”

140. It is my opinion that Dyson discloses this limitation.

141. Dyson discloses a handgrip 28 (pink) that has a pistol grip configuration, which Dyson describes as a “dumbbell-like configuration.” Ex. 1007, 6:10, Figs. 1-2. The handgrip 28 (pink) is inclined with respect to the cyclonic separating apparatus 18 to form an angle θ (green) of not less than 85 degrees and not greater than 140 degrees between a handle axis X-X (purple) and a longitudinal axis Y-Y (red) of the cyclonic separating apparatus 18. *Id.*, Figs. 1-2, 2:21-23, 3:11-30, 4:9-11, 4:22-27. In particular, as illustrated in Figure 2, angle θ (green) is approximately 95 degrees. *Id.*

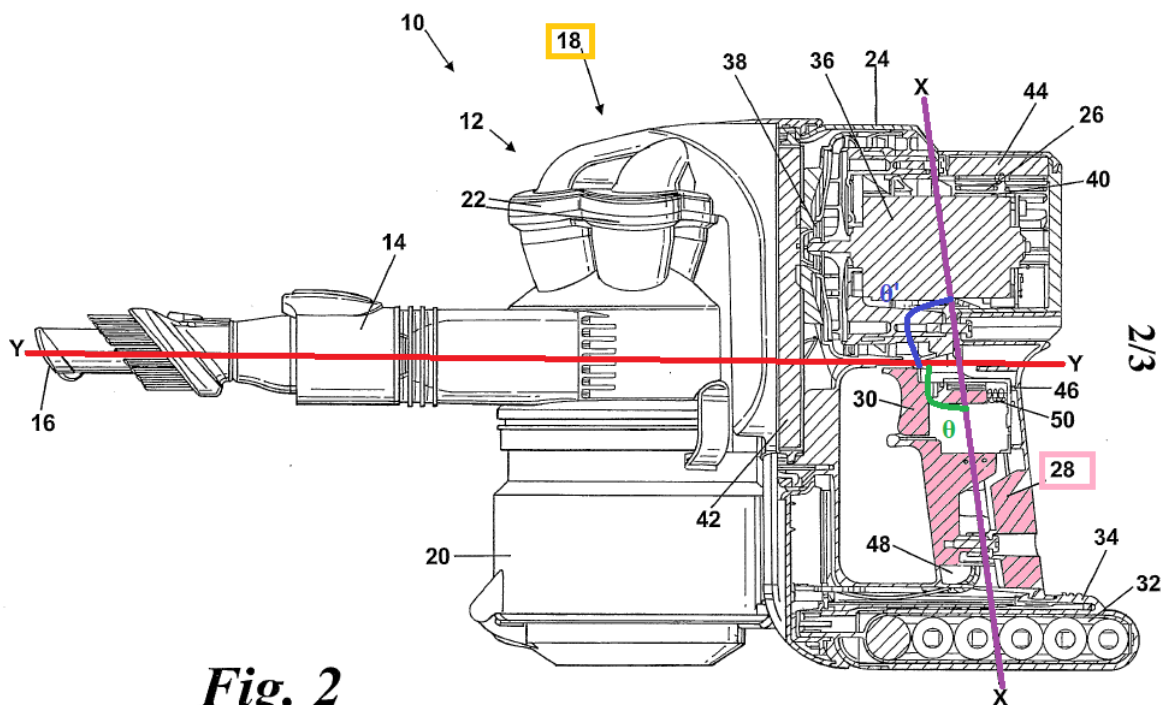


Fig. 2

Ex. 1007, Fig. 2 (annotated).

142. Furthermore, Dyson discloses specific ranges for angle θ' (blue) of 80 to 90 degrees, which is equal to $180 - \text{angle } \theta \text{ (green)}$ – because angle θ' (blue) and angle θ (green) are on the same straight line. Ex. 1007, 2:21-23 (“Preferably, the elongate handle lies at an angle to the longitudinal axis in the range of 80 to 90°. More preferably, the elongate handle lies at an angle to the longitudinal axis which is close to a right angle.”); 4:25-28 (“The longitudinal axis Y-Y passes through the suction opening 16. In this embodiment, the axis X-X is arranged at an angle to the longitudinal axis Y-Y which is close to 90°. This arrangement feels comfortable for

a user.”). As such, Dyson discloses that angle θ (green) is in the range of 100 to 90 degrees.

143. Moreover, the handle axis X-X (purple) and the longitudinal axis Y-Y (red) intersect within the vacuum cleaner, as illustrated in the annotated Figure 2. Ex. 1007, Fig. 2, 7:1-6 (“It is preferred that the angle between the longitudinal axis of the suction conduit and the axis of the handgrip is in the range of 80 to 90°. However, what is important is that these axes are transverse to one another such that the manipulation of the hand-held vacuum cleaner by a user feels comfortable.”).

144. A POSITA would have considered Dyson’s specific teachings as to the specific range for angle θ (green) and the shape of the handle 28 and incorporated those design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Dyson’s handle described above are attributable to those design elements, and would have therefore sought to incorporate such design elements into the combined handheld vacuum. As such, the POSITA would have designed a combined handheld vacuum that has a handle on the rear (as taught by Conrad ’630), and which handle was shaped in a pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Dyson, which falls within the claimed range of claim 1.

145. As discussed above, Section VII.B.1, a POSITA would have been motivated to combine Conrad '630 and Dyson, and would have had a reasonable expectation of success, and would have achieved the claimed range of 85 degrees to 140 degrees.

3. Dependent Claim 2

146. It is my opinion that Dyson discloses the elements of this claim.

[2] The handheld vacuum cleaner of claim 1, wherein the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 100 degrees and not greater than 125 degrees between the handle axis and the longitudinal axis of the cyclonic separating unit.

147. It is my opinion that Conrad '630 discloses this limitation.

148. As explained above in connection with Limitation [1d] (incorporated here by reference), Dyson discloses specific ranges for angle θ' (blue), which is equal to $180 - \text{angle } \theta$ (green). Ex. 1007, 2:21-23 (“Preferably, the elongate handle lies at an angle to the longitudinal axis in the range of 80 to 90°. More preferably, the elongate handle lies at an angle to the longitudinal axis which is close to a right angle.”); 4:25-28 (“The longitudinal axis Y-Y passes through the suction opening 16. In this embodiment, the axis X-X is arranged at an angle to the longitudinal axis Y-Y which is close to 90°. This arrangement feels comfortable for a user.”). Accordingly, Dyson discloses that angle θ (green) is preferably in the range of 100 to 90 degrees.

149. A POSITA would have considered Dyson's specific teachings as to the specific range for angle θ (green) and the shape of the handle 28 and incorporated those design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Dyson's handle described above are attributable to those design elements, and would have therefore sought to incorporate such design elements into the combined handheld vacuum. As such, the POSITA would have designed a combined handheld vacuum that has a handle on the rear (as taught by Conrad '630), and which handle was shaped in a pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Dyson, which falls within the claimed range of claim 2.

150. As discussed above, Section VII.B.1 and Section VII.B.2.[1d], a POSITA would have been motivated to combine Conrad '630 and Dyson, and would have had a reasonable expectation of success, and would have achieved a vacuum cleaner with a handle having the claimed range of 100 degrees to 125 degrees.

4. Dependent Claim 3

151. It is my opinion that Conrad '630 discloses the elements of this claim.

[3] The handheld vacuum cleaner of claim 1, wherein the end wall comprises an end wall of the cyclonic separating unit.

152. It is my opinion that Conrad '630 discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference.

5. Dependent Claim 4

153. It is my opinion that Conrad '630 discloses this limitation.

[4] The handheld vacuum cleaner of claim 1, wherein the end wall is arranged to pivot between the closed configuration and the open configuration.

154. It is my opinion that Conrad '630 discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference.

6. Dependent Claim 8

155. It is my opinion that Conrad '630 discloses this limitation.

[8] The handheld vacuum cleaner of claim 1, wherein the dirt collector is disposed forward of the handle.

156. It is my opinion that Conrad '630 discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference. Moreover, the combined Conrad '630 / Dyson vacuum would also have a dirt collector disposed forward of the handle.

7. Dependent Claim 10

157. It is my opinion that Conrad '630 discloses this limitation.

[10] The handheld vacuum cleaner of claim 1, wherein the cyclonic separating unit comprises a cyclonic separator having an axis that defines the longitudinal axis of the cyclonic separating unit.

158. It is my opinion that Conrad '630 discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 1, which is incorporated here by reference.

C. Ground 3: Claims 1–4, 8, and 10 Are Rendered Obvious by Matsumoto in View of Conrad '787

159. As I explain below, Matsumoto shows a vacuum cleaner that has the dirt collector as was claimed in the '687 patent. Matsumoto also discloses that the handle for its vacuum is at the back of the vacuum. However, Matsumoto does not explicitly disclose a “pistol grip configuration” as claimed in the '687 patent. On the other hand, Conrad '787 discloses a handheld vacuum cleaner with a handle as claimed in the '687 patent. In my opinion, a POSITA would have been motivated to combine Matsumoto with Conrad '787.

160. In my opinion, as I explain below, the combination of Matsumoto and Conrad '787 renders obvious claims 1–4, 8, and 10 of the '687 patent.

1. Motivation to Combine Matsumoto and Conrad '787

161. A POSITA would have been motivated to combine Matsumoto with Conrad '787. Specifically, a POSITA would have been motivated to use Conrad '787's handle with Matsumoto's vacuum.

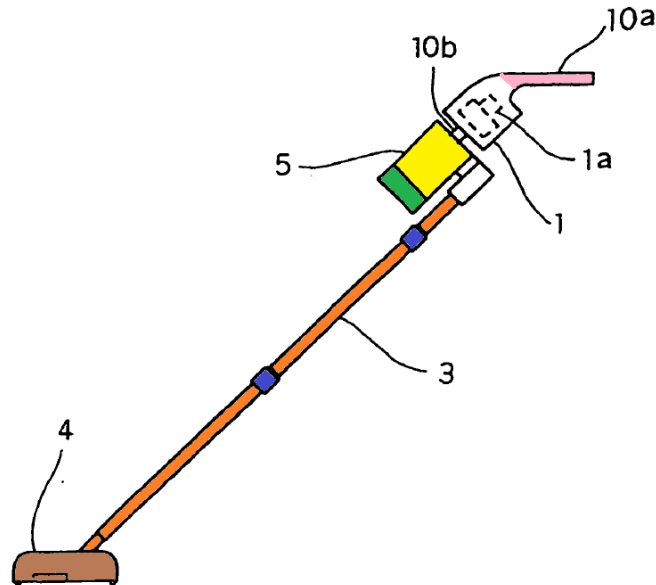
162. *First*, a POSITA would have been motivated to use Matsumoto in a handheld vacuum configuration. Matsumoto discloses a handheld stick-type vacuum cleaner that is suited for cleaning floors. Ex. 1005, Figs. 25, 1, ¶25. Matsumoto does not explicitly disclose a miniature handheld vacuum cleaner to be used as a handheld configuration that would be suited for cleaning other types of surfaces, such as couches and bedding. However, Matsumoto explains that “miniaturizing the vacuum” cleaner would “enhance the operability thereof.” Ex. 1005, ¶68. As such, a POSITA would have been motivated to miniaturize the vacuum cleaner as explained below, and to use the Matsumoto vacuum in a handheld configuration.

163. Matsumoto's body 1 is coupled to a cyclone dust collecting part 5 (yellow/green), which is coupled to suction port body 4 (brown) by a connection pipe 3 (orange). Ex. 1005, ¶¶25, 27. Matsumoto's illustrations of the connection pipe also show collars (blue), which indicate the connection pipe 3 is made of multiple pipes connected to one another and which can be disconnected from each other. *Id.*, Fig. 25. One possible interpretation of this connection pipe is that it is a telescopic wand. This type of pipe is a common feature found on such vacuums

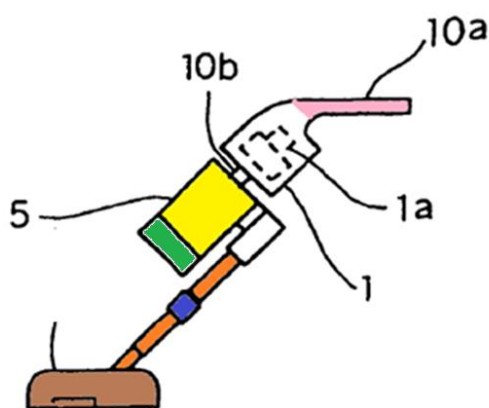
during the time prior to September 2015. Another interpretation is that it is simply a plurality of connecting pipes that are fit together to provide adequate length to clean flooring while walking upright. This interpretation allows for “miniaturizing” the pipes to shorter lengths as a substitute for a longer one, “to enhance the maneuverability.”

164. Thus, a POSITA would have understood that Matsumoto could be used as a handheld vacuum by using only the uppermost connection pipe 3, and connecting suction port body 4 (or another attachment) to the shortened connection pipe 3, as illustrated in the mockup of Figure 25 shown below.

FIG. 25



Ex. 1005, Fig. 25 (annotated).



Mockup of Matsumoto's Figure 25 to show use of Matsumoto's vacuum as a handheld.

165. *Second*, a POSITA would have understood that Matsumoto's long and skinny handle 484 is unergonomic and uncomfortable because of its shape, angle and orientation. The angle requires a grip along a somewhat horizontal axis which could strain the wrist over extended use. A POSITA would have known in 2015 that since the date of Matsumoto in 1999, handle configurations that offered improved comfort were commonplace.

166. An additional concern of the POSITA would be the robustness of the shown handle. The long skinny handle is essentially a cantilever absorbing the constant forces of the user's hand as the vacuum is maneuvered back and forth. That means that a POSITA would have recognized that Matsumoto's handle is likely to break because of its design.

