

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DYSON TECHNOLOGY LIMITED AND DYSON, INC.,

Petitioners,

v.

OMACHRON INTELLECTUAL PROPERTY INC.,

Patent Owner.

DECLARATION OF ROBERT GIACHETTI

REGARDING

U.S. Patent No. 11,903,546

TABLE OF CONTENTS

I.	Introduction.....	1
II.	Background and Qualifications	2
III.	Documents and Materials Considered.....	10
IV.	Legal Principles	10
V.	Person of Ordinary Skill in the Art.....	13
VI.	Technology Background.....	14
VII.	Background of the '546 Patent	20
	A. Summary of the '546 Patent's Specification.....	21
	B. Prosecution History of the '546 Patent	22
	C. Priority Date of the Challenged Claims	24
VIII.	Background of the Prior Art	24
	A. Butler	24
	B. Jianan.....	27
	C. IPVG.....	29
	D. Conrad335	30
IX.	Claim Construction.....	31
X.	Invalidity Opinions: '546 Patent.....	31
	A. Ground 1: Butler in Combination with Jianan Renders Obvious Claims 1-15	32
	1. A POSA Would Have Combined Butler and Jianan	32
	2. [1]/[8]/[9]/[10]/[14]/[15]	46
	3. [2]/[12]	111
	4. [3]	113
	5. [4]	113
	6. [5]	114
	7. [6]	116
	8. [7]/[13]	118
	9. [11]	120
	B. Ground 2: IPVG in Combination with Conrad335 Renders Obvious Claims 1-15.....	122
	1. A POSA Would Have Combined IPVG and Conrad335	122
	1. [1]/[8]/[9]/[10]/[14]/[15]	139
	2. [2]/[12]	187
	3. [3]	190
	4. [4]	191
	5. [5]	192
	6. [6]	196
	7. [7]/[13]	197

8.	[11]	200
XI.	Secondary Considerations Of Non-Obviousness	202

I. INTRODUCTION

1. My name is Robert Giachetti. I have been retained by Dyson Technology Limited and Dyson, Inc. (collectively “Dyson” or “Petitioners”) as an independent expert in this proceeding.
2. I understand Dyson is challenging the validity of claims 1-15 of U.S. Patent No. 11,903,546 (the “’546 Patent”) in this petition for *inter partes* review (“IPR”). I refer to these as the “Challenged Claims.”
3. I have been asked to consider whether certain references invalidate the Challenged Claims.
4. I am a salaried employee of Fusion Engineering, LLC. Fusion Engineering is being compensated for my time in connection with this matter at the consulting rate of \$410 per hour. My compensation is not affected by the content of my opinions, testimony, or the outcome of this matter.
5. The prior art references on which my opinions are based are:
 - PCT Publication No. 2007/084543 (“Butler,” attached as exhibit 1005)
 - Chinese Patent Publication No. 101,061,932 (“Jianan,” attached as exhibit 1006)
 - U.K. Patent Publication No. GB283,179 (“IPVG,” attached as exhibit 1007)
 - U.S. Patent Publication No. 2007/0209335 (“Conrad335,” attached as exhibit 1008)
6. In my opinion, the Challenged Claims are invalid based on the following:
 - The combination of Butler and Jianan renders claims 1-15 obvious.

- The combination of IPVG and Conrad335 renders claims 1-15 obvious.

II. BACKGROUND AND QUALIFICATIONS

7. I am a Licensed Professional Engineer in Illinois and Oklahoma, with over 20 years of experience in mechanical engineering. My experience in machinery and mechanisms spans numerous industries; I have worked directly designing mechanical systems and machinery, and I have consulted on the operation of machinery in various fields, including consumer products, commercial products, and industrial products.
8. I am employed by Fusion Engineering, LLC, where I have worked since November of 2020. Fusion is an engineering firm that provides multidisciplinary engineering consulting services.
9. I am currently the Senior Vice President at Fusion. In this role, I am responsible for providing engineering consulting services in mechanical engineering, coordinating client outreach, coordinating marketing materials, and recruiting.
10. I am currently a Member of ASTM (American Society for Testing and Materials) and ASME (American Society of Mechanical Engineers) where I sit on several committees, including the Power Transmission Gearing Committee (ASME), which looks at transferring movement with belts and gears. I am also on ASTM's F15 Consumer Product Committee, which

handles matters such as consumer product safety guidelines. I am also a member of the ICPHSO (International Consumer Products Health & Safety Organization) group, and attend ICPHSO conferences, which cover health and safety issues relevant to consumer products.

11. I hold a Bachelor's, Master's, and Ph.D. degree in Mechanical Engineering. I have Minors in Physics (as an undergraduate) and Mechanics and Aeronautics (as a graduate student). I have taught courses in Physics, Mechanical Engineering, and Biomechanics across three universities.
12. I have been recognized as an expert in mechanical power transmission equipment, and I serve on the American Society of Mechanical Engineers (ASME) Power Transmission and Gearing Committee. I have also participated, by invitation, in the National Council of Examiners for Engineering and Surveying (NCEES) Mechanical Professional Activities and Knowledge Studies (PAKS) committee. This committee reviews and evaluates the problems and problem types that appear on the Mechanical Engineering Professional Engineering exam for licensure as a Professional Engineer.
13. For the past 30 years, I have been involved in the area of machine design and applications of machine design. These machines and products have

- ranged from children's mattresses to garden hoses, pressure cookers, electronic tire/raft inflators, and industrial equipment including conveyors.
14. In approximately 1993-1994, I was a part of a team that developed and built a functioning autonomous, battery-powered vacuum cleaner. This design and development project involved analyzing the layout and inclusion of various vacuum-cleaner components, such as surface agitators, air filtration units, motors, fluid flow paths, batteries, and other electronic and mechanical components.
 15. From 2003-2008, I was employed by the University of Wisconsin-Madison's Biomechanics laboratory in the Department of Kinesiology, where I was also a teaching assistant in biomechanics. While there, my research responsibilities included designing equipment with ergonomic handles for efficient use. While teaching biomechanics at the University of Wisconsin-Madison, I regularly instructed on the proper use of canes, crutches, and arm crutches in relationship to biomechanical principles, taking into consideration user ergonomics.
 16. From 2008-2020, I was employed by Exponent, Inc., where I worked as a Senior Managing Engineer. At Exponent, I worked on various mechanical engineering projects that frequently related to consumer product design, machinery design, product and machinery performance, and human

interaction with consumer products and industrial equipment.

17. In approximately 2010-2013, I conducted an engineering analysis of vacuum cleaner products. In particular, I single-handedly developed tests to assess the dust-collection efficacy of various physical-media filters used in bagless, cyclonic vacuum cleaners. My work on this project included product tear-downs to analyze the efficacy and safety of these vacuum cleaners and their filters. I also developed a protocol for nationwide in-home testing of vacuum cleaner filtration system efficacy across climates, as well as a protocol for analyzing the materials collected by the vacuum cleaners and their filters. This analysis considered, among other things, the size of particulates that were collected by vacuum cleaner cyclones and filters.
18. In approximately 2010-2014, I conducted an analysis of collets—a pipe and tube connection device—under dynamic fluid pressurization conditions. After initial and traditional methods of testing the collets, which included X-Rays and geometric measurements, failed to identify the source of collet failure, I developed novel tests intended to mimic real-world conditions. These novel tests involved a hydro-static test and a dynamic test. The hydro-static test involved exposing the collets to extended periods of pressurized conditions. The dynamic test involved

- development of a computer-controlled manifold system that could selectively pressurize, de-pressurize, and drain collets in various sequences to determine the difference in performance. The novel tests I developed successfully determined the root cause of the collet failures.
19. In approximately 2012-2017, I performed a holistic safety and efficacy analysis of various consumer vacuum-sealer products. In particular, I conducted tear-down analyses, reviewed the vacuum-sealers' performance for safety and functionality considerations, analyzed the function and operation of vacuum pumps, analyzed fluid flow paths, and analyzed the operation of small valves. I further worked with an electrical engineer to review the safety of the products' internal electronics.
 20. Since approximately 2013 to the present, I have used principles of biomechanics, as well as principles of physics, to analyze the effect on a user or nearby operator of pressure cookers that failed, ejecting hot liquid. This work involved analyses of, among other things, forces that are applied to pressure cookers, the physics involved in the operation of pressure cookers, and biomechanical principles.
 21. In approximately 2013-2016, I used industry testing methods and developed and designed novel experiments and testing related to fluid flow analysis for a consumer garden hose. The analysis involved testing the

hose's strength, durability, environmental performance (temperature and UV exposure), and material selection in connection with user operation. I further designed computer-controlled pressurization and de-pressurization systems for these garden hoses. The system was initially powered pneumatically with compressed air driven through a manifold in conjunction with a tank of water. When scaled, the system involved two parallel pumps that pressurized two groups of manifolds using computer-controlled valves in series to pressurize and de-pressurize expandable garden hoses. Developing this system involved, among other things, selecting the appropriate fluid power components and optimizing fluid flow paths.

22. In approximately 2015, I applied my biomechanical background to the use of cane handles, which involved assessing the amount of force to be applied to the handle and developing a handle that could both support that amount of force reliably and house a battery for novel electronics that were embedded in the cane.
23. In approximately 2015-2017, I investigated various properties of a garden hose ball valve. I worked as a part of a team to investigate valve properties, including materials, geometry, and seal selection. We further investigated fluid flow through the valve to ensure that the flow was optimized by

analyzing valve shape with the Bernoulli equation.

24. In approximately 2016, I conducted an analysis of a cordless, handheld consumer leaf blower. In particular, I analyzed the functioning, operation, and failure of blower motors and fans in relation to the direction of fluid flow within a consumer leaf blower. This analysis concerned, among other things, consideration of fluid flow and mechanical design of leaf blowers, specifically regarding fan blade failure and its potential impact on the consumer-operator.
25. In approximately 2017-2018, I conducted an efficacy analysis of hand grips for ergonomic handheld hose nozzles. This analysis included a review of handheld nozzles in the marketplace that were advertised as ergonomic, as well as biomechanically modelling postures expected to be associated with the ergonomic handheld nozzles. To biomechanically model these handheld nozzles, I used a program called 3DSSPP, which models, among other things, human balance and effort levels. This program can be used calculate human joint torque based on operator input, which I used (and continue to use) to analyze the ergonomics of holding various handles, including handles for household consumer products.
26. I further used 3DSSPP to model biomechanics for use in household consumer products and industrial products. For example, in my paper,

Analytical Model for Estimating Knee Loads During Ladder Climbing, published in the 2013 edition of the ASME International Mechanical Engineering Congress Exposition, I discussed how force output at the hands based on arm posture influences the forces within the knee joint. At a high level, this involved analyzing the ergonomics of how posture influences likely force output of limbs, particularly in connection with household consumer products, specifically ladders.

27. In approximately 2018-2020, I analyzed the operation of computer-controlled blowers, manifolds, valves, and sensors in consumer air mattresses. In particular, the analysis concerned the ability to control and maintain constant air pressure within air mattresses at particular pressure set points. This analysis concerned, among other things, fluid dynamics, fluid flow, fluid path selection, and changes in pressure.
28. In 2021, I published a paper, *Characterization of the Release of Heated and Pressurized Water from a Pressure Cooker*, in the Journal of Burns. In this paper, I analyzed and described how fluid is ejected from a pressure cooker as a result of a flash boil event. In this analysis, I considered the operation of an exemplary household pressure cooker, analyzing fluid dynamics resulting from the trade-off between volume of liquid and pressure on fluid dynamics and its effect on consumer-users.