167. A POSITA would have therefore sought to take advantage of the improved handle configuration provided in Conrad '787 while retaining the improved dustbin configuration of Matsumoto. A POSITA would have recognized that Conrad's handle would be more comfortable and more reliable. Moreover, in 2015 (at the time of the priority of the '687 patent), a POSITA would have known that handheld vacuum cleaners with handles that have a "pistol-grip" configuration were commonplace due to the added comfort in use, in particular as compared with vacuum cleaners from the time Matsumoto's priority application was filed in 1999.

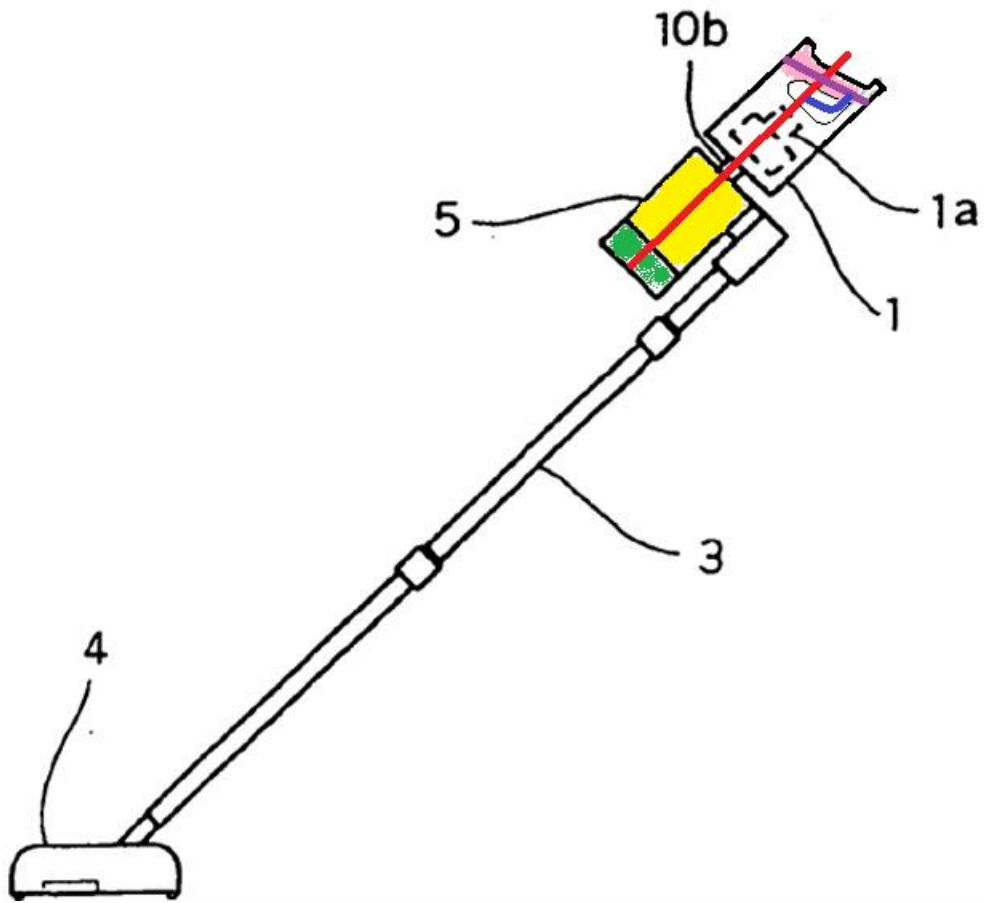
168. For example, Conrad '787 explains that:

- Its handle configuration allows a user to "operate handvac 112 during cleaning." Ex. 1006, ¶314.
- This handle configuration can be "comfortably operated in an orientation that does not require an application of torque by the user's hands when the handvac 112 is held by handle 484," because "the center of gravity 524 of the handvac 112 is aligned vertically below the user's hand." *Id.* This is important for use of Conrad '630 vacuum to clean surfaces that are not horizontal (*e.g.*, a drapery). Since the vacuum of Conrad '630 is a handheld, it is more likely to be used to clean surfaces other than floors.
- Conrad '787 further explains that in "the illustrated embodiment, handle axis 888 of handle 484 extends at a (non-zero) forward angle 892 to the vertical

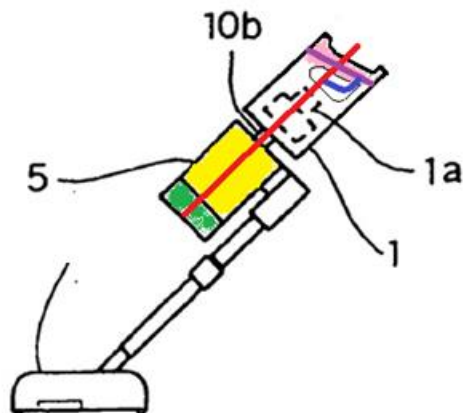
(e.g., e.g. when bottom wall 216 is horizontal). This may provide a comfortable handle alignment for grasping by a user when picking up handvac 112, and when using handvac 112 for cleaning surfaces below the user's elbows.” *Id.* at ¶317.

169. A POSITA would have therefore sought to take advantage of the improved handle configuration provided in Conrad '787 while retaining the advantages of Matsumoto's design, including its improved dustbin configuration.

170. *Third*, a POSITA would have had a reasonable expectation of success in modifying Matsumoto's handle, which is already at the back of vacuum cleaner 100, to have the same configuration as Conrad '787's handle 484. As illustrated in the mockup below, a POSITA would simply replace Matsumoto's uncomfortable long and skinny handle with Conrad '787's more ergonomic handle 484 (pink) or another handle similar to Conrad '787's that adapts Conrad '787's teachings as the shape and angle θ of the handle. The location of the new handle would not interfere with any other component of Matsumoto's vacuum.



Mockup of Matsumoto's Figure 25 to show combined Matsumoto/Conrad '787 vacuum cleaner.



Mockup of Matsumoto's Figure 25 in a miniaturized form to show combined Matsumoto/Conrad '787 vacuum cleaner.

2. Independent Claim 1

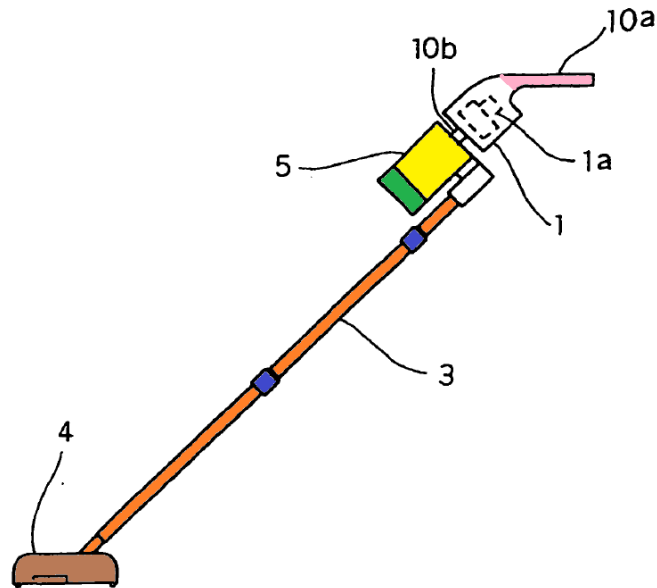
171. It is my opinion that limitations of claim 1 are rendered obvious by Matsumoto in view of Conrad '787.

1[pre] "A handheld vacuum cleaner, comprising"

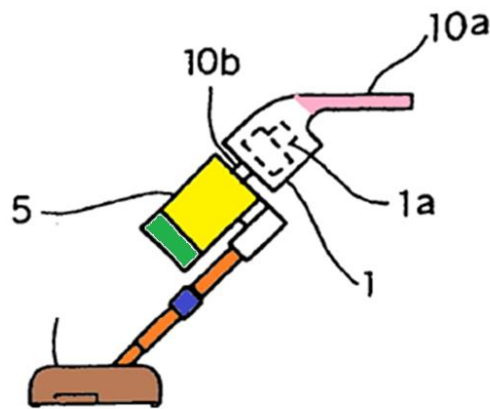
172. I understand that a preamble generally does not state a claim limitation. However, to the extent the preamble limits claim 1, it is my opinion that the limitation is disclosed and taught by Matsumoto.

173. Matsumoto discloses a vacuum cleaner having a body 1 and a handle 10a (pink). Ex. 1005, Figs. 25, 1, and 2, ¶60. The body 1 is coupled to a cyclone dust collecting part 5 (yellow/green), which is coupled to suction port body 4 (brown) by a connection pipe 3 (orange). *Id.*, ¶¶25, 27. Matsumoto's illustrations of the connection pipe also show collars (blue), which indicate the connection pipe 3 is made of multiple pipes connected to one another and which can be disconnected from each other. *Id.*, Fig. 25. As explained above (Section IV.C.1), a POSITA would have understood that Matsumoto could be used as a handheld vacuum by using only the uppermost connection pipe 3, and connecting suction port body 4 to the shortened connection pipe 3, as illustrated in the mockup of Figure 25 shown below.

FIG. 25



Ex. 1005, Fig. 25 (annotated).



Mockup of Figure 25.

174. Similarly, Conrad '787 discloses a handheld vacuum cleaner, referred to as “handvac 122” having a handle 484. Ex. 1006, ¶¶185, 312, 314, 316, Figs. 78, 96.

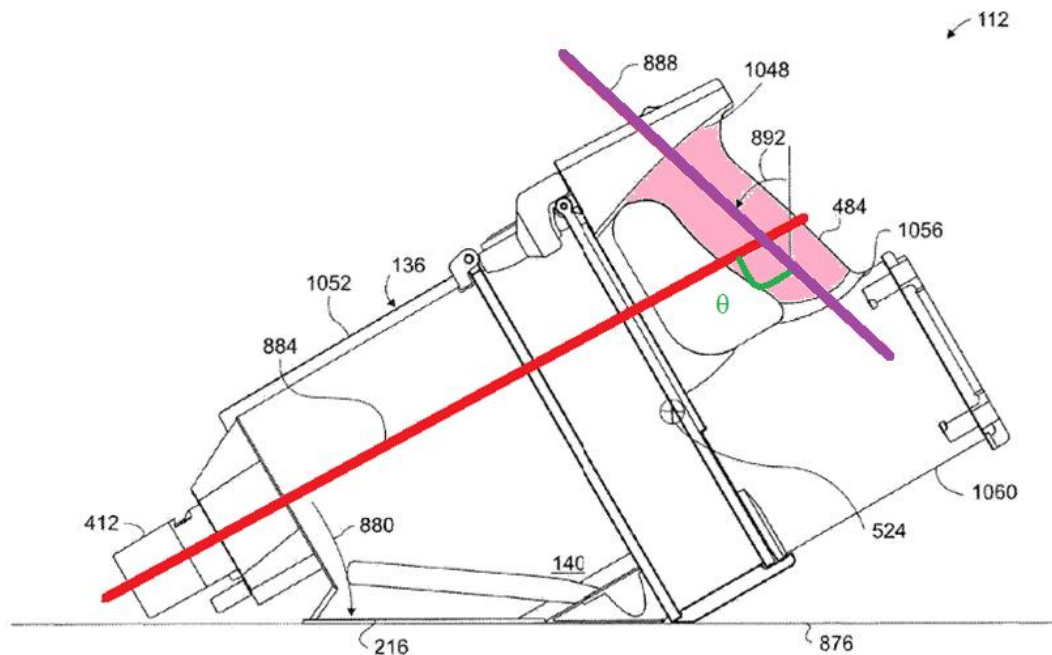


FIG. 78

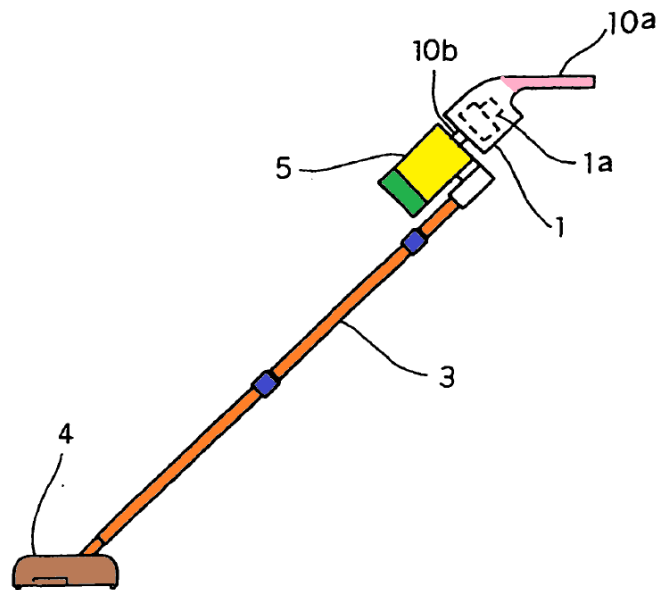
Ex. 1006, Fig. 78 (annotated).

[1a] “a handle by which the vacuum cleaner is supported during normal use;”

175. It is my opinion that Matsumoto discloses this limitation.

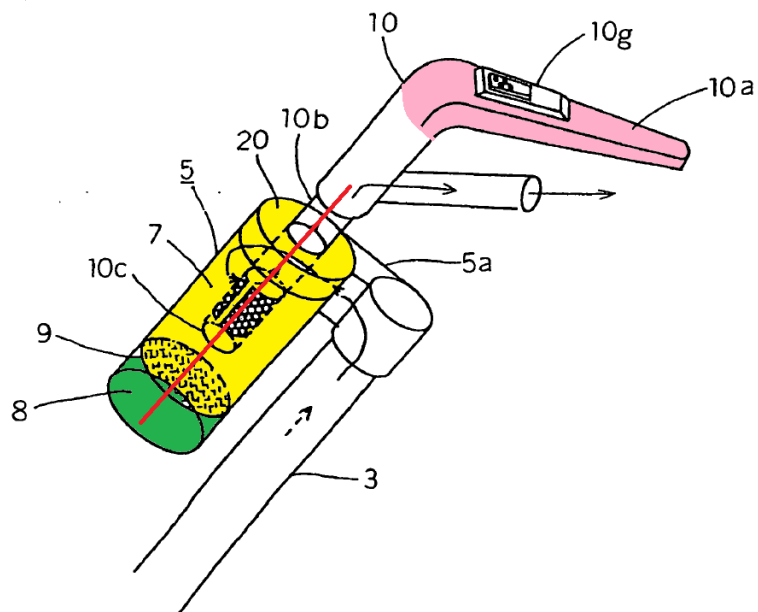
176. Matsumoto discloses a vacuum cleaner having a body 1 and a handle 10a (pink). Ex. 1005, Figs. 25, 1, and 2, ¶60.

FIG. 25



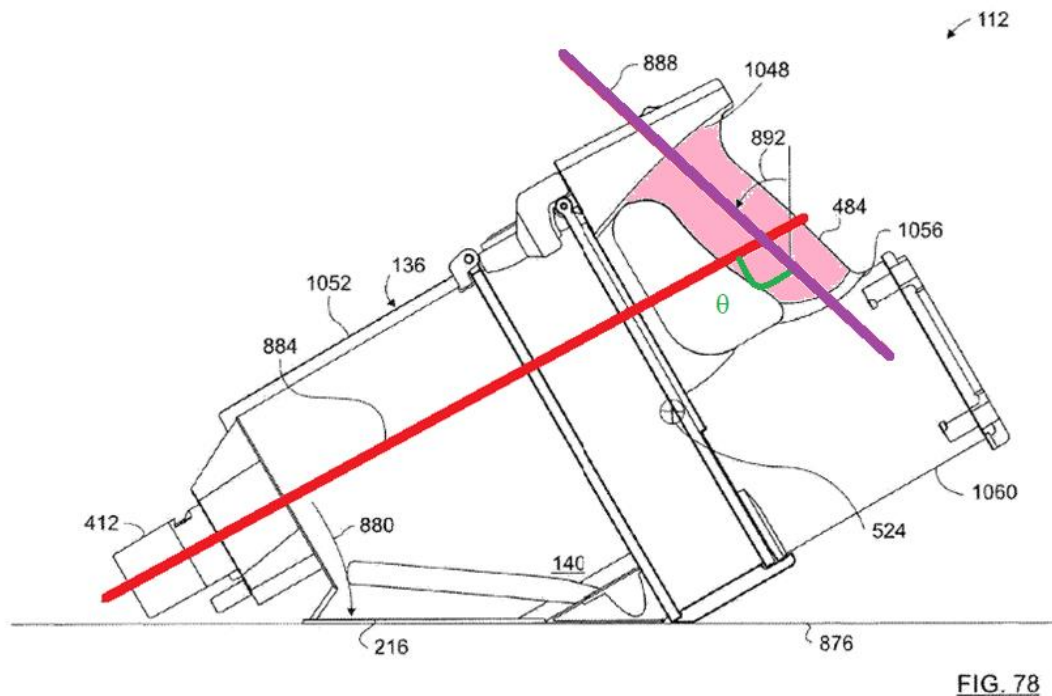
Ex. 1005, Fig. 25 (annotated).

FIG. 2



Ex. 1005, Fig. 2 (annotated).

177. Similarly, Conrad '787 discloses that handvac 122 has a handle 484 (pink). Ex. 1006, ¶¶185, 312, 314, 316, Figs. 78, 96. Thus, in my opinion, the combination of Conrad '630 and Conrad '787 also teaches the use of a handle in a handheld vacuum.



Ex. 1006, Fig. 78 (annotated).

[1b] “a cyclonic separating unit having a longitudinal axis and a dirt collector at one end of the cyclonic separating unit,”

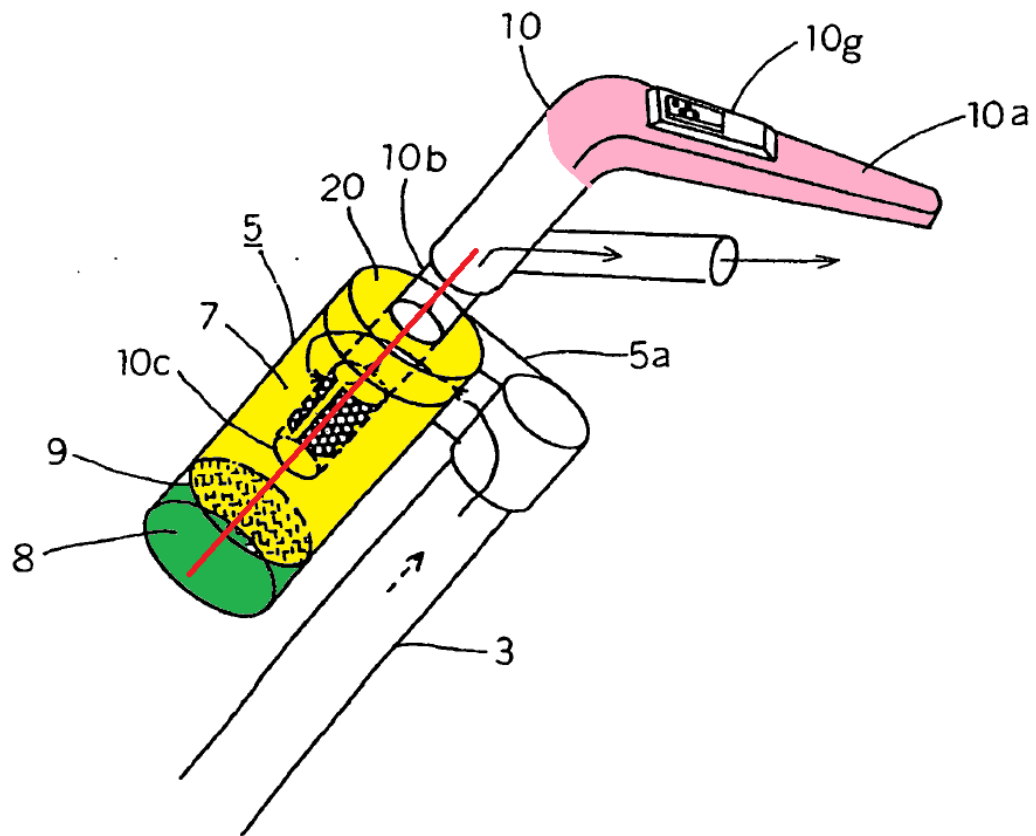
178. It is my opinion that Matsumoto discloses this limitation.

179. Matsumoto discloses a cyclone dust collecting part 5 having a longitudinal axis (red), a dust collecting chamber 7 (yellow) and a dust collecting chamber 8 (green) at one end of the cyclone dust collecting part 5. Ex. 1005, Fig. 2,

3, ¶¶25-28, 30 41, 43. The cyclone dust collecting part 5, which includes a first dust collecting chamber 7 (yellow) and a dust collecting chamber 8 (green), corresponds to the claimed “cyclonic separating unit.” *Id.*, Claim 1 (“the cyclone type dust collecting part (5) has a first dust collecting chamber (7) and a second dust collecting chamber (8)”).

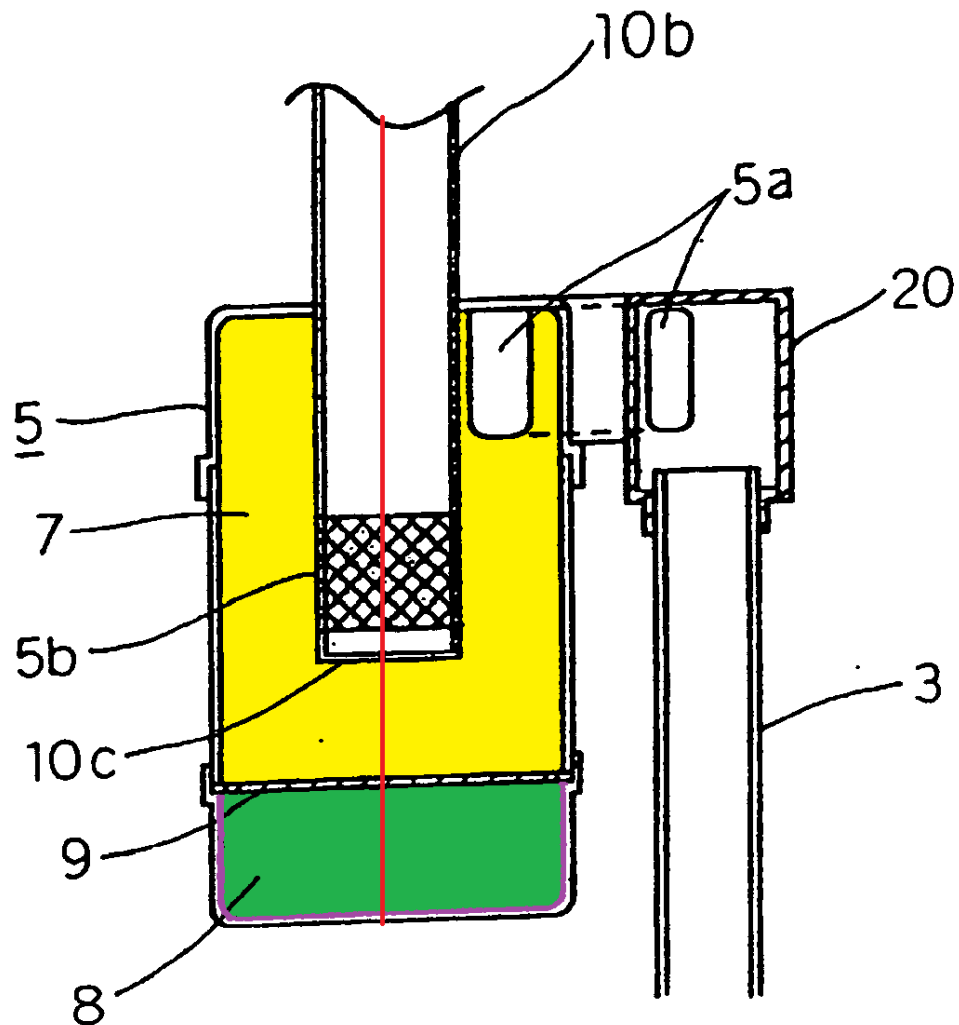
180. Matsumoto explains that “suction air collides with an inner wall 5c of the cyclone dust collecting part 5 and is thereby formed into a whirling stream, dust is separated from the suction air and is collected in a first dust collecting chamber 7.” *Id.*, ¶30. Suction air passes through a first dust collecting chamber 7 (yellow) of the cyclone 5. *Id.*, ¶43. Fine dust particles are separated and collected in dust collecting chamber 8 (green). *Id.* Moreover, dust collecting chamber 8 (green), as illustrated in Figures 2 and 3, is at one end of the cyclone dust collecting part 5 (yellow).

FIG. 2



Ex. 1005, Fig. 2 (annotated).

FIG. 3



Ex. 1005, Fig. 3 (annotated).

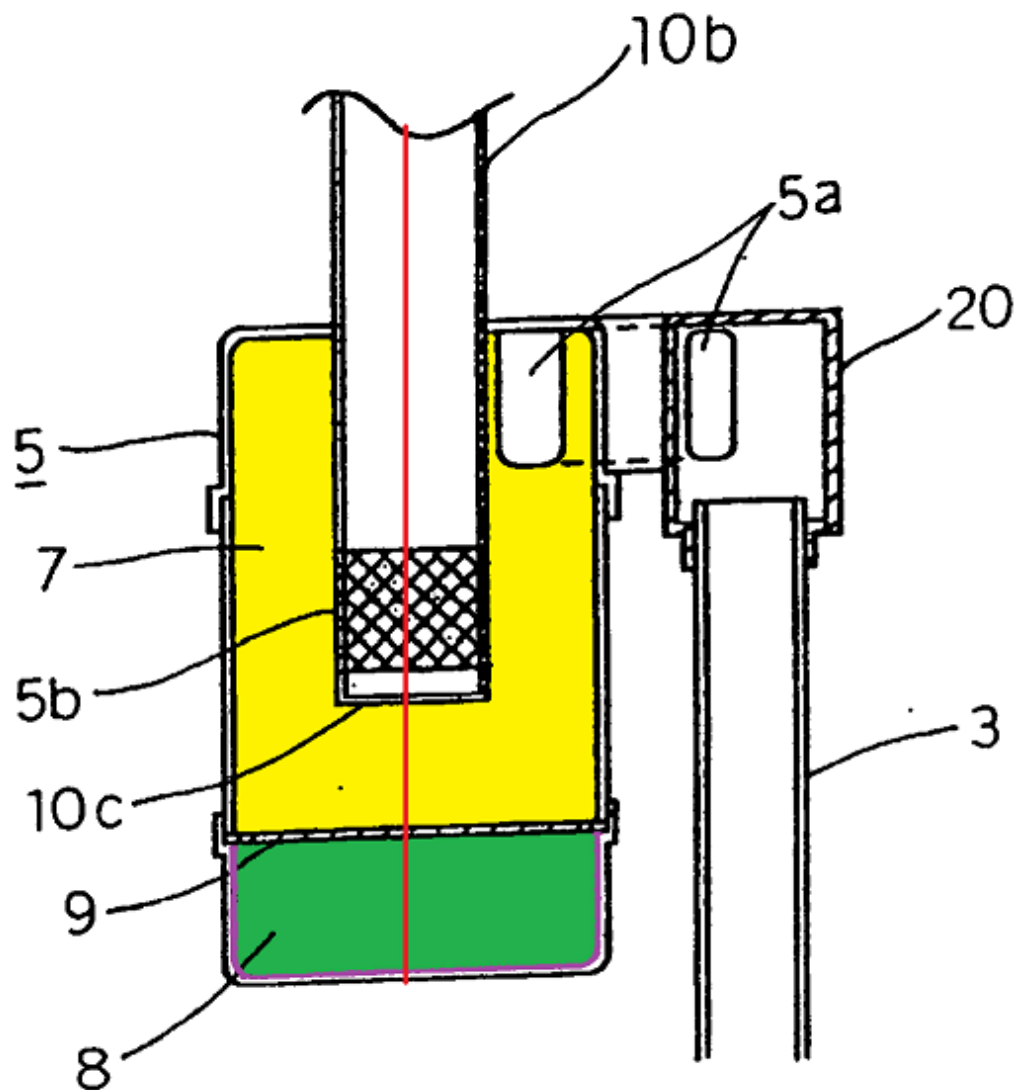
[1c] “the cyclonic separating unit comprising an end wall having a closed configuration in which dirt is retained within the dirt collector by the end wall and an open configuration for the removal of dirt from the dirt collector, wherein the end wall is movable relative to the longitudinal axis and, when the end wall is in the closed configuration, the longitudinal axis extends through a region bounded by a perimeter of the end wall,”

181. It is my opinion that Matsumoto discloses this limitation.

182. Matsumoto discloses a cyclone dust collecting part 5 having a first dust collecting chamber 7 (yellow) and a second first dust collecting chamber 8 (green), with a lid 8c (purple) that has an end wall. Ex. 1005, Fig. 2, 3, 18, ¶45. The lid 8c (purple) has a closed configuration in which dirt is retained within dust collecting chamber 8 (green) by the lid 8c (purple). *Id.*, Fig. 3, ¶45. The lid 8c (purple) also has an open configuration for the removal of dirt from dust collecting chamber 8 (green). *Id.*, Fig. 18, ¶45 (“Furthermore, as shown in Fig. 18, the second dust collecting chamber 8 may be so structured that a lid 8c at its lid is openable by means of a coupling part 5h realized by screw engagement, with a bayonet, with a clamp, or by another means.”).