29. I have provided my full background in the curriculum vitae that is attached as Exhibit 1003.

III. DOCUMENTS AND MATERIALS CONSIDERED

30. In forming the opinions expressed in this Declaration, I relied upon my education, training, knowledge, and experience in the relevant field of the art, as well as information pertaining to the documents described below.
31. In preparing this Declaration, I have considered the materials referenced herein, including the '546 patent and its file history, the Butler, Jianan, IPVG, and Conrad335 prior art references on which my opinions are based, and other documents listed in the Exhibit List of the Petition. These references and documents reflect the state of the relevant art at the time of the alleged invention and the background knowledge of a POSA.
32. I have also reviewed the Patent Owner ("PO")'s infringement contentions served in the related litigation, *Certain Surface Cleaning Devices and Components Thereof*, Dkt. No. 337-TA-1404 (the "ITC Litigation").

IV. LEGAL PRINCIPLES

33. Dyson's counsel has informed me of certain legal standards. I have applied these understandings in my analysis as detailed below. I am not an attorney and offer no legal opinions.
34. I have been informed and understand that a patent claim is invalid if it is

obvious, and that obviousness requires that the claim be obvious from the perspective of a person of ordinary skill in the relevant art at the time of the alleged invention. I have been informed and understand that a claim may be obvious in view of a single prior art reference, or may be obvious in view of a combination of two or more prior art references.

35. I have been informed and understand that the level of ordinary skill in the art may be determined by considering such factors as the education level of those working in the field, the sophistication of the technology, the types of problems encountered in the art, the prior art solutions to those problems, and the speed at which innovations are made. I have been informed and understand that not all of these factors need be considered and that one or more of these factors may control.
36. I have been informed and understand that an obviousness analysis is based on several factors, including the scope and content of the prior art, what differences, if any, existed between the alleged invention and the prior art, and the level of ordinary skill in the pertinent art at the time of the alleged invention.
37. I have been informed and understand that to determine whether a claim is obvious, it is appropriate to consider, among other factors:
 - (1) whether the teachings of the prior art references disclose known

concepts combined in familiar ways, and when combined, would yield predictable results; (2) whether a person of ordinary skill in the art could implement a predictable variation, and would see the benefit of doing so; (3) whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art; (4) whether a person of ordinary skill would have recognized a reason to combine known elements in the manner described in the claim; (5) whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and (6) whether the innovation applies a known technique that had been used to improve a similar device or method in a similar way.

38. I further have been informed and understand that while it may be helpful to identify a reason for this combination, common sense should guide and no rigid requirement of finding a teaching, suggestion, or motivation to combine is required.
39. I further have been informed and understand that certain factors called secondary considerations may be considered in evaluating the obviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the alleged invention, skepticism of those having ordinary skill in the art at the time of the alleged

invention, unexpected results of the alleged invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field. I have been informed and understand that there must be a nexus—a connection—between any such secondary considerations and the alleged invention. I also have been informed and understand that contemporaneous and independent invention by others is a secondary consideration tending to show obviousness.

40. I have been informed and understand that a prior art reference may expressly or inherently describe a limitation of a claim. I have been informed and understand that if the prior art necessarily includes or functions in accordance with a claim's limitation, then the prior art inherently discloses that limitation. I have been informed and understand that to establish inherency, the evidence must make clear that the missing descriptive matter is necessarily present in the item of prior art and that it would be so recognized by persons of ordinary skill in the art.

V. PERSON OF ORDINARY SKILL IN THE ART

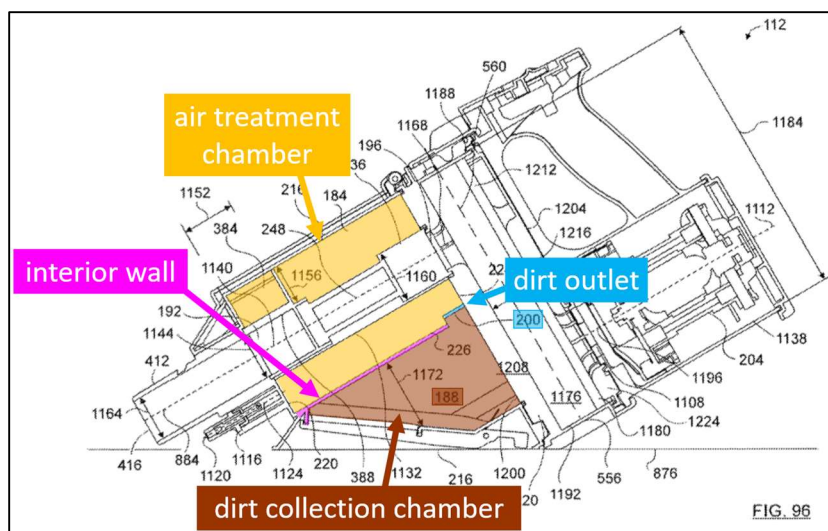
41. In my opinion, a Person of Ordinary Skill in the Art ("POSA") in the subject matter of the '546 Patent would have had a bachelor's degree in

mechanical engineering or a similar field and 2-3 years of experience in machine design, including machines that include fluid dynamics or fluid paths, such as vacuum cleaners. Additional education could offset less experience and vice versa, and a POSA could have also obtained similar knowledge and experience through other means.

42. I have been a POSA since at least 2003. The opinions I am offering are from the perspective of a POSA at the time of the alleged invention. For the purposes of my opinions below, I have been asked to assume that the relevant time frame is the relevant priority date for the Challenged Claims.

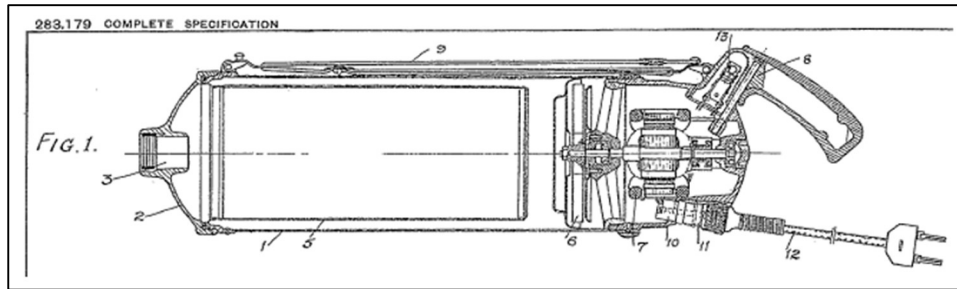
VI. TECHNOLOGY BACKGROUND

43. The Challenged Claims are directed to hand vacuum cleaners that use a cyclone unit to treat the air, where the cyclone unit includes “an external dirt collection chamber.” Ex1001, 1:52-56.
44. The '546 Patent explains that “dirt separated in the **air treatment chamber** travels to the **dirt collection chamber** via a **dirt outlet** of the **air treatment chamber**,” with the two chambers separated by an “**interior wall 226**,” as shown in the annotated image below:



Id., 1:54-56, 12:41-42, Fig. 96.

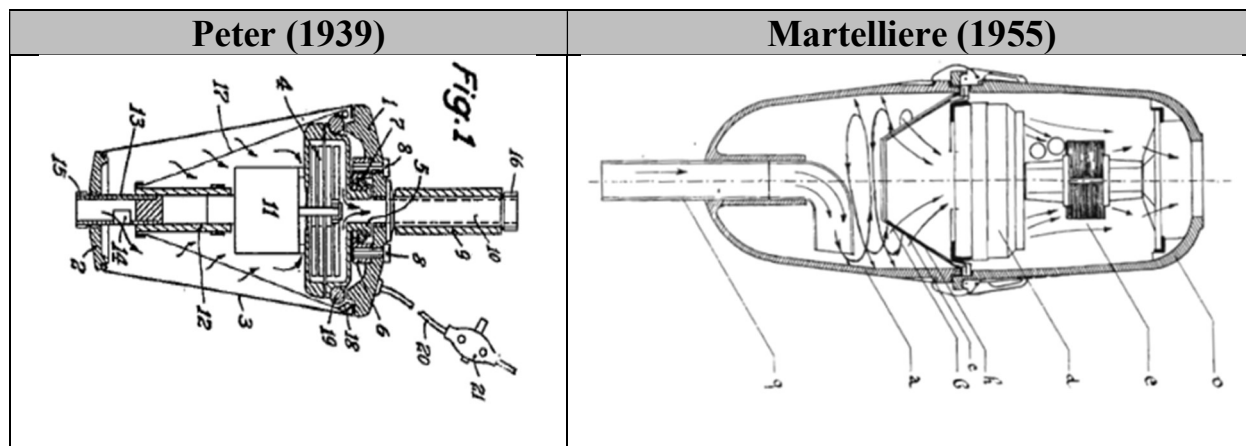
45. In my opinion, this feature was well-known, as were the '546 Patent's claims' remaining elements, which concern commonly used features, such as suction motors, cyclone units, pistol grip handles, surface cleaning heads, and rigid air flow conduits. *Id.*, Claims.
46. For over a century, vacuum cleaners have been using the features that are described in the '546 Patent, such as a suction motor that draws dirty air into a dirty air inlet, filtration processes that clean the air, and dirty air outlets that exhaust the cleaned air. Many early vacuum cleaners, such as the vacuum cleaner described in U.K Patent Publication No. GB283,179 to Inventia Patent-Verwertungs-Gesellschaft ("IPVG"), used disposable dust bags to separate dust from the air, as shown in the figure below:



Ex1007, Fig. 1; *see also id.*, 1:22-33 (“According to the present invention the apparatus comprises a casing containing a motor driven fan and a dust bag or like member through which the air stream passes and provided with a handle by which the apparatus may be readily lifted during operation, the handle being formed at its end to be connected to the casing with a conical portion fitting in a conical bore of the casing and secured therein by a longitudinally acting screw arranged eccentrically of the bore.”).

47. Those skilled in the art at the time of the '546 Patent's alleged invention recognized that this dust-bag method is costly (dust bags must be replaced), loses effectiveness during use (dust-bag cleaners lose suction as they fill), and prevents the user from seeing how full the bag is, leaving a user to guess as to when to empty or replace the bag. However, those skilled in the art also recognized, more than 80 years ago, that vacuum cleaners that use cyclonic separation units—which use cyclonic airflow to separate heavier-than-air dust particles from the dirty air—have certain advantages over vacuum cleaners that use dust bag filtration units, as was

taught by Swiss Patent No. CH203,675 to Peter in 1939, and by French Patent No. 1,094,603 to Martelliere in 1955, as shown in the figures below:



Ex1010¹, Fig. 1; Ex1013², 1, Fig. 1.

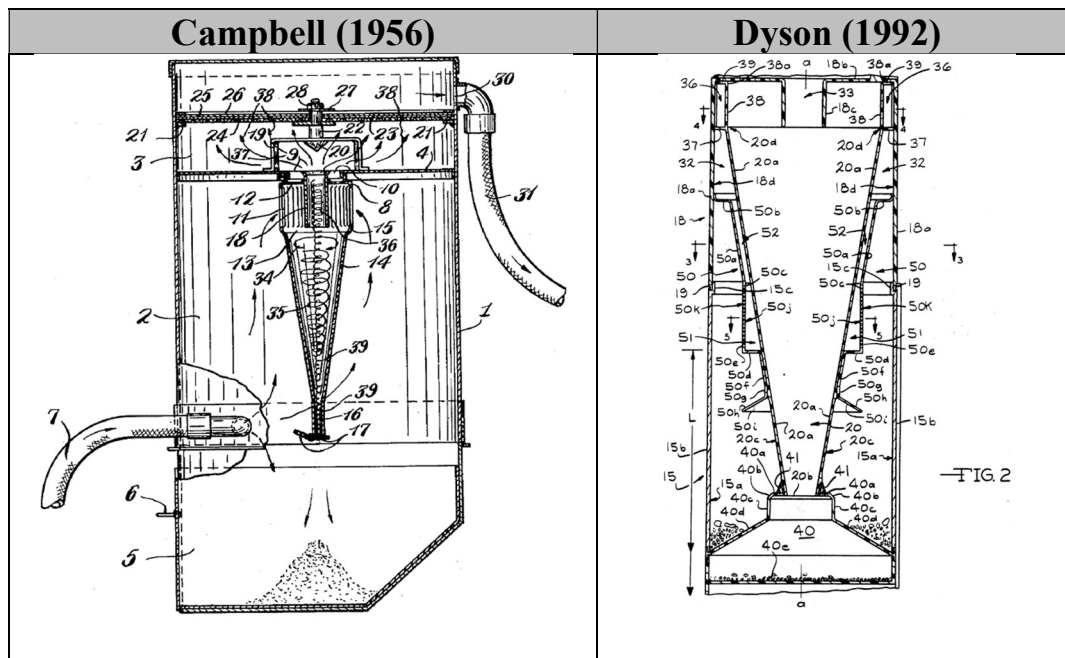
48. For example, Martelliere explains that “[b]y application of the ‘Whirlwind’ principle,” i.e., cyclonic filtration, “the materials are deposited in the bottom of the container, after having separated from the air, before it passes through the filter screen,” which “prevent[s] clogging”

¹ Ex1010 is a certified English translation of Ex1009, originally published in German. Citations to Ex1009 are by page, as the English translation does not include column or line numbers.

² Ex1013 is a certified English translation of Ex1012, originally published in French. Citations to Ex1013 are by page, as the English translation does not include column or line numbers.

and creates “stable suction,” and by using a transparent cyclonic chamber, “the user is able, when stopped, to see where the filling of the container is” and “can therefore better judge when it must be emptied.” Ex1013, 1.

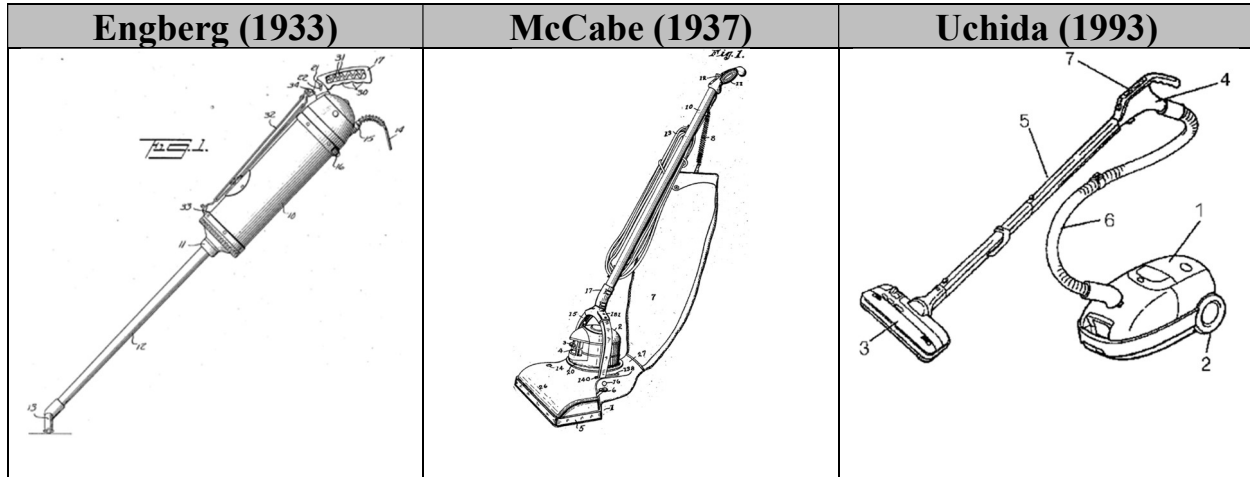
49. More than 60 years ago, those skilled in the art recognized that cyclone units with exterior dirt collection chambers—which store the collected dirt in an area that is separate from the location of the cyclone—prevent the separated dirt from re-entering and interfering with the cyclonic airflow, as was taught by U.S. Patent No. 2,768,707 to Campbell in 1956, and U.S. Patent No. 5,078,761 to Dyson in 1992, as shown in the figures below:



Ex1023, Fig. 1; Ex1024, Fig. 2.

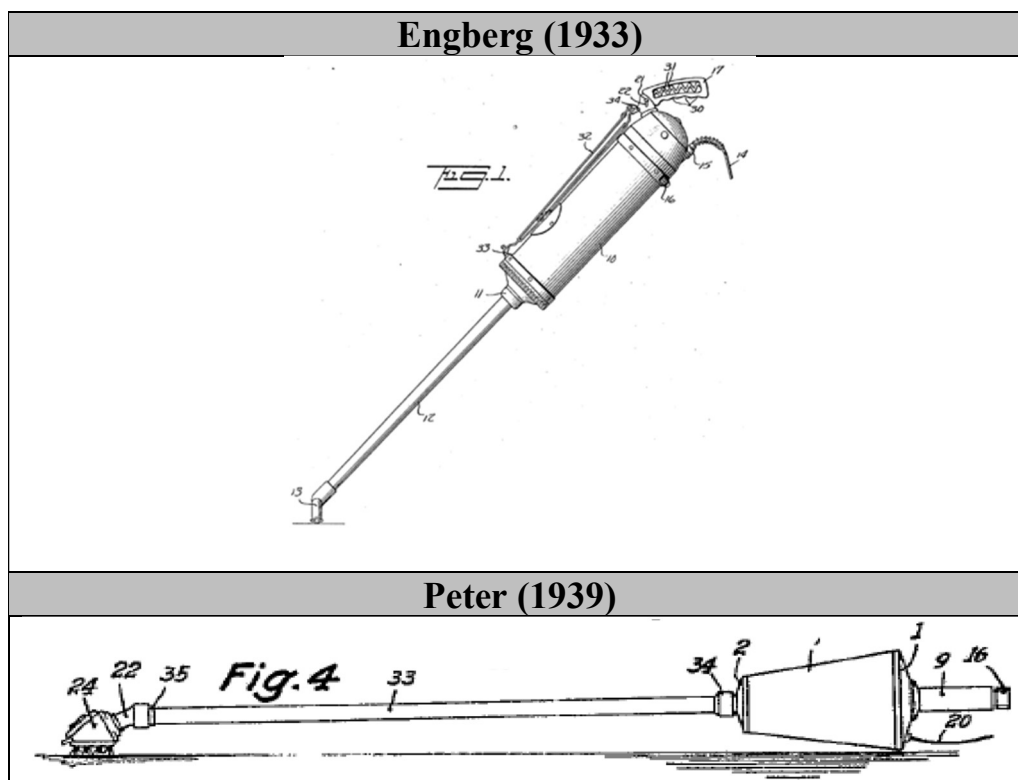
50. Further, vacuum cleaners having features that assist with maneuverability and usability, such as a pistol grip handle, have also been known in the art

for nearly a century, including as taught by U.S. Patent No. 1,908,834 to Engberg et al. in 1933, U.S. Patent No. 2,099,172 to McCabe et al. in 1937, and Japanese Patent Publication No JPH0580451U to Uchida et al. in 1993, as shown in the figures below:



Ex1016, Fig. 1; *see also id.* 1:53-54 (“Handle 17 has the general form of a pistol grip.”); Ex1017, Fig. 1; Ex1019, Fig. 1; *see also* Ex1019 ¶6 (“4 is a gun-type handle connected to the suction unit 3 via an extension tube 5 at the front and the suction port of the main unit 1 via a flexible hose 6 at the rear.”).

51. It has also been well known in the art for nearly a century that vacuum cleaners with rigid air flow conduits and surface cleaning heads improve vacuum reach and the ability to clean under objects, as taught by Engberg in 1933 and Peter in 1939, as shown in the figures below:



Ex1016, Fig. 1; Ex1010, Fig. 4; *see also* Ex1010, 2-3 (“Particularly hard-to-reach areas of the floor or walls obstructed by furniture can also be reached effortlessly if, as Fig. 4 shows, the extension rod 33 is inserted between the vacuum cleaner housing and the pipe angle.”).

VII. BACKGROUND OF THE ’546 PATENT

52. The ’546 Patent is titled “Surface Cleaning Apparatus.” Ex. 1001, Title.

The ’546 Patent states that it issued on February 20, 2024, from U.S. Patent Application No. 17/830,529, filed on June 2, 2022. *Id.*, Cover. The ’546 Patent states that it is a continuation of application No. 17/351,943, filed on June 18, 2021, which in turn claims to be a continuation-in-part of application No. 16/590,972, filed on October 2, 2019, which in turn claims

to be a division of application No. 16/156,006, filed on October 10, 2018, which in turn claims to be a continuation of application No. 15/088,876, filed on April 1, 2016, which in turn claims to be a continuation of application No. 14/822,211, filed on August 10, 2015. *Id.* The '546 Patent also states that it claims priority to provisional application No. 62/093,189, filed on December 17, 2014. *Id.*