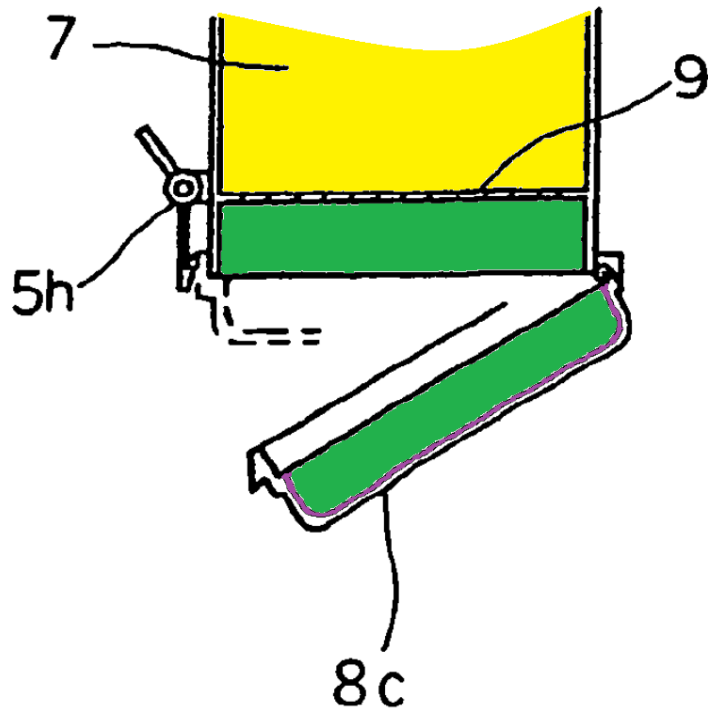
183. Lid 8c is movable relative to the longitudinal axis (red) of cyclone dust collecting part 5 (yellow), and, when the lid 8c (purple) is in the closed configuration (Figure 3), the longitudinal axis (red) extends through a region bounded by a perimeter of lid 8c (purple). *Id.* Matsumoto also explains that “the openable lid 8c makes the disposal of refuse easier.” *Id.*, ¶46.

FIG. 3



Ex. 1005, Fig. 3 (annotated).

FIG. 18



Ex. 1005, Fig. 18 (annotated).

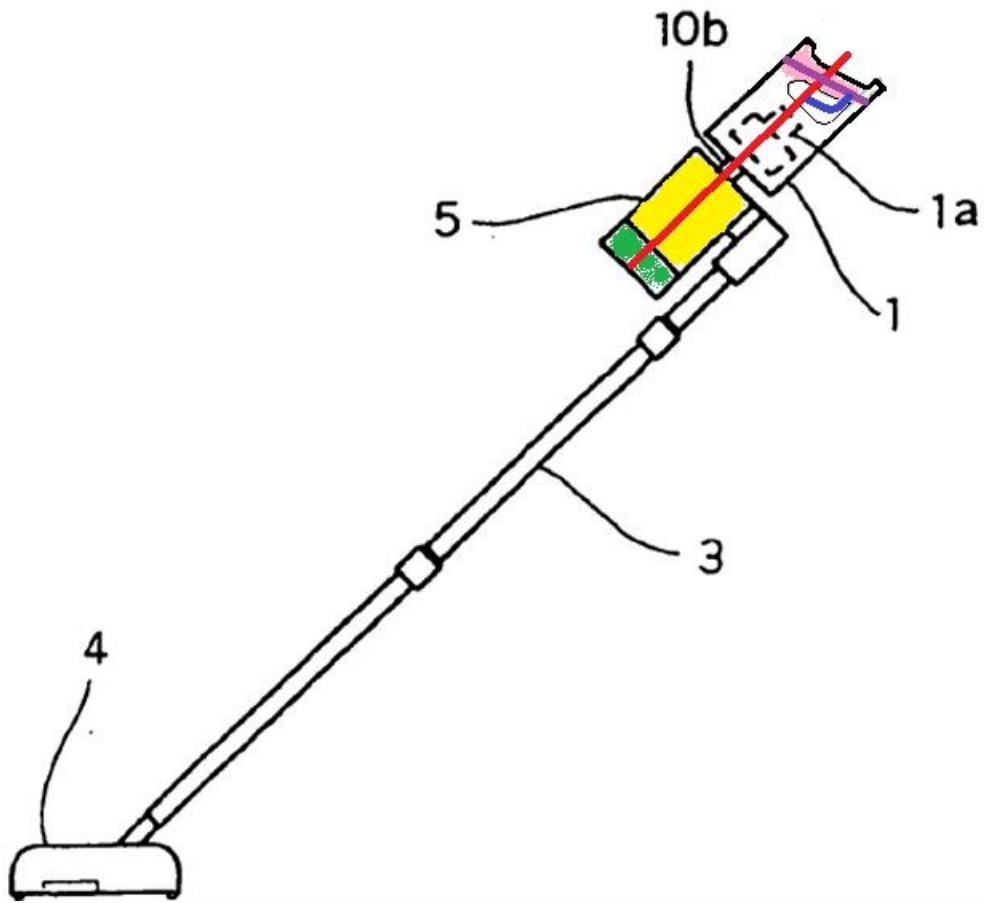
[1d] “wherein the handle has a pistol grip configuration in which the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 85 degrees and not greater than 140 degrees between a handle axis and the longitudinal axis of the cyclonic separating unit, and wherein the handle axis and the longitudinal axis intersect within the vacuum cleaner.”

184. As explained above in connection with Ground 1 (Section VII.A.2.[1d]; incorporated here by reference), it is my opinion that Conrad ’787 discloses this limitation.

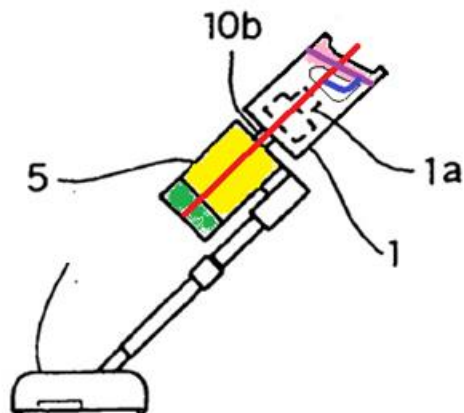
185. A POSITA would have considered Conrad '787's specific teachings as to the specific range for angle θ (green) and the shape of the handle 484 and incorporated those design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Conrad '787's handle described above are attributable to those design elements, and would have therefore sought to incorporate such design elements into the combined handheld vacuum. As such, the POSITA would have designed a combined handheld vacuum that has a shaped in a pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Conrad '787, which falls within the claimed range of claim 1.

186. In the proposed combination (as shown below), I measured that the handle would be inclined with respect to cyclonic separating unit 5 (yellow/green) to form an angle (blue) of approximately 110 degrees between the handle axis (purple) and the longitudinal axis (red) of the cyclonic separating unit 5. The combined vacuum inherently discloses a handle that falls within the claimed angle range of Element 1[d].

187. Similarly, in the proposed combination, the handle axis (purple) and the longitudinal axis (red) intersect within the vacuum cleaner.



Mockup of Matsumoto's Figure 25 to show combined Matsumoto/Conrad '787 vacuum cleaner.



Mockup of Matsumoto's Figure 25 in a miniaturized form to show combined Matsumoto/Conrad '787 vacuum cleaner.

188. Moreover, a POSITA would have been motivated to combine Matsumoto and Conrad '787 with a reasonable expectation of success for the reasons explained under Section VII.C.1, incorporated here by reference.

3. Dependent Claim 2

189. It is my opinion that Conrad '787 discloses the elements of this claim.

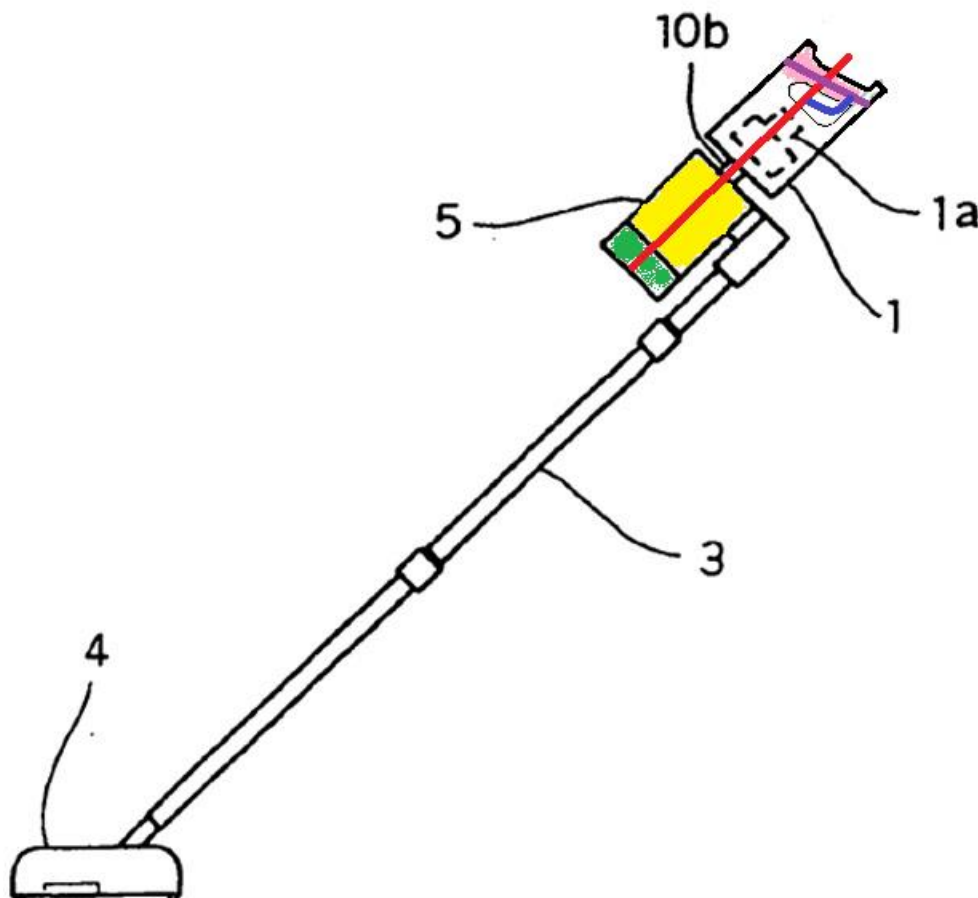
[2] The handheld vacuum cleaner of claim 1, wherein the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 100 degrees and not greater than 125 degrees between the handle axis and the longitudinal axis of the cyclonic separating unit.

190. As explained above in connection with Ground 1 (Section VII.A.2.[1d], Section VII.A.3; incorporated here by reference), it is my opinion that Conrad '787 discloses this limitation.

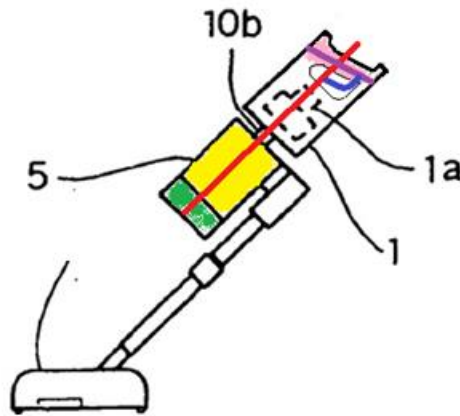
191. A POSITA would have considered Conrad '787's specific teachings as to the specific range for angle θ (green) and the shape of the handle 484 and incorporated those design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Conrad '787's handle described above are attributable to those design elements, and would have therefore sought to incorporate such design elements into the combined handheld vacuum. As such, the POSITA would have designed a combined handheld vacuum

that has a shaped in a pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Conrad '787, which falls within the claimed range of claim 2.

192. In the proposed combination (as shown below), I measured that the handle would be inclined with respect to cyclonic separating unit 5 (yellow/green) to form an angle (blue) of approximately 110 degrees between the handle axis (purple) and the longitudinal axis (red) of the cyclonic separating unit 5. The combined vacuum inherently discloses a handle that falls within the claimed angle range of Claim 2.



Mockup of Matsumoto's Figure 25 to show combined Matsumoto/Conrad '787 vacuum cleaner.