A. Summary of the '546 Patent's Specification

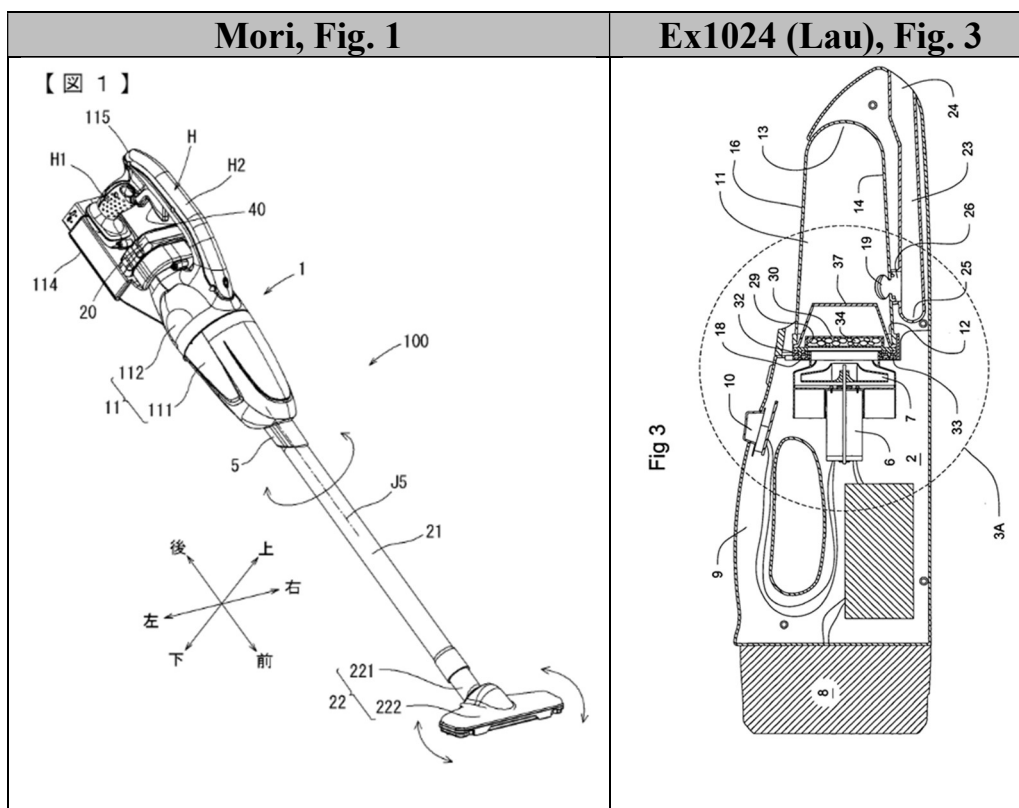
53. The '546 Patent identifies “limited dirt collection capacity” as a problem with existing hand vacuum cleaners, which the '546 Patent purports to solve with an “external dirt collection chamber wherein dirt separated in the air treatment chamber travels to the dirt collection chamber via a dirt outlet of the air treatment chamber.” *Id.* at 1:52-56.
54. The '546 Patent further states that “[a] sidewall of the air treatment chamber separates the air treatment chamber and the dirt collection chamber.” *Id.* at 1:56-58. The '546 Patent further states that the vacuum cleaner may have a “drive handle,” an “air treatment chamber (such as a cyclone chamber),” “a surface cleaning head,” and a “wand.” In my opinion, these are a mix of well-known, interchangeable features and configurations.
55. I have reviewed the '546 Patent's specification, and the combination of

these claimed elements does not purport to provide any technical benefit or solve any purported problem.

B. Prosecution History of the '546 Patent

56. I have reviewed the prosecution history of the '546 Patent. The following is my understanding:

57. During prosecution, the Examiner rejected certain claims as obvious over Japanese Publication JP2014083241 ("Mori") in combination with U.S. Publication 2006/0090290 ("Lau"), as shown in the figures below:



Ex1004, 442-47.

58. The Examiner stated that Mori "disclose[s] a filtration filter 14, not a

cyclone unit comprising a cyclone chamber,” but “Lau disclose[s] a cyclone unit 11 comprising a cyclone chamber” and that “it would have been obvious to one skilled in the art at the time of the invention to substitute the cyclone unit in Lau for the separation assembly in the hand vacuum cleaner in Mori et al. since the cyclone unit in Lau is used for the same purpose of separating dust particles from air as the separation assembly in Lau.” *Id.*, 445-46.

59. The Applicant did not dispute this. *See id.*, 473-86. Instead, the Applicant amended then-pending independent claims 1 and 11 to include the limitations of former dependent claims 3 and 14 (“a dirt collection chamber that is exterior to the cyclone chamber and a forward end of the dirt collection chamber is openable”) and the Applicant argued that the Mori-Lau combination failed to teach this feature. *Id.*, 474-78, 483-86. The Applicant also recast former dependent claims 9/10 and 16/17 as new independent claims and amended them to include subject matter previously presented in former claims 1 and 11, respectively. *Id.*, 474-85.
60. The Examiner then allowed the claims without providing reasons for allowance, *id.*, 504-508, 513, after which the Applicant provided yet further amendments, *id.*, 518-525, 528-30, which the Examiner then entered. *Id.*, 538.

61. However, in my opinion, these features were well-known at the time and were disclosed in prior art that was not before the Examiner.
62. While Jianan and Conrad335 were before the United States Patent and Trademark Office during the prosecution of the application that resulted in the '546 Patent, Butler and IPVG were not. Nor were any of the prior art combinations that are presented herein considered by the Examiner during the prosecution of the application that issued as the '546 Patent or its parent applications.

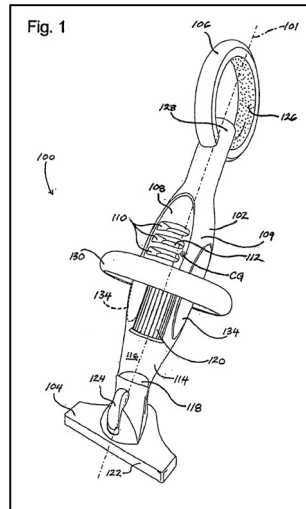
C. Priority Date of the Challenged Claims

63. For the purposes of my analysis, I have been instructed to apply, and have applied a priority date of December 17, 2014, for the Challenged Claims.

VIII. BACKGROUND OF THE PRIOR ART

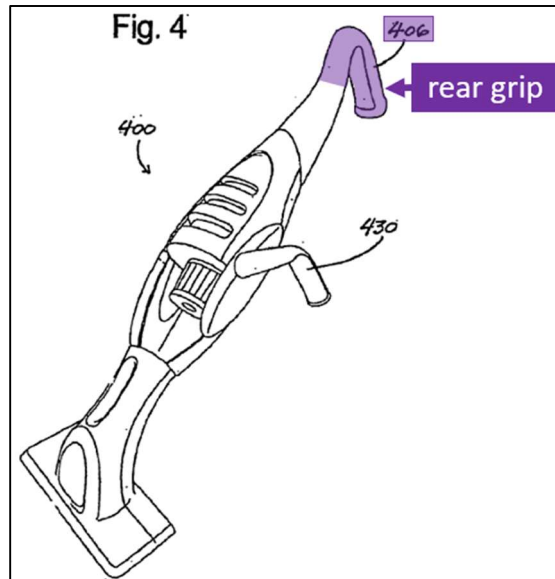
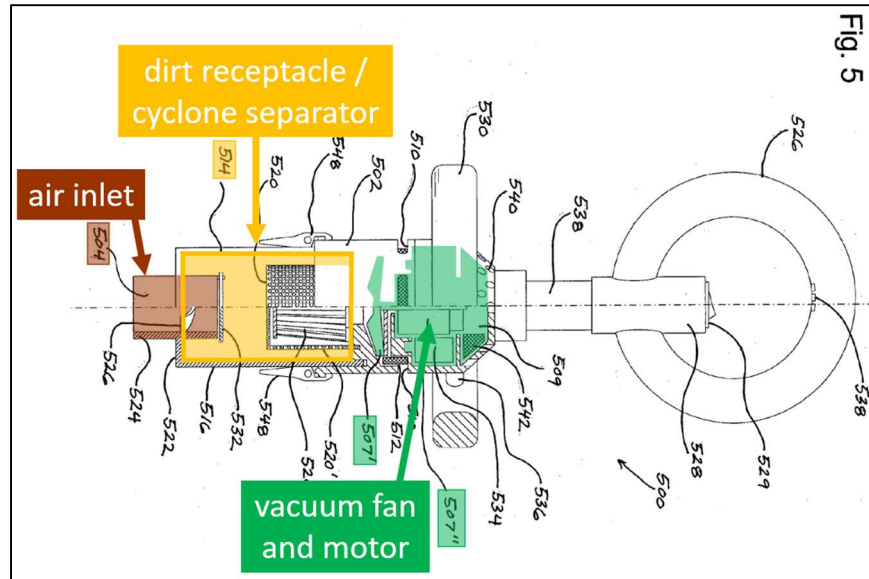
A. Butler

64. Butler is a PCT publication from 2007. Ex1005, Cover. Butler teaches “an improved vacuum cleaner for cleaning raised and vertical surfaces” including stairs, as shown in the figure below:



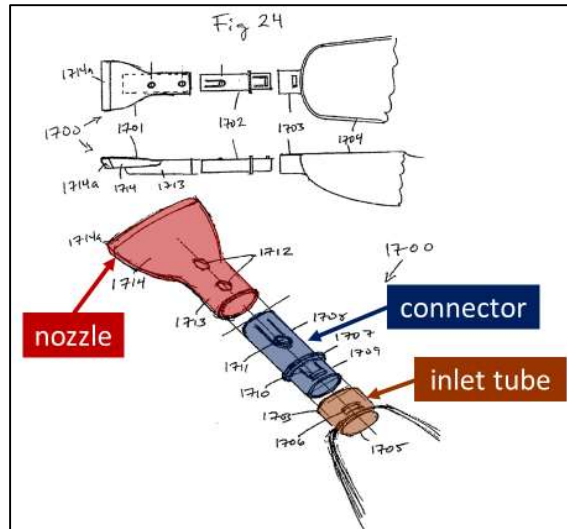
Ex1005, 3:10-12, Fig. 1.

65. In my opinion, Butler teaches a single vacuum cleaner system that is reconfigurable and optimizable. Butler explains that its various components, including handles, grips, dirt receptacles, air filters, and cleaning tools, “may be interchangeable with one another to provide the user with various cleaning options,” and the arrangement of these components may be “used individually or in various other inventive combinations.” *Id.*, 16:25-29, 43:29-44:3; *see also id.*, 4:17-28, 18:22-28, 19:9-15, 34:12-13.
66. Butler’s cleaner comprises a “housing” with a “longitudinal axis,” an “**air inlet**,” a “**dirt receptacle** compris[ing] a **cyclone separator**,” a “**vacuum fan and a motor**,” and a “**pistol-grip style rear grip**,” as shown in the annotated images below:



Ex1005, Abstract, 3:20-28, 19:22-24, 22:14-22, Figs. 4-5.

67. Butler further teaches a “**connector 1702**,” with an upstream “inlet portion 1708,” which is “telescopically received within the **nozzle 1701**,” and a downstream “outlet portion 1709,” which is “telescopically received within or around the **inlet tube 1703**,” as shown in the annotated image below:

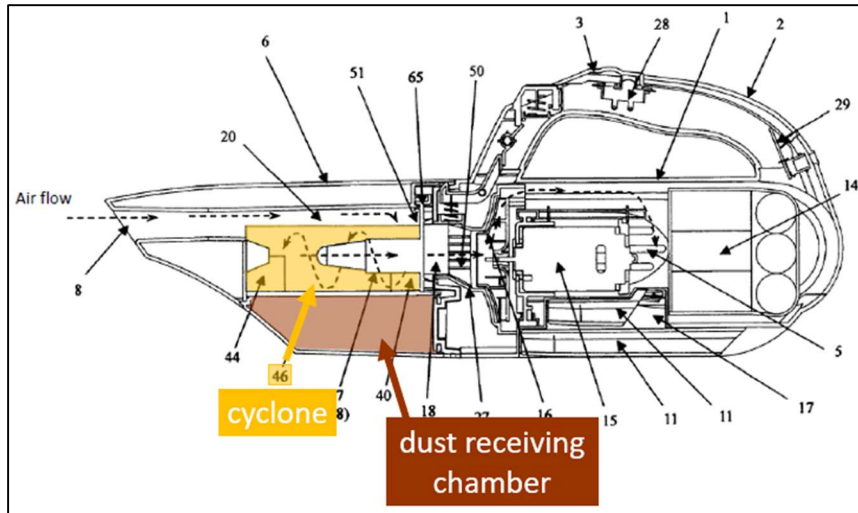


Ex1005, 41:19-29, Fig. 24.

B. Jianan³

68. Jianan is a Chinese patent application publication from 2007. Ex1006, Cover. Jianan teaches a “handheld vacuum” with a “detachable **dust cup**” comprising “two parallel **cyclones** and separate **dust receiving chambers**,” as shown in the annotated image below:

³ Citations are by page, as the English translation does not include column or line numbers.



Ex1006, Abstract, 4, Fig. 3.

69. Jianan teaches a “**wall 55**” with a “**dust release hole**” that separates “**cyclone 46**” and the “independent **dust collection chamber 9**,” as shown in the annotated images below:

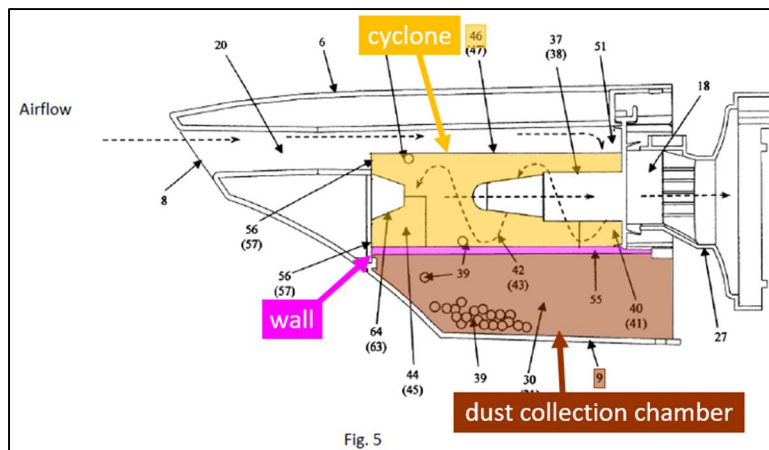
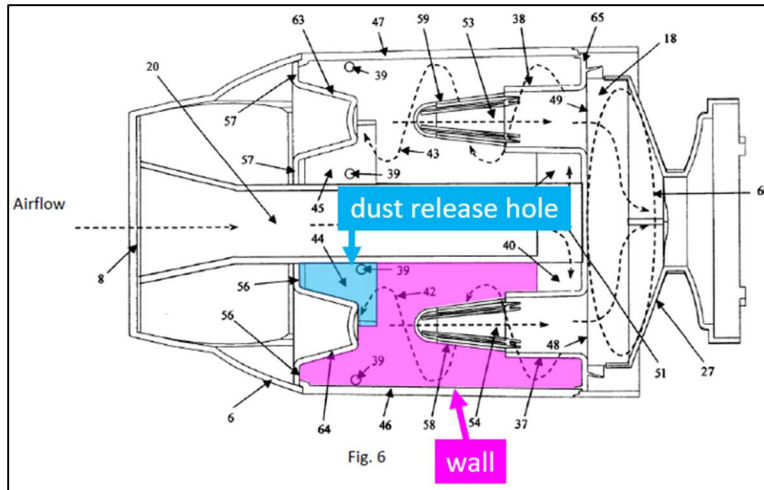


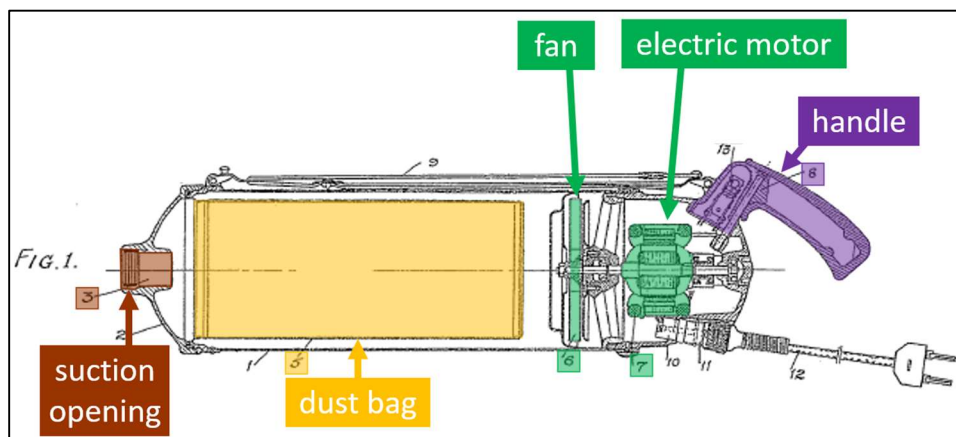
Fig. 5



Ex1006, 9-10, Figs. 5-6.

C. IPVG

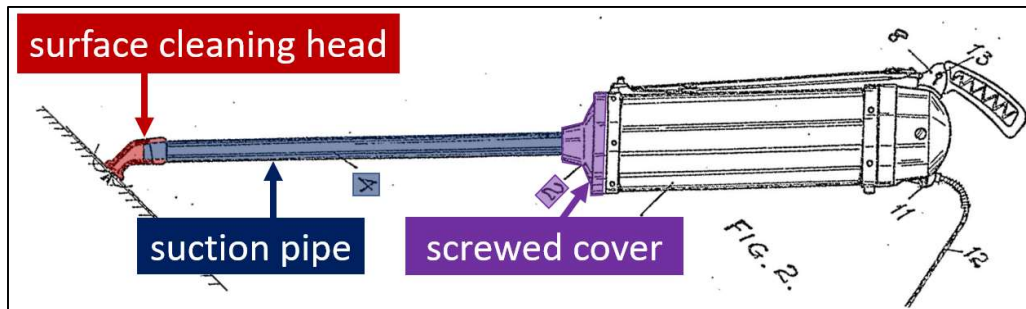
70. IPVG is a U.K. patent publication from 1928. Ex. 1007, Cover. IPVG teaches a “portable dust suction apparatus” with “a **suction opening 3**,” “a **dust bag [5] or like member**,” “**handle [8]**,” and “a **fan 6** driven by an **electric motor 7**,” as shown in the annotated image below:



Ex1007, 1:10-12, 1:22-33, 1:51-62, Fig. 1.

71. IPVG teaches a “**suction pipe 4**” that screws into “**screwed cover 2**” and also teaches a **surface cleaning head**, as shown in the annotated image

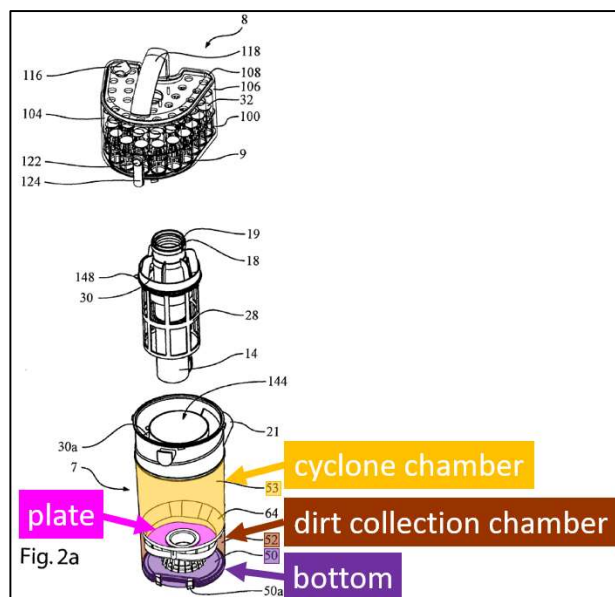
below:



Ex1007, 1:51-57, Fig. 2.

D. Conrad335

72. Conrad335 is a U.S. patent application publication from 2007. Ex. 1008, Cover. Conrad335's vacuum cleaner comprises "a cyclone separator having ... a **cyclone chamber** and a **dirt collection chamber**" divided by a "**plate 32**," and "a **bottom** that is openable," as shown in the annotated image below:



Ex1008, Abstract, ¶23, Fig. 2a.

73. Conrad335 teaches that its “cyclonic embodiments ... may be used ... to create a ... hand vacuum.” Ex1008 ¶375-376.

IX. CLAIM CONSTRUCTION

74. I am unaware of any claim construction determinations related to the ’546 Patent.
75. For purposes of this proceeding, I have been asked to consider, and have considered whether the Challenged Claims are invalid as anticipated or obvious under their plain and ordinary meaning.

X. INVALIDITY OPINIONS: ’546 PATENT

76. In my opinion, the Challenged Claims of the ’546 Patent are invalid based on the following references and combinations: claims 1-15 are rendered obvious by the combination of Butler and Jianan; claims 1-15 are rendered obvious by the combination of IPVG and Conrad335; and it would have been obvious to a POSA to combine the teachings of these references.
77. As part of my obviousness analysis, I have considered the scope and content of the prior art, and whether any differences between the alleged invention and the prior art are such that the subject matter, as a whole, would have been obvious to a person having ordinary skill in the art at the time of the alleged invention, which I have been asked to assume was December 17, 2014, for the Challenged Claims of the ’546 Patent, as

discussed above. I have also considered the level of ordinary skill in the pertinent art.

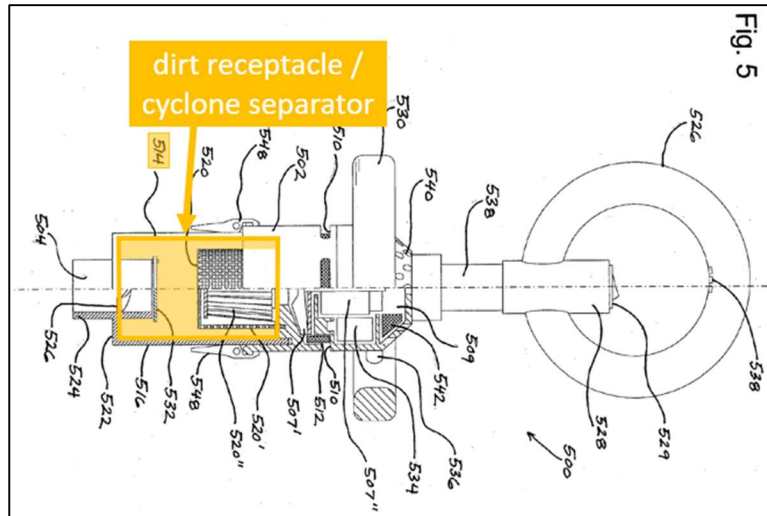
78. I describe in detail below the scope and content of the prior art, as well as any differences between the alleged invention and the prior art, on an element-by-element basis for each Challenged Claim of the '546 Patent.