Mockup of Matsumoto's Figure 25 in a miniaturized form to show combined Matsumoto/Conrad '787 vacuum cleaner.

193. Moreover, a POSITA would have been motivated to combine Matsumoto and Conrad '787 with a reasonable expectation of success for the reasons explained under Section VII.C.1, incorporated here by reference.

4. Dependent Claim 3

194. It is my opinion that Matsumoto discloses the elements of this claim.

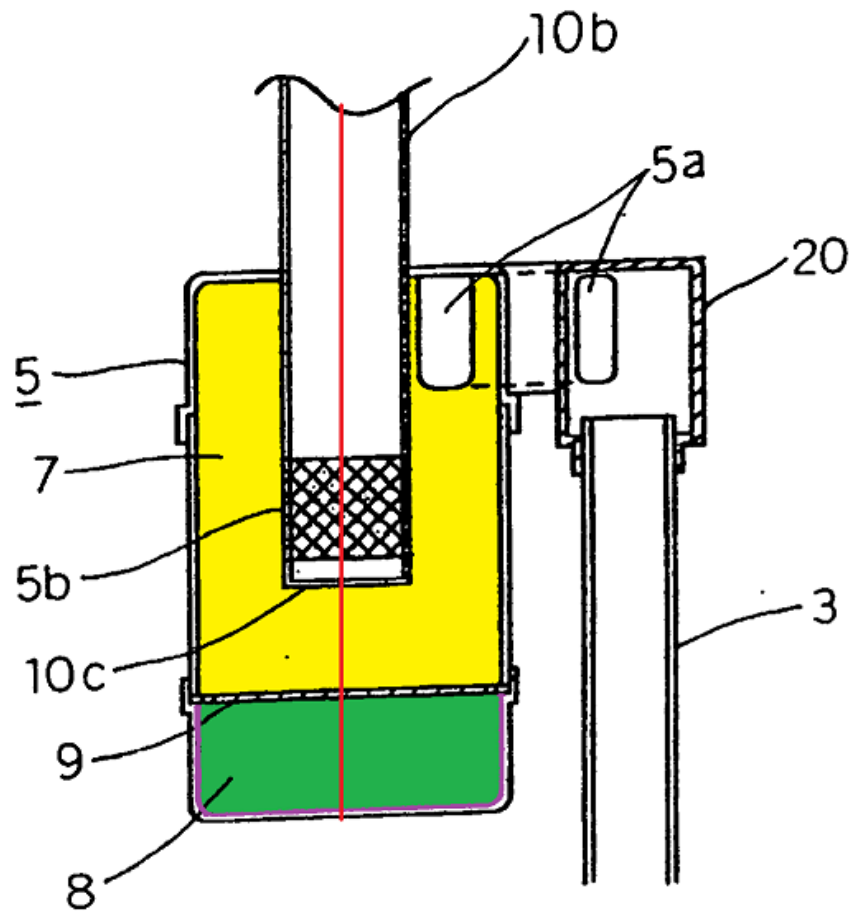
[3] The handheld vacuum cleaner of claim 1, wherein the end wall comprises an end wall of the cyclonic separating unit.

195. It is my opinion that Matsumoto discloses this limitation.

196. Matsumoto discloses that lid 8c forms an end wall of the cyclone dust collecting part 5 (yellow/green). Ex. 1006, Figs. 2, 3, 18, ¶¶25-28, 30, 32, 33, 44,

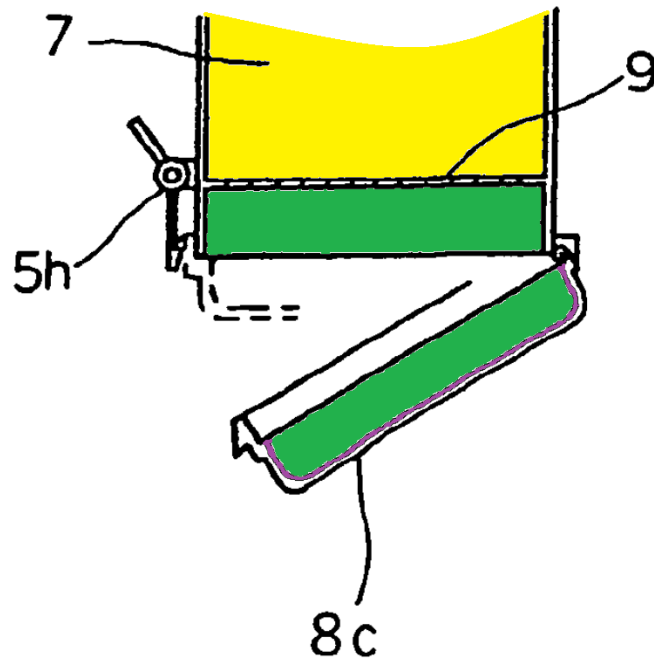
Claim 1 (“the cyclone type dust collecting part (5) has a first dust collecting chamber (7) and a second dust collecting chamber (8)”); *see also*, Section VII.C.2.[1b] (incorporated by reference).

FIG. 3



Ex. 1005, Fig. 3 (annotated).

FIG. 18



Ex. 1005, Fig. 18 (annotated).

5. Dependent Claim 4

197. It is my opinion that Matsumoto discloses the elements of this claim.

[4] The handheld vacuum cleaner of claim 1, wherein the end wall is arranged to pivot between the closed configuration and the open configuration.

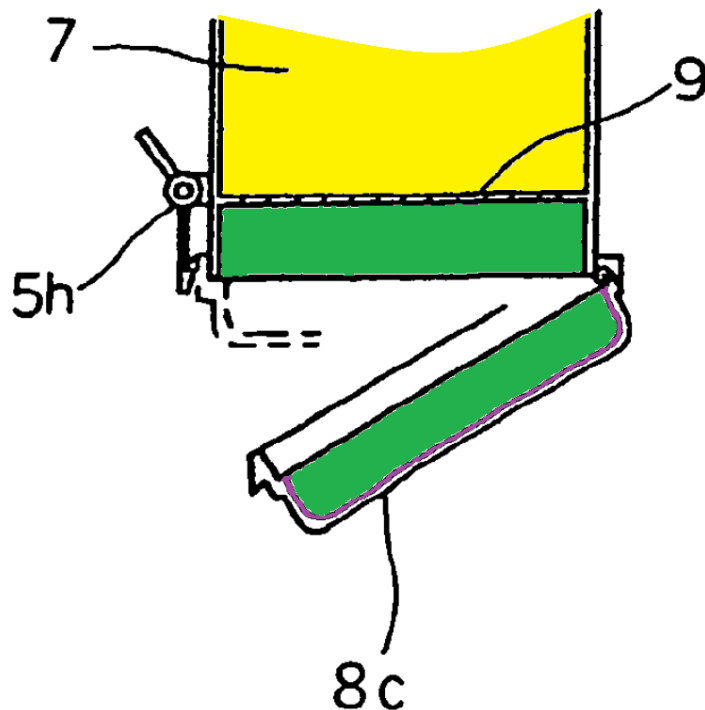
198. It is my opinion that Matsumoto discloses this limitation.

199. Matsumoto discloses that lid 8c is arranged to pivot between the closed configuration and the open configuration. Ex. 1005, Figs. 3, 18 (illustrating a pivot), ¶45 (“Furthermore, as shown in Fig. 18, the second dust collecting chamber 8 may

be so structured that a lid 8c at its lid is openable by means of a coupling part 5h realized by screw engagement, with a bayonet, with a clamp, or by another means.”).

200. Matsumoto also explains that “the openable lid 8c makes the disposal of refuse easier.” *Id.*, ¶46. *See also* Section IV.C.21.[1c]; incorporated herein by reference).

FIG. 18



Ex. 1005, Fig. 18 (annotated).

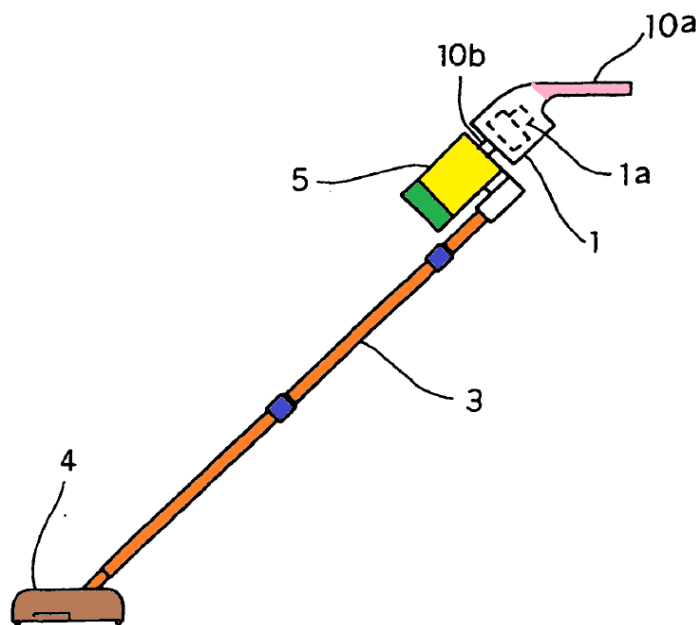
6. Dependent Claim 8

201. It is my opinion that Matsumoto discloses the elements of this claim.

[8] The handheld vacuum cleaner of claim 1, wherein the dirt collector is disposed forward of the handle.

202. It is my opinion that Matsumoto discloses this limitation. Matsumoto discloses that the dust collecting chamber 8 (green) is disposed forward of handle 10a (pink). Ex. 1005, Fig. 25, 2. A POSITA would have understood the location of dust collecting chamber 8 (green) to be “forward of the handle,” as claimed, because the dirt collection chamber is in front of the handle 10a when the vacuum is in use.

FIG. 25



Ex. 1005, Fig. 25 (annotated).

203. Moreover, the combined Matsumoto / Conrad '787 vacuum would also have a dirt collector disposed forward of the handle.

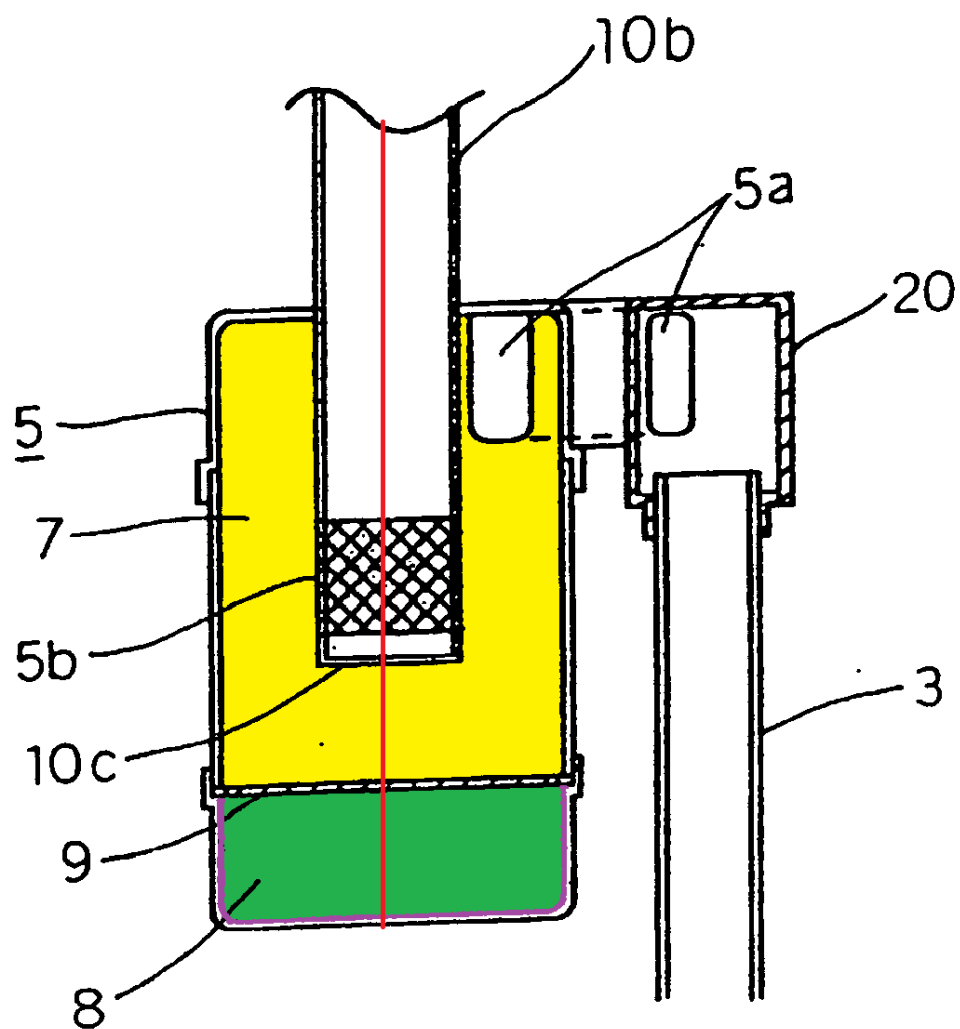
204. It is my opinion that Matsumoto discloses the elements of this claim.

205. It is my opinion that Matsumoto discloses this limitation.

103

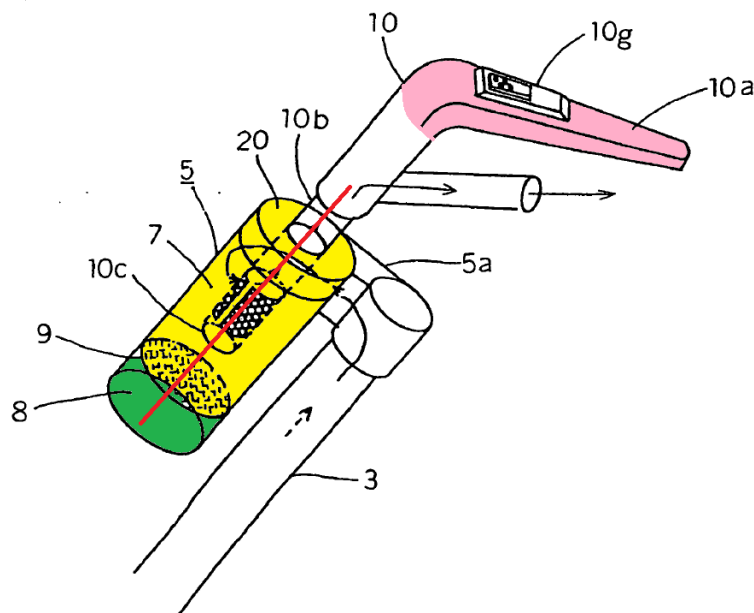
“the exhaust port 5b is formed as mesh having a large number of through holes.”), ¶41 (“The mesh of the exhaust port 5b is as fine as or finer than the mesh of the partition wall 9 so that the coarse particles of dust collected in the first dust collecting chamber 7 do not evade through the exhaust port 5b. Fine particles of dust are collected in the second dust collecting chamber 8, which is arranged outside the suction air passage away from the exhaust port 5b, and are thereby prevented from evading through the exhaust port 5b.”); *see also* Section IV.C.1.[1c]; incorporated herein by reference).

FIG. 3



Ex. 1005, Fig. 3 (annotated).

FIG. 2



Ex. 1005, Fig. 2 (annotated).

D. Ground 4: Claims 1–4, 8, and 10 Are Rendered Obvious by Matsumoto in View of Dyson

207. As I explain below, Matsumoto shows a vacuum cleaner that has the dirt collector as was claimed in the '687 patent. Matsumoto also discloses that the handle for its vacuum is at the back of the vacuum. However, Matsumoto does not explicitly disclose a “pistol grip configuration” as claimed in the '687 patent. On the other hand, Dyson discloses a handheld vacuum cleaner with a handle as claimed in the '687 patent. In my opinion, a POSITA would have been motivated to combine Matsumoto with Dyson.

208. In my opinion, as I explain below, the combination of Matsumoto and Dyson renders obvious claims 1–4, 8, and 10 of the '687 patent.

1. Motivation to Combine Matsumoto and Dyson

209. A POSITA would have been motivated to combine Matsumoto with Dyson. Specifically, a POSITA would have been motivated to use Dyson's handle with Matsumoto's vacuum.

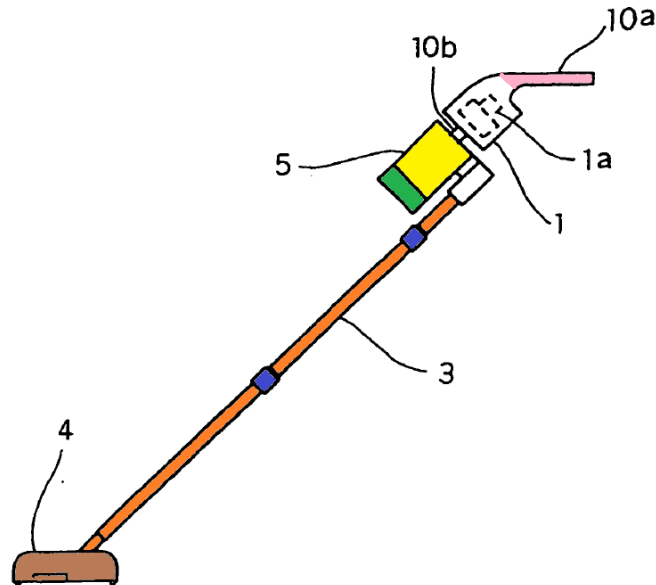
210. *First*, a POSITA would have been motivated to use Matsumoto in a handheld vacuum configuration. Matsumoto discloses a handheld stick-type vacuum cleaner that is suited for cleaning floors. Ex. 1005, Figs. 25, 1, ¶25. Matsumoto does not explicitly disclose a miniature handheld vacuum cleaner that would be suited for cleaning other types of surfaces, such as couches and bedding. However, Matsumoto explains that “miniaturizing the vacuum” cleaner would “enhance the operability thereof.” Ex. 1005, ¶68. As such, a POSITA would have been motivated to miniaturize the vacuum cleaner as explained below, and to use the Matsumoto vacuum in a handheld configuration.

211. Matsumoto's body 1 is coupled to a cyclone dust collecting part 5 (yellow/green), which is coupled to suction port body 4 (brown) by a connection pipe 3 (orange). Ex. 1005, ¶¶25, 27. Matsumoto's illustrations of the connection pipe also show collars (blue), which indicate the connection pipe 3 is made of multiple pipes connected to one another and which can be disconnected from each other. *Id.*, Fig. 25. One possible interpretation of this connection pipe is that it is a telescopic wand. This type of pipe is a common feature found on such vacuums

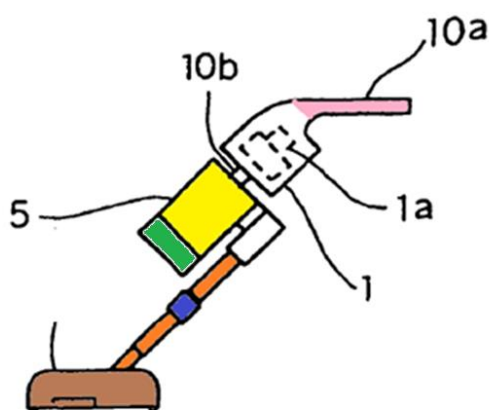
during the time prior to September 2015. Another interpretation is that it is simply a plurality of connecting pipes that are fit together to provide adequate length to clean flooring while walking upright. This interpretation allows for “miniaturizing” the pipes to shorter lengths as a substitute for a longer one, “to enhance the maneuverability.”

212. Thus, a POSITA would have understood that Matsumoto could be used as a handheld vacuum by using only the uppermost connection pipe 3, and connecting suction port body 4 to the shortened connection pipe 3, as illustrated in the mockup of Figure 25 shown below.

FIG. 25



Ex. 1005, Fig. 25 (annotated).



Mockup of Matsumoto's Figure 25 to show use of Matsumoto's vacuum as a handheld.

213. *Second*, a POSITA would have understood that Matsumoto's long and skinny handle 484 is unergonomic and uncomfortable because of its shape, angle and orientation. The angle requires a grip along a somewhat horizontal axis which could strain the wrist over extended use. A POSITA would have known in 2015 that since the date of Matsumoto in 1999, handle configurations that offered improved comfort were commonplace. Moreover, in 2015 (at the time of the priority of the '687 patent), a POSITA would have known that handheld vacuum cleaners with handles that have a "pistol-grip" configuration were commonplace due to the added comfort in use, in particular as compared with vacuum cleaners from the time Matsumoto's priority application was filed in 1999.

214. An additional concern of the POSITA would be the robustness of the shown handle. The long skinny handle is essentially a cantilever absorbing the

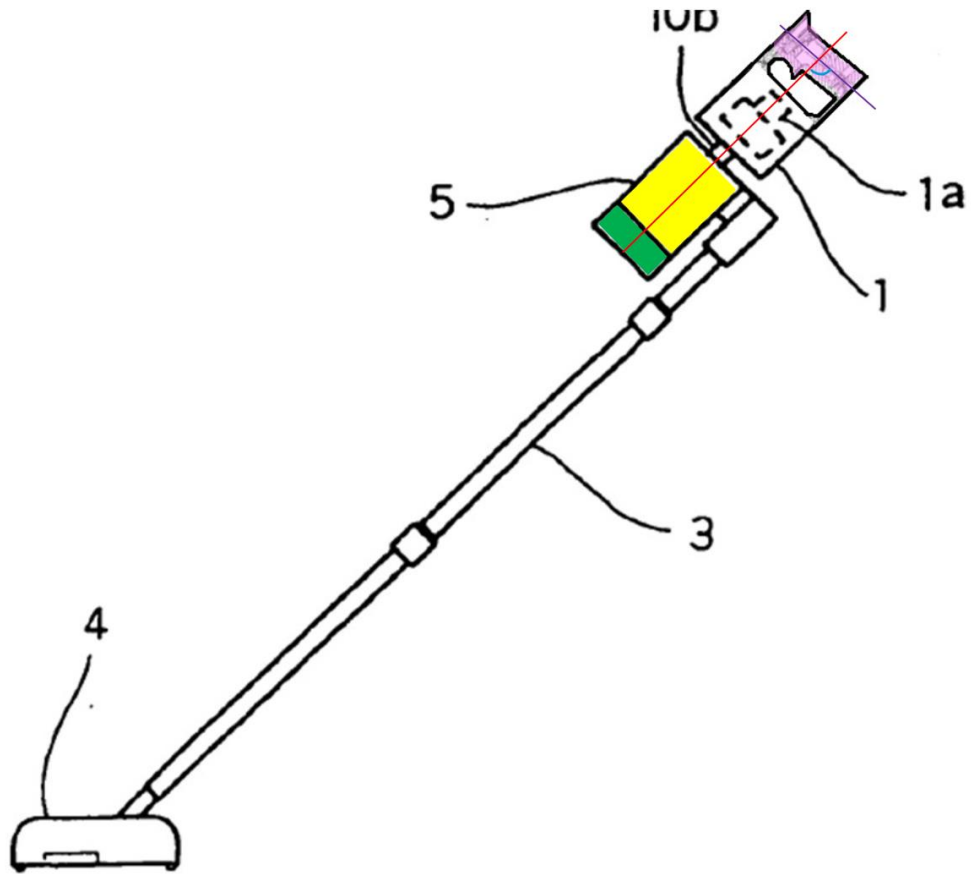
constant forces of the user's hand as the vacuum is maneuvered back and forth. That means that a POSITA would have recognized that Matsumoto's handle is likely to break because of its design.

215. A POSITA would have therefore sought to take advantage of the improved handle configuration provided in Dyson while retaining the improved dustbin configuration of Matsumoto. A POSITA would have recognized that Dyson's handle would be more comfortable and more reliable. For example, Dyson discloses that its handgrip configuration is in a "dumbbell-like' configuration," which ensures that "the weight of the hand-held vacuum cleaner 10 is distributed on both sides of the user's hand." Ex. 1007, 6:10-11. Dyson explains that this configuration is important because "a user may wish to clean a variety of surfaces which may be orientated at different angles," and "will need to lift and move the hand-held vacuum cleaner 10 into a variety of positions and orientations in order to clean effectively." *Id.*, 6:4-7. In short, as Dyson explains, "[t]his arrangement feels comfortable for a user," and allows the user to "maintain a comfortable wrist position and movement of the hand-held vacuum cleaner feels comfortable." *Id.*, 2:17-19, 4:27-29.

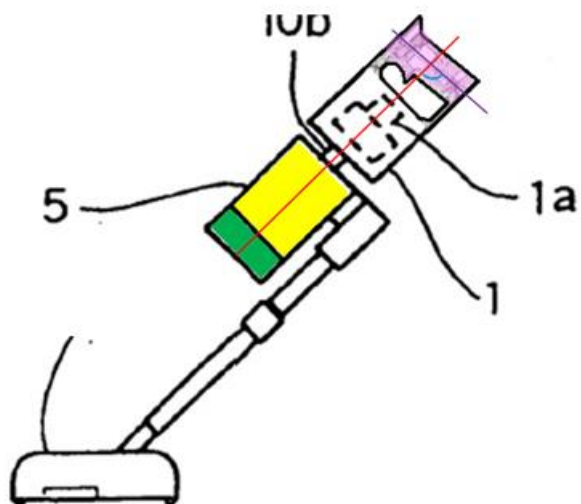
216. A POSITA would have therefore sought to take advantage of the improved handle configuration provided in Dyson while retaining the advantages of Matsumoto's design, including its improved dustbin configuration.

217. A POSITA would have therefore been motivated to combine the two references in a way that incorporates Dyson's teachings concerning the handle 28, including the shape and angle arrangement disclosed by Dyson.

218. *Third*, a POSITA would have had a reasonable expectation of success in modifying Matsumoto's handle, which is already at the back of vacuum cleaner 100, to have the same configuration as Dyson's handle 28. The modified handle would have the same shape and range for angle θ . As illustrated in the mockup below, a POSITA would simply replace Matsumoto's uncomfortable long and skinny handle with Dyson's more ergonomic handle 28 (pink). The location of the new handle would not interfere with any other component of Matsumoto's vacuum, or with another handle similar to Dyson's that adapts Dyson's teachings as the shape and angle θ of the handle.



Mockup of Matsumoto's Figure 25 to show combined Matsumoto/Dyson vacuum cleaner.



Mockup of Matsumoto's Figure 25 in a miniaturized form to show combined Matsumoto/Dyson vacuum cleaner.

2. Independent Claim 1

219. It is my opinion that limitations of claim 1 are rendered obvious by Matsumoto in view of Dyson.

1[pre] “A handheld vacuum cleaner, comprising”

220. I understand that a preamble generally does not state a claim limitation. However, to the extent the preamble limits claim 1, it is my opinion that the limitation is disclosed and taught by Matsumoto. I refer to my analysis above in connection with this claim element under Ground 3, which is incorporated here by reference.

[1a] “a handle by which the vacuum cleaner is supported during normal use;”

221. It is my opinion that Matsumoto discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 3, which is incorporated here by reference.

[1b] “a cyclonic separating unit having a longitudinal axis and a dirt collector at one end of the cyclonic separating unit,”

222. It is my opinion that Matsumoto discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 3, which is incorporated here by reference.

[1c] “the cyclonic separating unit comprising an end wall having a closed configuration in which dirt is retained within the dirt collector by the end wall and an open configuration for the removal of dirt from the dirt collector, wherein the end wall is movable relative to the longitudinal axis and, when the end wall is in the closed configuration, the longitudinal axis extends through a region bounded by a perimeter of the end wall,”

223. It is my opinion that Matsumoto discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 3, which is incorporated here by reference.