A. Ground 1: Butler in Combination with Jianan Renders Obvious Claims 1-15

1. A POSA Would Have Combined Butler and Jianan

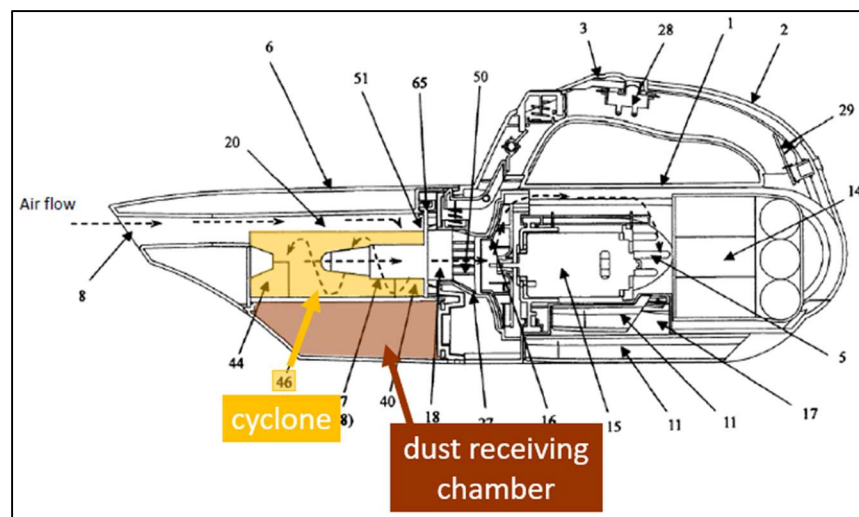
a. Scope and Content of the Butler and Jianan Prior Art References

79. As noted briefly above in the Background of the Prior Art section, Butler is a PCT publication from 2007 that teaches “an improved vacuum cleaner for cleaning raised and vertical surfaces,” including stairs. Ex1005, 3:10-12. Butler’s vacuum uses a “**dirt receptacle** compris[ing] a **cyclone separator**” to separate dirt from air, as shown in the annotated image below:



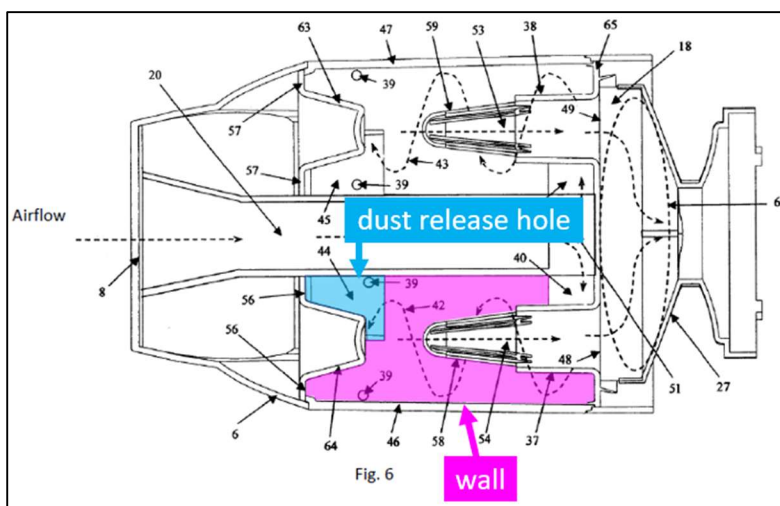
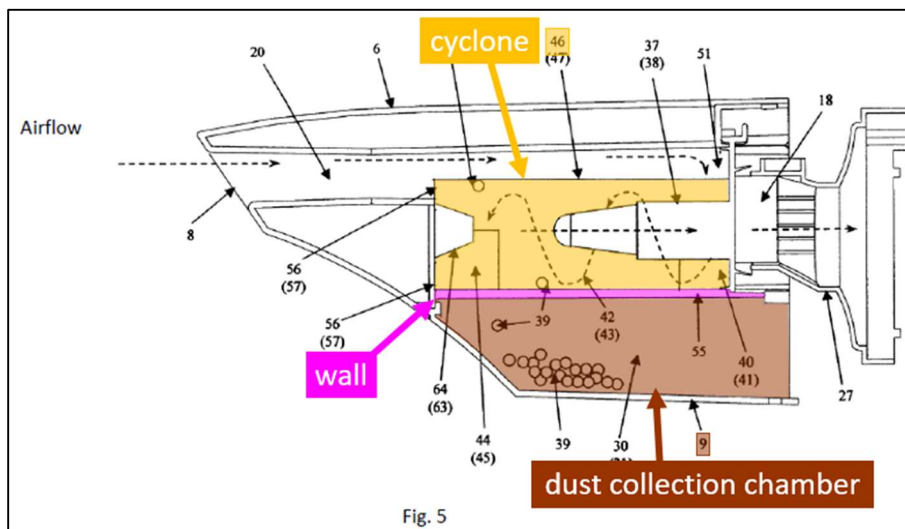
Ex1005, claim 11, Fig. 5.

80. As described briefly above in the background of the prior art section, Jianan is a Chinese patent application publication from 2007. Ex. 1006, Cover. Jianan teaches a “handheld vacuum” with a “detachable dust cup” comprising “two parallel **cyclones** and separate **dust receiving chambers**,” as shown in the annotated image below:



Ex1006, Abstract, 4, Fig. 3.

81. Jianan explains that a “**wall 55**” separates “**cyclone 46**” and the “independent **dust collection chamber 9**,” as shown in the annotated images below:

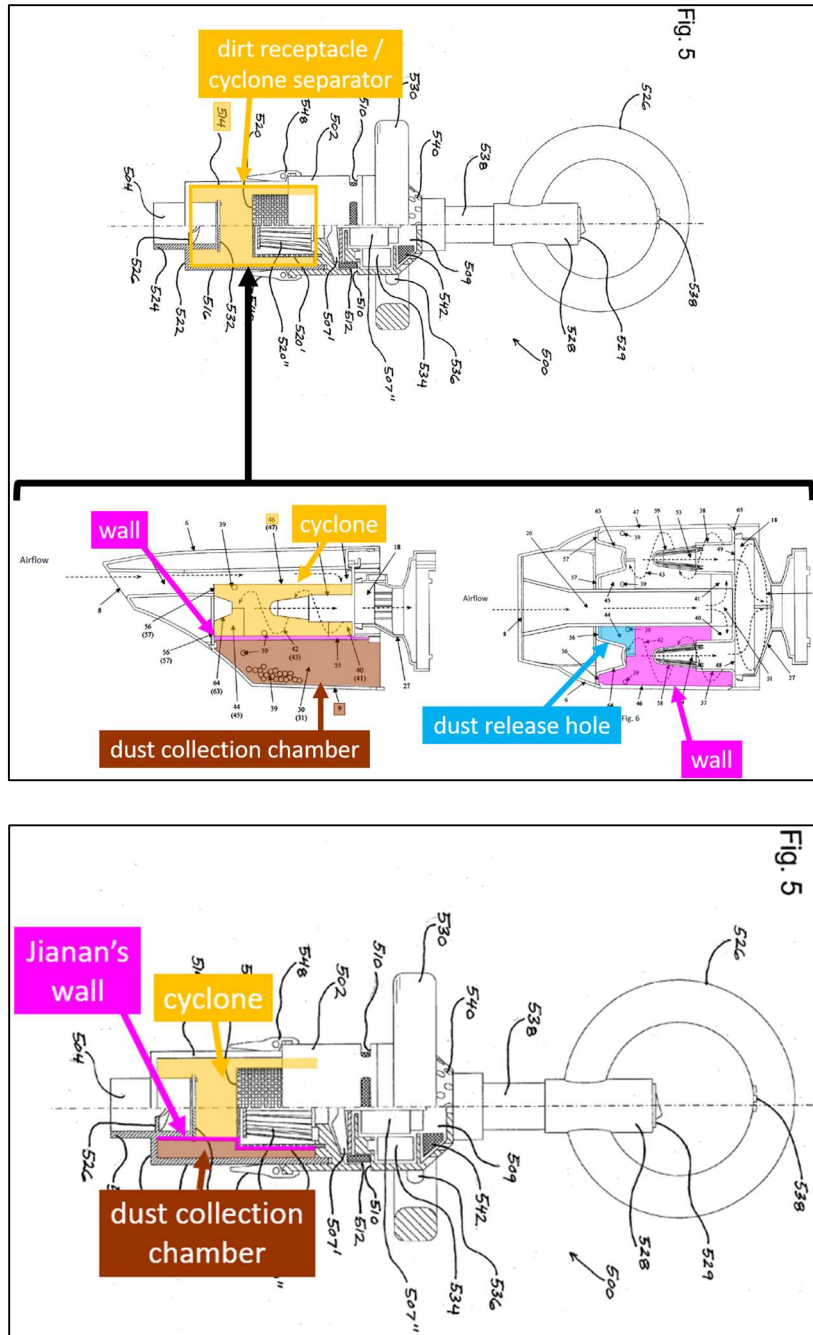


Ex1006, 9-10, Figs. 5-6.

82. As shown in the annotated images above, Jianan teaches that “the **dust collection chamber 9** is connected to the cyclone body via the **dust release hole**.” Ex1006, 9.

b. A POSA Would Have Been Motivated to Combine the Teachings of Butler and Jianan

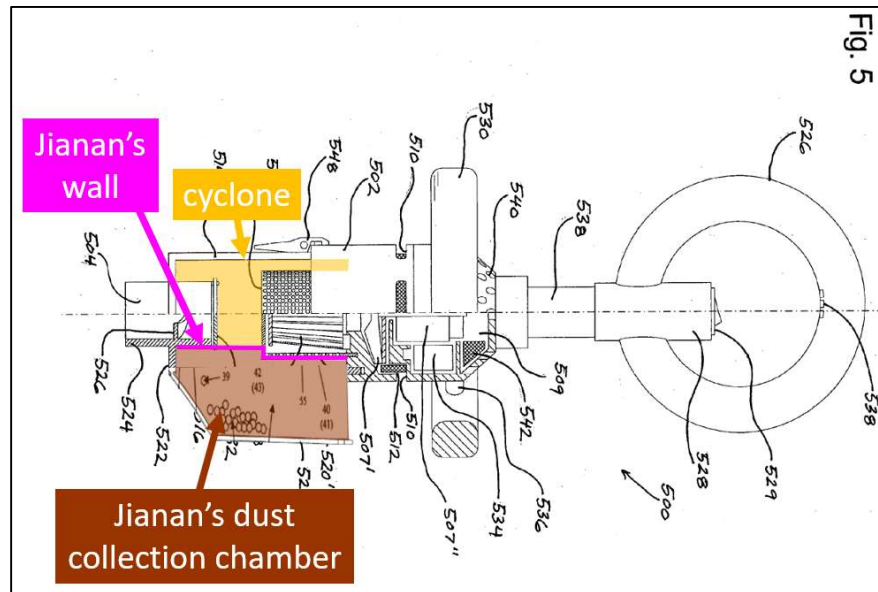
83. Having reviewed the teachings of both Butler and Jianan, in my opinion, a POSA would have been motivated to modify Butler to achieve the benefits of Jianan’s cyclonic-separation system. A POSA would have understood that there were multiple ways to implement Jianan’s independent dust-collection chamber teachings. Specifically, in my opinion, a POSA would have been motivated to modify Butler’s “**dirt receptacle** compris[ing] a **cyclone separator**” to have an “independent **dust collection chamber**,” oriented and functioning in the same way that Jianan teaches—namely, by separating the “**cyclone**” chamber from the “independent **dust collection chamber**” by using a horizontal “**wall**” with a “**dust release hole**,” as shown in the annotated images below:



Ex1005, Fig. 5(modified); Ex1006, Figs. 5-6.

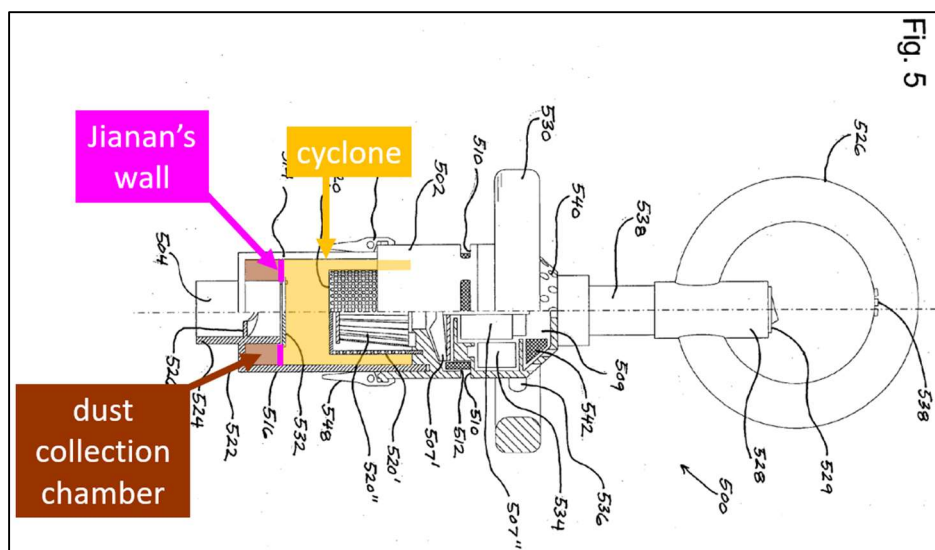
84. Also, in my opinion, a POSA also would have been motivated to modify Butler's “**dirt receptacle** compris[ing] a **cyclone separator**” to include an extended “independent **dust collection chamber**” and a horizontal “**wall**”

as Jianan teaches, and as shown in the annotated image below:



Ex1005, Fig. 5(modified); Ex1006, Fig. 5(modified).

85. Further, in my opinion, a POSA would have also been motivated to modify Butler's “**dirt receptacle** compris[ing] a **cyclone separator**” to have an “independent **dust collection chamber**” separated from the cyclone chamber by a vertically oriented “**wall**,” as shown in the annotated image below:



Ex1005, Fig. 5(modified).

86. In my opinion, a POSA would have been motivated to combine Butler and Jianan as described for several reasons.
87. First, a POSA would have understood that Butler and Jianan are analogous art. Butler teaches a hand vacuum cleaner with a removable cyclone unit (“dirt receptacle compris[ing] a cyclone separator” is “remov[ed]” by unclamping “[a] set of over-center clamps 548”) and an openable door (“dirt receptacle 214 may be covered by an access panel or door” to “facilitate the chamber’s emptying”). Ex1005, 18:26-30, 21:8-23, claim 11. Likewise, Jianan teaches a “handheld vacuum cleaner” with a removable cyclone unit (“a detachable dust cup part” “includes” “two parallel cyclones and separate dust receiving chambers”) and an openable door (“the dust [collection] chamber has ... an opening and closing device

such as a door or the like”). Ex1006, Abstract, 2, 4, claim 3.

88. Second, in my opinion, Butler and Jianan each provide motivations for this combination. Butler discloses several cyclonic embodiments:

Referring now to Figure 2D, in still another embodiment, the dirt receptacle 214 comprises a cyclone separation chamber in which the working airflow is swirled to remove dirt and dust by centrifugal or cyclonic action. In this embodiment, the inlet air passage 242 may be provided through the structural portion 238 of the housing 202 and terminate at or near the top of the dirt receptacle 214. Also in this embodiment, the inlet air passage 242 enters or terminates at an inlet port 270 through the dirt receptacle sidewall in a tangential or nearly tangential manner, which initiates a cyclonic flow therein. A frusto-conical filter 272 is located over the fan/ motor inlet opening 244 to prevent dirt and debris that is not separated by cyclonic action from entering the fan/ motor 207. As before, any alternative filter shape, material, construction or filtration grade may be used, and multiple filter layers may also be used, as known in the art.

Ex1005, 18:3-14.

Located inside the entry tube 524 is a helical ramp 526. The helical ramp 526 extends radially inward from the entry tube's inner wall, and may terminate short of the entry tube's centerline, as shown, to allow an unobstructed central path through the entry tube 524, or may extend to the centerline (or beyond) to block any direct flow of air through the entry tube 524. A one-way flap

valve 532 made of a flexible material, such as are known in the art, is provided at the end of the entry tube 524 to prevent reverse flow of dirt out of the dirt receptacle 514. It has been found that the use of the foregoing helical ramp 524 is sufficient to establish a cyclonic airflow pattern within the dirt receptacle 514, despite the presence of the flap valve 532.

While the foregoing cyclonic arrangement for the dirt receptacle 514 is preferred, other types of dirt separation system may alternatively be used, as will be appreciated by those of ordinary skill in the art in view of the present disclosure.

Id., 22:14-25

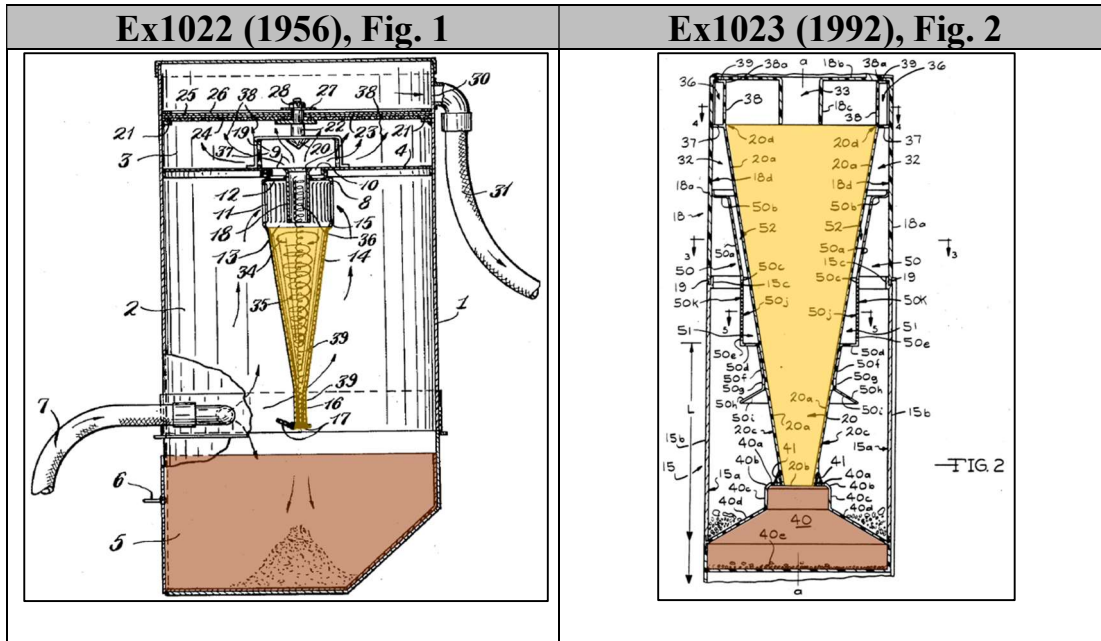
The dustcup 1522 provides storage of collected refuse and debris, and may comprise a bag chamber, a non-cyclonic cup, or a cyclonic separation chamber.

Id., 36:2-4.

89. Butler even explicitly explains that its vacuum “may alternatively comprise[] any known type of dirt separation and retention system,” and that such “variations will be apparent to those of ordinary skill in the art in view of the present disclosure and with routine experimentation with the invention.” *Id.*, 8:26-27, 19:1-3.

90. In my opinion, a POSA would have therefore looked for “known type[s] of dirt separation and retention system[s]” to supplement Butler’s teachings, including a cyclone unit with a **cyclone chamber** and an

independent dirt collection chamber, as Jianan teaches, and as had existed for over 50 years before the '546 Patent's earliest-claimed priority filing, as shown in the annotated images below:



91. In my opinion, a POSA would have understood that cyclone units with this exterior dirt collection chamber had certain benefits. These benefits include: (1) improved separation, because large dust particles no longer interfere with the cyclonic airflow, (2) improved suction, because less dust accumulates in the filter, and (3) reduced recurring pre-filter cleaning and replacement, because less debris reaches the pre-motor filter. Further, Jianan itself teaches two advantages to this design. Jianan teaches that: (1) because “the cyclone system is designed to collect dust 39 in an independent dust collection chamber 9,” “most of the dust ... separated

through the cyclone” will remain in the “dust collection chamber,” and “users will not have to clean the filter as often,” and (2) because “only a small amount of dust (mainly very fine dust) will ... enter the filter,” “users ... will experience constant suction power” and “improvement[s]” in “the efficiency of the cyclone. Ex1006, 5, 10.

92. Third, in my opinion, a POSA would have understood that these benefits could be achieved by implementing Jianan’s independent dust-collection chamber teachings in various ways, as I show and describe above. Each configuration provides additional benefits for different use cases that, in my opinion, would have further motivated a POSA to modify Butler. In my opinion, a POSA would have understood that implementing a horizontal “wall” is beneficial for cleaning vertical surfaces, and a vertical “wall” is beneficial for cleaning horizontal surfaces (each of which are Butler’s stated objectives, Ex1005, 7:2-5 (“The present invention provides a vacuum cleaner that can be used to clean floors and carpets, but is particularly adapted to clean stair treads or other elevated horizontal surfaces, stair risers and other inclined or vertical surfaces, and surfaces located in confined spaces.”))), because, when so oriented during those use-cases, gravity naturally forces the dust particles to collect in the independent dust collection chamber.

93. In my opinion, implementing a vertical “wall” would also make it easier and more hygienic to empty the dust collection chamber, because it would be provided adjacent to Butler’s openable front door:

Also, the dirt receptacle 214 may be covered by an access panel or door. The dirt receptacle 214 may also be omitted and replaced by a non-removable chamber within the housing. In this variation, the chamber may be selectively covered by a door or the like to facilitate the chamber's emptying.

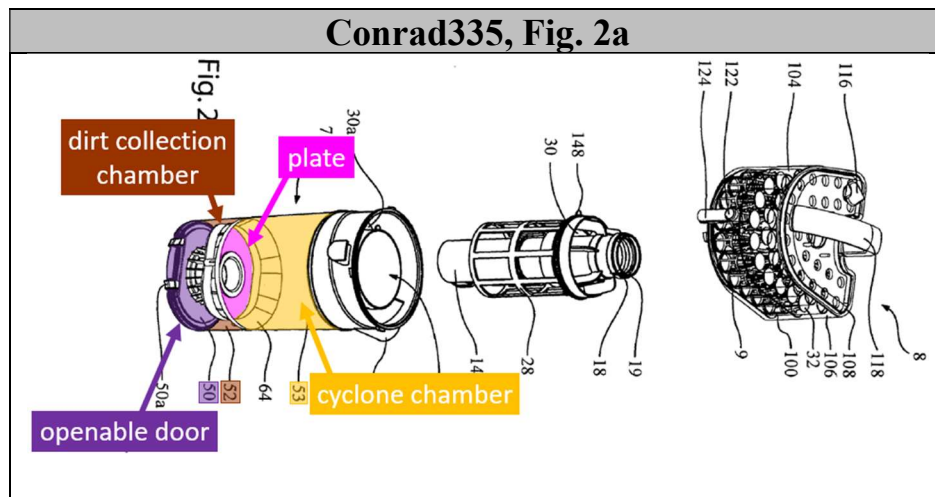
Ex1005, 18:26-30.