[1d] “wherein the handle has a pistol grip configuration in which the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 85 degrees and not greater than 140 degrees between a handle axis and the longitudinal axis of the cyclonic separating unit, and wherein the handle axis and the longitudinal axis intersect within the vacuum cleaner.”

224. It is my opinion that Dyson discloses this limitation.

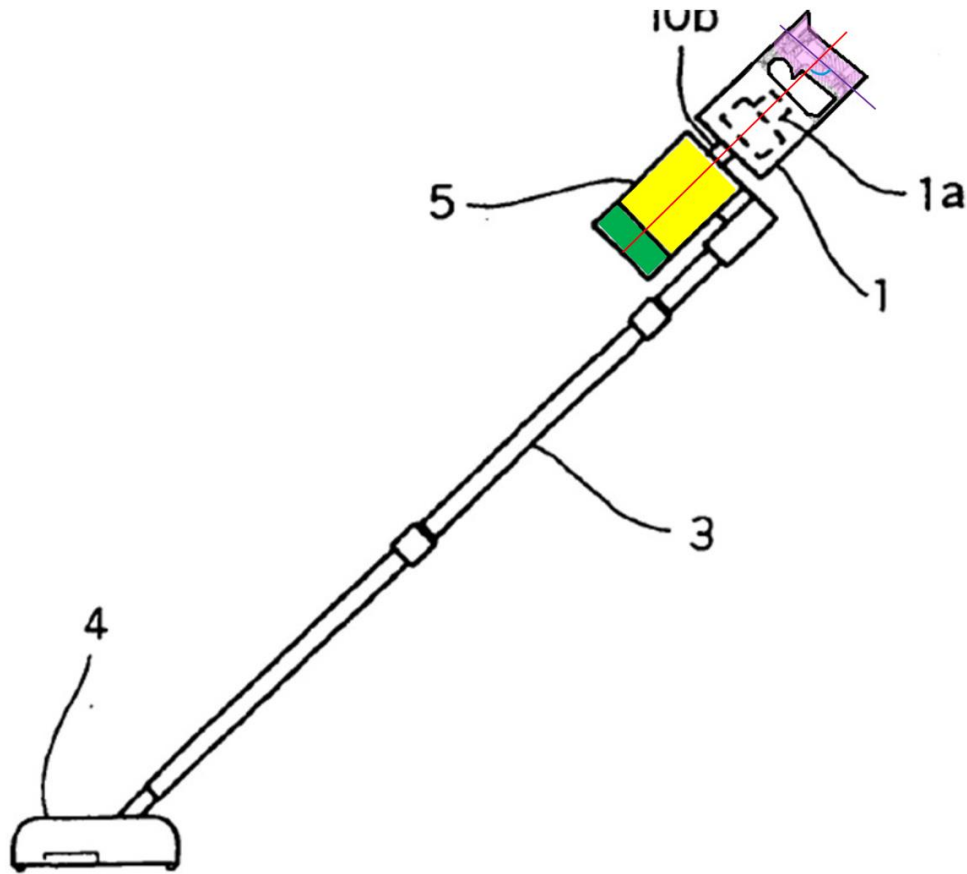
225. As explained above in connection with Ground 2 (Section VII.B.2.[1d]; incorporated here by reference), it is my opinion that Dyson discloses this limitation.

226. A POSITA would have considered Dyson’s specific teachings as to the specific range for angle θ (green) and the shape of the handle 484 and incorporated those design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Dyson’s handle described above are attributable to those design elements, and would have therefore sought to incorporate such design elements into the combined handheld vacuum. As such, the POSITA would have designed a combined handheld vacuum that has a shaped in a

pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Dyson, which falls within the claimed range of claim 1.

227. In the proposed combination (as shown below), I measured that the handle would be inclined with respect to cyclonic separating unit 5 (yellow/green) to form an angle (blue) of approximately 95 degrees between the handle axis (purple) and the longitudinal axis (red) of the cyclonic separating unit 5. The combined vacuum inherently discloses a handle that falls within the claimed angle range of Element 1[d].

228. Similarly, in the proposed combination, the handle axis (purple) and the longitudinal axis (red) intersect within the vacuum cleaner.



Mockup of Matsumoto's Figure 25 to show combined Matsumoto/Dyson vacuum cleaner.

229. Moreover, a POSITA would have been motivated to combine Matsumoto and Dyson with a reasonable expectation of success for the reasons explained under Section VII.D.1, incorporated here by reference.

3. Dependent Claim 2

230. It is my opinion that Dyson discloses the elements of this claim.

[2] The handheld vacuum cleaner of claim 1, wherein the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 100 degrees and not greater than 125 degrees between the handle axis and the longitudinal axis of the cyclonic separating unit.

231. It is my opinion that Dyson discloses this limitation.

232. A POSITA would have considered Dyson's specific teachings as to the specific range for angle θ (green) and the shape of the handle 484 and incorporated those design elements into the combined handheld vacuum. The POSITA would have recognized that advantages associated with Dyson's handle described above are attributable to those design elements, and would have therefore sought to incorporate such design elements into the combined handheld vacuum. As such, the POSITA would have designed a combined handheld vacuum that has a shaped in a pistol grip configuration and which had an incline relative to the longitudinal axis that was within the specific range for angle θ (green) taught by Dyson, which falls within the claimed range of claim 2.

233. As explained above in connection with Ground 2 (Section VII.B.2.[1d], Section VII.B.3; incorporated here by reference), it is my opinion that Dyson discloses this limitation.

234. Moreover, a POSITA would have been motivated to combine Matsumoto and Dyson with a reasonable expectation of success for the reasons explained under Section VII.D.1, incorporated here by reference.

4. Dependent Claim 3

235. It is my opinion that Matsumoto discloses the elements of this claim.

[3] The handheld vacuum cleaner of claim 1, wherein the end wall comprises an end wall of the cyclonic separating unit.

236. It is my opinion that Matsumoto discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 3, which is incorporated here by reference.

5. Dependent Claim 4

237. It is my opinion that Matsumoto discloses the elements of this claim.

[4] The handheld vacuum cleaner of claim 1, wherein the end wall is arranged to pivot between the closed configuration and the open configuration.

238. It is my opinion that Matsumoto discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 3, which is incorporated here by reference.

6. Dependent Claim 8

239. It is my opinion that Matsumoto discloses the elements of this claim.

[8] The handheld vacuum cleaner of claim 1, wherein the dirt collector is disposed forward of the handle.

240. It is my opinion that Matsumoto discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 3, which is

incorporated here by reference. Moreover, the combined Matsumoto / Dyson vacuum would also have a dirt collector disposed forward of the handle.

7. Dependent Claim 10

241. It is my opinion that Matsumoto discloses the elements of this claim.

[10] The handheld vacuum cleaner of claim 1, wherein the cyclonic separating unit comprises a cyclonic separator having an axis that defines the longitudinal axis of the cyclonic separating unit.

242. It is my opinion that Matsumoto discloses this limitation. I refer to my analysis above in connection with this claim element under Ground 3, which is incorporated here by reference.

VIII. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

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

244. I am not aware of any secondary considerations of non-obviousness with respect to the '687 Patent. For example, I am not aware of any showing of a

long-felt but unmet need satisfied by the '687 Patent. To the contrary, as explained above, the alleged “need” satisfied by the '687 Patent had been satisfied before in references such as Conrad '630 and Matsumoto. Similarly, I am not aware of any commercial success of any vacuum cleaners due to practicing the '687 Patent, nor of any evidence on any of the other secondary considerations identified above.

245. Therefore, consideration of secondary indicia of non-obviousness does not alter my conclusion that the claims of the '687 Patent are invalid as obvious.

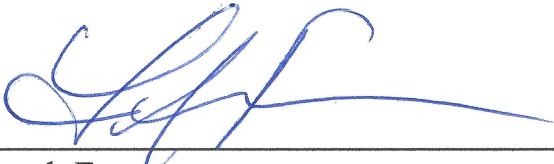
IX. RESERVATION OF RIGHTS

246. My opinions are based upon the information that I have considered to date. I am unaware of any evidence of secondary considerations with respect to the '687 Patent that would render any of the challenged claims non-obvious. I reserve the right, however, to supplement my opinions in the future to respond to any arguments raised by the Patent Owner and to take into account new information that becomes available to me.

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

Executed on August 21, 2023.

By:



Joseph Fester

Appendix A

JOSEPH A. FESTER

+1 (616) 304-4085 / joey.fester@gmail.com / www.linkedin.com/in/joeyfester

SUMMARY

Accomplished engineering leader and team builder with over 25 years' experience in concept innovation, product development and project management. Extensive work onsite in Asia and Europe to deliver electromechanical products to market. Recognized collaborator and communicator. Results driven.

- Engineering Management
 - Project Management
 - Global Manufacturing Expertise
 - Agile Product Development
 - Intellectual Property & Patents
 - Prototype Build & Testing
 - Safety & Code Compliance
 - Test Methodology Creation
 - Cross-Functional Collaboration
-

PROFESSIONAL EXPERIENCE

Dematic Corporation, Grand Rapids, MI 2014 – present

Project Manager, Customer Services Modernizations & Upgrades

- Managed efforts of engineering and installation personnel on a variety of projects
- Direct communication with customers to ensure smooth delivery and commissioning of orders

Product Owner, Mechatronics R&D

- Led a team of 12 engineers, designers and technicians in development of a new conveyor system
- Subject Matter Expert for MCC project to specify and test configuration tool (Maestro/CET)

Solution Design Engineer, Solution Development

- Developed system layouts and cost estimations to Sales for new project quotations
- Regular direct communications with high visibility customer to define and address requirements

Senior Product Engineer, Mechatronics R&D

- Led project team of 6 to design modular sortation machines built in China and Mexico
- Supported manufacturing launch in China through regular conference calls, emails and onsite support
- Collaborated with Product Safety for Risk Assessment and Safety Reviews for CE Compliance

Bissell Homecare, Inc., Grand Rapids, MI 2002 – 2013

Senior Engineering Manager, Product Engineering

- Managed team of 7 lead, senior and entry-level engineers accountable for delivering vacuum category new product development projects on time and at cost
- Implemented modular design on new major platform to deliver derivatives up to 50% faster

Lead Engineer, Advanced Engineering

- Responsible for delivering ready-to-commercialize innovative technology to Product Engineering team
- Investigated and tested a variety of water filtration methods, including flocculants and electrolyzed (EO) water

Senior Development Engineer, Product Engineering

- Led 10 project teams of engineering, design and testing from concept through start of production
- Total sales of these vacuum products exceeded 25 million units and \$1.25 billion in revenue
- Created intellectual property with multiple patents awarded

PROFESSIONAL EXPERIENCE – continued

X-Rite, Incorporated, Grand Rapids, MI 1998 – 2001

[Mechanical Engineer](#)

- Led development of handheld color-measuring instrument from concept to production; created all CAD models and drawings for the product

Electrolux Home Products (formerly Frigidaire Company), Greenville, MI 1995 – 1998

[Project Engineer](#)

- Responsible for interior features (bins, shelves, racks) of current and new product lines of refrigerators

Whirlpool Corporation, Benton Harbor, MI 1989 – 1995

[Mechanical Engineer](#)

- Developed cost and quality improvements in drivetrain and brake systems

[Engineering Co-op](#)

- Analyzed and developed various processes for a plastic refrigerator door
 - Conducted a competitive analysis of a variety of water filtration products
-

ACADEMIC SUMMARY

Grand Valley State University, Grand Rapids, Michigan

[Master of Business Administration](#), 2002

Kettering University (formerly General Motors Institute), Flint, Michigan

[Bachelor of Science in Mechanical Engineering](#), Machine Design Specialty, 1994

PROFESSIONAL CERTIFICATIONS

Project Management Institute

[Project Management Professional \(PMP\)®](#), 2021

Scrum Alliance

[Certified Scrum Product Owner \(CSPO\)®](#), 2020

[Certified ScrumMaster \(CSM\)®](#), 2015

INTELLECTUAL PROPERTY

- [23 patents awarded](#) – 16 US utility, 2 US design, 3 European, 2 Australian

Complete Intellectual Property List

1. USD 565,818, *Filter*, Filed Sep 14, 2006, Issued Apr 1, 2008
2. USD 568,014, *Filter housing*, Filed Sep 19, 2007, Issued Apr 29, 2008
3. US 7,547,336, *Vacuum cleaner with multiple cyclonic dirt separators and bottom discharge dirt cup*, Filed Dec 28, 2005, Issued Jun 16, 2009
4. US 7,651,544, *Vacuum cleaner with multiple cyclonic dirt separators and bottom discharge dirt cup*, Filed Dec 29, 2005, Issued Jan 26, 2010
5. US 7,708,789, *Vacuum cleaner with cyclonic dirt separation and bottom discharge*, Filed Dec 21, 2004, Issued May 4, 2010
6. US 7,770,256, *Vacuum cleaner with multiple cyclonic dirt separators and bottom discharge dirt cup*, Filed Apr 29, 2005, Issued Aug 10, 2010
7. US 7,900,316, *Filter for a vacuum cleaner*, Filed Jan 30, 2007, Issued Mar 8, 2011
8. US 8,424,153, *Vacuum cleaner and filters therefor*, Filed Mar 19, 2009, Issued Apr 23, 2013
9. AU 2009201028, *Vacuum cleaner with cyclonic dirt separation and pet hair remover*, Filed Mar 13, 2009, Granted Nov 14, 2013
10. AU 2014100580, *Vacuum cleaner and vacuum cleaner system*, Filed May 30, 2014, Granted Jul 3, 2014
11. US 8,789,235, *Vacuum cleaner with agitator height control mechanism*, Filed Nov 16, 2011, Issued Jul 29, 2014
12. US 8,999,911, *Enzyme cleaning composition and method of use*, Filed Nov 2, 2012, Issued Apr 7, 2015
13. US 9,149,165, *Vacuum cleaner and vacuum cleaner system*, Filed Jul 10, 2011, Issued Oct 6, 2015
14. US 9,215,959, *Vacuum Accessory Tool*, Filed May 5, 2006, Issued Dec 22, 2015
15. US 9,277,845, *Flexible Crevice Tool for Vacuum Cleaners*, Filed Mar 9, 2007, Issued Mar 8, 2016
16. EP 2 574 262, *Vacuum cleaner and filters thereof*, Filed Feb 18, 2010, Granted Jun 21, 2017
17. EP 2 636 348, *Vacuum Cleaner and vacuum cleaner system*, Priority Mar 8, 2012, Grant Jul 13, 2016
18. US 9,717,380, *Vacuum Cleaner*, Filed Oct 5, 2015, Issued Aug 1, 2017
19. EP 2 589 650, *Enzyme cleaning composition and method of use*, Priority Nov 4, 2011, Grant June 28, 2017
20. US 10,112,782, *Motor Driven Roller Support*, Filed Jun 15, 2017, Issued Oct 30, 2018
21. US 10,130,224, *Vacuum Accessory Tool*, Filed Dec 17, 2015, Issued Nov 20, 2018
22. US 10,398,268, *Vacuum Cleaner*, Filed Oct 5, 2017, Issued Sep 3, 2019
23. US 10,932,632, *Vacuum Accessory Tool*, Filed Aug 29, 2018, Issued Mar 2, 2021

Appendix B

APPENDIX B: MATERIALS CONSIDERED

In addition to all documents and references cited or referred to in my Declaration, I considered the following materials in forming my opinions:

Exhibit	Description
1001	U.S. Patent No. 10,433,687
1002	File History for U.S. Patent No. 10,433,687 (Appl. No. 15/269,430)
1003	Declaration of Joseph Fester
1004	U.S. Patent Publication No. 2011/0314630 (“Conrad ’630”)
1005	EP Publication No. 1,199,023 (“Matsumoto”)
1006	U.S. Patent Publication No. 2016/0174787 (“Conrad ’787”)
1007	Int’l Publication No. WO 2008/009888 (“Dyson”)
1008	U.S. Patent No. 9,301,663 (“Conrad ’663”)

Appendix C

APPENDIX C: CHALLENGED CLAIMS

No.	Limitation
1[pre]	A handheld vacuum cleaner, comprising:
1[a]	a handle by which the vacuum cleaner is supported during normal use;
1[b]	a cyclonic separating unit having a longitudinal axis and a dirt collector at one end of the cyclonic separating unit,
1[c]	the cyclonic separating unit comprising an end wall having a closed configuration in which dirt is retained within the dirt collector by the end wall and an open configuration for the removal of dirt from the dirt collector, wherein the end wall is movable relative to the longitudinal axis and, when the end wall is in the closed configuration, the longitudinal axis extends through a region bounded by a perimeter of the end wall,
1[d]	wherein the handle has a pistol grip configuration in which the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 85 degrees and not greater than 140 degrees between a handle axis and the longitudinal axis of the cyclonic separating unit, and wherein the handle axis and the longitudinal axis intersect within the vacuum cleaner.
2	The handheld vacuum cleaner of claim 1, wherein the handle is inclined with respect to the cyclonic separating unit to form an angle of not less than 100 degrees and not greater than 125 degrees between the handle axis and the longitudinal axis of the cyclonic separating unit.
3	The handheld vacuum cleaner of claim 1, wherein the end wall comprises an end wall of the cyclonic separating unit.
4	The handheld vacuum cleaner of claim 1, wherein the end wall is arranged to pivot between the closed configuration and the open configuration.
8	The handheld vacuum cleaner of claim 1, wherein the dirt collector is disposed forward of the handle.
10	The handheld vacuum cleaner of claim 1, wherein the cyclonic separating unit comprises a cyclonic separator having an axis that defines the longitudinal axis of the cyclonic separating unit.

Appendix D

APPENDIX D: UNDERSTANDING OF THE LAW

I have applied the following legal principles provided to me by counsel in arriving at the opinions set forth in this declaration.

Legal Standard for Prior Art

I am not an attorney. I have been informed by attorneys of the relevant legal principles and have applied them to arrive at the opinions set forth in this declaration.

I understand that the petitioner for *inter partes* review may request the cancelation of one or more claims of a patent based on grounds available under AIA 35 U.S.C. § 102 and 35 U.S.C. § 103 using prior art that consists of patents and printed publications.

Anticipation and Prior Art

I understand that § 102 specifies when a challenged claim is invalid for lacking novelty over the prior art, and that this concept is also known as “anticipation.” I understand that a prior art reference anticipates a challenged claim, and thus renders it invalid by anticipation, if all elements of the challenged claim are disclosed in the prior art reference. I understand the disclosure in the prior art reference can be either explicit or inherent, meaning it is necessarily present or implied. I understand that the prior art reference does not have to use the same words as the challenged claim, but all of the requirements of the claim must be disclosed so that a person of ordinary skill in the art could make and use the claimed subject matter.

In addition, I understand that § 102 also defines what is available for use as a prior art reference to a challenged claim.

Under § 102(a)(1), a challenged claim is anticipated if it was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention.

Under § 102(b)(1), a challenged claim is anticipated if it was described in an issued patent or published patent application, in which the patent or application names another inventor and was effectively filed before the effective filing date of the claimed invention.

I understand that the effective filing date of a patent or patent application is the earlier of the actual filing date of the patent or the application for patent or, if the patent or application for patent is entitled to claim earlier priority or the benefit of an earlier filing, the filing date of the earliest application that describes the claimed subject matter.

I understand that when a challenged claim covers several structures, either generically or as alternatives, the claim is deemed anticipated if any of the structures within the scope of the claim is found in the prior art reference.

I understand that when a challenged claim requires selection of an element from a list of alternatives, the prior art teaches the element if one of the alternatives is taught by the prior art.

Legal Standard for Obviousness

I understand that even if a challenged claim is not anticipated, it is still invalid if the differences between the claimed subject matter and the prior art are such that the claimed subject matter would have been obvious to a person of ordinary skill in the pertinent art at the time the alleged invention.

I understand that, in order for a prior art reference to be proper for use in an obviousness analysis, the reference must be analogous art. I understand that a prior art reference is analogous art if: (1) the reference is from the same field of endeavor as the challenged patent (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor of the challenged patent (even if it is not in the same field of endeavor). I understand that the field of endeavor is determined by reference to explanations of the challenged claims' subject matter in the challenged patent, including the embodiments, functions, and structures of the challenged claims. A prior art reference is "reasonably pertinent" to a problem if it would have logically commended itself to an inventor's attention in considering the problem.

I understand that obviousness must be determined with respect to the challenged claim as a whole.

I understand that one cannot rely on hindsight in deciding whether a claim is obvious.

I also understand that an obviousness analysis includes the consideration of factors such as (1) the scope and content of the prior art, (2) the differences between the prior art and the challenged claim, (3) the level of ordinary skill in the pertinent art, and (4) “secondary” or “objective” evidence of non-obviousness.

Secondary or objective evidence of non-obviousness includes evidence of: (1) a long felt but unmet need in the prior art that was satisfied by the claimed invention; (2) commercial success or the lack of commercial success of the claimed invention; (3) unexpected results achieved by the claimed invention; (4) praise of the claimed invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the claimed invention; and (7) contemporaneous and independent invention by others. However, I understand that there must be a relationship between any secondary evidence of non-obviousness and the claimed invention.

I understand that a challenged claim can be invalid for obviousness over a combination of prior art references if a reason existed (at the time of the alleged invention) that would have prompted a person of ordinary skill in the art to combine elements of the prior art in the manner required by the challenged claim. I understand that this requirement is also referred to as a “motivation to combine,” “suggestion to combine,” or “reason to combine,” and that there are several rationales that meet this requirement.

I understand that the prior art references themselves may provide a motivation to combine, but other times simple common sense can link two or more prior art references. I further understand that obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that a motivation to combine references may come from market forces.

I understand obviousness to include, for instance, scenarios where known techniques are simply applied to other devices, systems, or processes to improve them in an expected or known way. I also understand that practical and common-sense considerations should be applied in a proper obviousness analysis. For instance, familiar items may have obvious uses beyond their primary purposes.

I understand that the combination of familiar elements according to known methods is obvious when it yields predictable results. For instance, obviousness bars patentability of a predictable variation of a technique even if the technique originated in another field of endeavor. This is because design incentives and other market forces can prompt variations of it, and predictable variations are not the product of innovation, but rather ordinary skill and common sense.

I understand that a particular combination may be obvious if it was obvious to try the combination. For example, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or

her technical grasp. This would result in something obvious because the result is the product not of innovation but of ordinary skill and common sense. However, I understand that it may not be obvious to try a combination when it involves unpredictable technologies.

It is further my understanding that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill in the art, not just the patentee. Accordingly, I understand that any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

It is my understanding that the Manual of Patent Examining Procedure §2143 sets forth the following as exemplary rationales that support a conclusion of obviousness:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of known technique to improve similar devices (methods, or products) in the same way;
- Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;

- Choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;
- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

A person of ordinary skill in the art looking to overcome a problem will often use the teachings of multiple publications together. I understand that obviousness analysis takes into account inferences, creative steps, common sense, and practical logic and applications that a person of ordinary skill in the art would employ under the circumstances.

I understand that a claim can be obvious in light of a single reference, if the elements of the challenged claim that are not explicitly or inherently disclosed in the reference can be supplied by the common sense of one of skill in the art.

I understand that obviousness also bars the patentability of applying known or obvious design choices to the prior art. One cannot patent merely substituting one prior art element for another if the substitution can be made with predictable results.

Likewise, combining prior art techniques that are interoperable with respect to one another is generally obvious and not patentable.

In order for a claim to be found invalid based upon a modification or combination of the prior art, there must be reasonable expectation that a person of ordinary skill would have successfully modified or combined the prior art to arrive at the claimed arrangement. This does not mean that it must be certain that a person of ordinary skill would have been successful—the law only requires that the person of ordinary skill in the art would have perceived a reasonable expectation of success in modifying or combining the prior art to arrive at the claimed invention.

In sum, my understanding is that obviousness invalidates claims that merely recite combinations of, or obvious variations of, prior art teachings using understanding and knowledge of one of skill in the art at the time and motivated by the general problem facing the inventor at the time. Under this analysis, the prior art references themselves, or any need or problem known in the field of endeavor at the time of the invention, can provide a reason for combining the elements of or attempting obvious variations on prior art references in the claimed manner.

Legal Standard for Claim Construction

I understand that before any invalidity analysis can be properly performed, the scope and meaning of the challenged claims must be determined by claim construction.

I understand that a patent may include two types of claims, independent claims and dependent claims. I understand that an independent claim stands alone and includes only the limitations it recites. I understand that a dependent claim depends from an independent claim or another dependent claim. I understand that a dependent claim includes all the limitations that it recites in addition to the limitations recited in the claim (or claims) from which it depends.

In comparing the challenged claims to the prior art, I have carefully considered the patent and its file history in light of the understanding of a person of skill at the time of the alleged invention.

I understand that to determine how a person of ordinary skill would have understood a claim term, one should look to sources available at the time of the alleged invention that show what a person of skill in the art would have understood disputed claim language to mean. It is my understanding that this may include what is called “intrinsic” evidence as well as “extrinsic” evidence.

I understand that, in construing a claim term, one should primarily rely on intrinsic patent evidence, which includes the words of the claims themselves, the remainder of the patent specification, and the prosecution history. I understand that extrinsic evidence, which is evidence external to the patent and the prosecution history, may also be useful in interpreting patent claims when the intrinsic evidence itself is insufficient. I understand that extrinsic evidence may include principles,

concepts, terms, and other resources available to those of skill in the art at the time of the invention.

I understand that words or terms should be given their ordinary and accepted meaning unless it appears that the inventors were using them to mean something else or something more specific. I understand that to determine whether a term has special meaning, the claims, the patent specification, and the prosecution history are particularly important, and may show that the inventor gave a term a particular definition or intentionally disclaimed, disavowed, or surrendered claim scope.

I understand that the claims of a patent define the scope of the rights conferred by the patent. I understand that because the claims point out and distinctly claim the subject matter which the inventors regard as their invention, claim construction analysis must begin with and is focused on the claim language itself. I understand that the context of the term within the claim as well as other claims of the patent can inform the meaning of a claim term. For example, because claim terms are normally used consistently throughout the patent, how a term is used in one claim can often inform the meaning of the same term in other claims. Differences among claims or claim terms can also be a useful guide in understanding the meaning of particular claim terms.

I understand that a claim term should be construed not only in the context of the particular claim in which the disputed term appears, but in the context of the

entire patent, including the entire specification. I understand that because the specification is a primary basis for construing the claims, a correct construction must align with the specification.

I understand that the prosecution history of the patent as well as art incorporated by reference or otherwise cited during the prosecution history are also highly relevant in construing claim terms. For instance, art cited by or incorporated by reference may indicate how the inventor and others of skill in the art at the time of the invention understood certain terms and concepts. Additionally, the prosecution history may show that the inventors disclaimed or disavowed claim scope, or further explained the meaning of a claim term.

With regard to extrinsic evidence, I understand that all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises, can also be considered. For example, technical dictionaries may indicate how one of skill in the art used or understood the claim terms. However, I understand that extrinsic evidence is considered to be less reliable than intrinsic evidence, and for that reason is generally given less weight than intrinsic evidence.

I understand that in general, a term or phrase found in the introductory words or preamble of the claim, should be construed as a limitation if it recites essential structure or steps, or is necessary to give meaning to the claim. For instance, I

understand preamble language may limit claim scope: (i) if dependence on a preamble phrase for antecedent basis indicates a reliance on both the preamble and claim body to define the claimed invention; (ii) if reference to the preamble is necessary to understand limitations or terms in the claim body; or (iii) if the preamble recites additional structure or steps that the specification identifies as important.

On the other hand, I understand that a preamble term or phrase is not limiting where a challenged claim defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. I understand that to make this determination, one should review the entire patent to gain an understanding of what the inventors claim they invented and intended to encompass in the claims.