A cylindrical dirt receptacle 514 is removably attached at a bottom end of the housing 502 adjacent the fan/ motor chamber 509. In this embodiment, the housing 502 terminates at the dirt receptacle 514, and therefore the dirt receptacle 514 is constructed as a structural member of the vacuum cleaner 500 that can convey bending moments and longitudinal loads from the grips 506, 530 to the inlet nozzle 504. A set of over-center clamps 548 are used to hold the dirt receptacle 514 and housing 502 together, but bayonet fittings, threaded fitment, tabs and slots, screws, or other fasteners may alternatively be used. While the foregoing construction is preferred in this embodiment, other variations may be used. In one variation, the dirt receptacle 514 may be removably attached in pocket formed in a structural portion of the housing that extends to the inlet nozzle 504, as in the previous embodiments. In another variation, the dirt receptacle 514, or at least a portion of it, may be permanently

attached to the housing 502, and only the bottom end of it is removable from the device, along with the inlet nozzle 504. For example, the bottom wall 522 may be removably attached to the sidewalls 516 by threaded engagement, bayonet fittings, clamps, screws, or the like.

Id., 21:8-23.

94. Vacuum cleaners with this configuration were well-known in the art, as shown in the annotated image below, which, in my opinion, would further motivate a POSA and provide a reasonable expectation of success:



95. Also, in my opinion, a POSA would have understood that implementing a horizontal “wall” and an enlarged dust collection chamber enables longer periods of operation between emptying because the collection chamber can hold more dirt/dust.
96. Fourth, in my opinion, this combination would have involved a simple substitution of known elements to obtain predictable results. A POSA

would have understood that Butler teaches a cyclone unit with an integrated dirt collection chamber/cyclone chamber. Ex1005, Fig. 5. A POSA also would have understood that Jianan teaches a cyclone unit with a cyclone chamber separated from a dirt collection chamber by a wall. Ex1006, Figs. 5-6. In my opinion, a POSA would have understood that the simple substitution of an integrated dirt collection chamber for a separated one would achieve the predictable result of more efficient cyclonic air filtration and reduced pre-filter maintenance. Further, as I depicted and explained above, Butler and Jianan are directed to hand vacuums having a similar orientation of cyclone unit relative to the overall vacuum configuration, which, in my opinion, would have further motivated a POSA to make the combination.

97. Fifth, in my opinion, it would have been at least obvious to try this combination. In my opinion, a POSA would have understood that there are a finite number of identified cyclonic separation solutions, including cyclone units with separate cyclone and dirt collection chambers (as Jianan teaches), and it would have been obvious to try to achieve the known benefits I described above.

c. A POSA Would Have Had A Reasonable Expectation of Success Combining the Teachings of Butler and Jianan

98. In my opinion, a POSA would have had a reasonable expectation of success implementing Jianan's "independent dust collection chamber" teachings into Butler's "dirt receptacle compris[ing] a cyclone separator" for the reasons stated above. Ex1006, 10; Ex1005, claim 11. Further, as explained above, Butler and Jianan are very similar, including because they are both hand vacuums having similar orientations and removable cyclonic separating units with openable doors for emptying, which, in my opinion, would have further given a POSA a reasonable expectation of success. Ex1005, 18:26-30, 21:8-15, claim 11, Fig. 5; Ex1006, Abstract, 4, claim 3, Figs. 3, 5-6.

2. [1]/[8]/[9]/[10]/[14]/[15]

a. [1pre]/[8pre]/[9pre]/[10pre]/[14pre]/[15pre]

Reference Number	Claim Limitation
[1pre]	"A surface cleaning apparatus comprising:"
[8pre]	"A surface cleaning apparatus comprising:"
[9pre]	"A surface cleaning apparatus comprising:"
[10pre]	"A surface cleaning apparatus comprising:"
[14pre]	"A surface cleaning apparatus comprising:"
[15pre]	"A surface cleaning apparatus comprising:"

99. To the extent the preambles are limiting, in my opinion, Butler teaches a surface cleaning apparatus.

100. Butler teaches a “vacuum cleaner” for cleaning surfaces, including “floors and carpets,” “horizontal surfaces,” and “vertical surfaces.” Ex1005, Title, 7:2-5. A POSA would have understood that this is a surface cleaning apparatus.

b. [1a]/[8a]/[9a]/[10a]/[14a]/[15a]

Reference Number	Claim Limitation
[1a]	“(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle, the hand vacuum cleaner comprising:”
[8a]	“(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle, the hand vacuum cleaner comprising:”
[9a]	“(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle, the hand vacuum cleaner comprising:”
[10a]	“(a) a hand vacuum cleaner comprising:”
[14a]	“(a) a hand vacuum cleaner comprising:”
[15a]	“(a) a hand vacuum cleaner comprising:”

101. In my opinion, Butler teaches a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle.

102. Butler teaches that its vacuum cleaner has a “**rear grip**” and “one or more **foregrips**” that the user grasps during use. Ex. 1005, Abstract. Butler describes a vacuum cleaner wherein the distance between the **foregrip** and

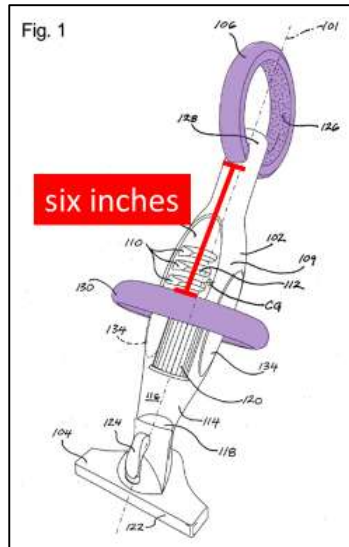
the rear grip is six inches, and the overall vacuum length is eighteen inches, as shown in the annotated image below:

Considering the general build of many users, in one embodiment, the distance between the grips is about six to thirty inches. In a more preferred embodiment, the foregrip 130 is spaced from the most distant graspable portion of the rear grip 106 by about eight to twenty-four inches. These distances are expected to allow the user to comfortably grasp both grips and operate the vacuum cleaner 100 at about a 30 to 60 degree angle on the surface being cleaned, while remaining in a generally upright, comfortable standing position.

Ex. 1005, 15:5-11.

Embodiments of the present invention address these shortcomings by providing a relatively compact vacuum cleaner that is long enough to allow typical users to clean elevated stairs without excessive stooping, yet short enough to still provide ergonomic grip and control of the device, and the ability to maneuver in tight spaces, such as enclosed stairwells. As an ancillary benefit, this length may also prove to be better adapted for cleaning in confined spaces, such as closets. In a preferred embodiment, the vacuum cleaner of the present invention has an overall length of about 18 to 46 inches, and more preferably about 20 to 24 inches.

Id., 26:1-10.

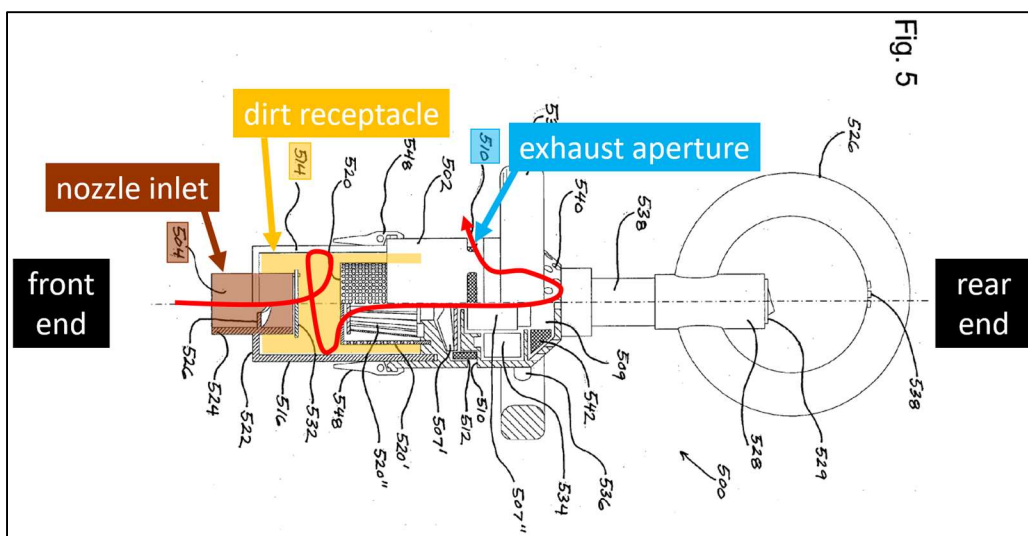


Id., Fig. 1.

103. In my opinion, a POSA would have understood that Butler’s vacuum cleaner, including when the distance between the rear grip and foregrip is 6 inches, and the overall length is 18 inches, is a hand vacuum cleaner.
104. Further, Butler explains that its vacuum cleaner is “compact” and “maneuverable,” “adapted for cleaning ... stairwells and other confined spaces,” and teaches telescoping handgrip members as well as extension members to reach the floor. Ex. 1005, Abstract, 1:2-3, 26:1-5, 27:12-29. These extension members would commonly be used in hand vacuum cleaners. Butler’s cleaner is also designed to have an optimal “center of gravity” and to “remov[e] excess weight.” *Id.*, 13:1-19, 15:12-18. A POSA would have understood that these (center of gravity position, and weight) are considerations that are crucial to hand vacuum cleaners,

particularly since a hand vacuum is expected to be picked up and moved from place to place during use, not just during storage, and accordingly, removal of excess weight and optimization of balance are important to minimizing exertion and effort while maximizing comfort. Furthermore, optimization of weight and balance also provides the most maneuverability for users of the device. For example, a hand vacuum cleaner that had a sub-optimal center of gravity could disadvantageously create strain on a user's hand and wrist during use. A hand vacuum cleaner that was excessively heavy would be fatiguing for a user. Similarly, a hand vacuum cleaner that has a sub-optimal center of gravity, i.e., one that is unfavorably far from the hand, or unbalanced, can also have the same effect on a user as an excessively heavy vacuum.

105. Regarding Limitations [1a]/[8a]/[9a], in my opinion, a POSA would have understood that Butler teaches that its hand vacuum has a front end having a dirty air inlet, a rear end, and a clean air outlet. Butler teaches that **air** enters the hand vacuum cleaner **front end** via “**nozzle inlet 504**,” is cleaned by “a cyclonic airflow pattern within the **dirt receptacle 514**,” and exits via “**exhaust apertures 510**,” as shown in the annotated image below:

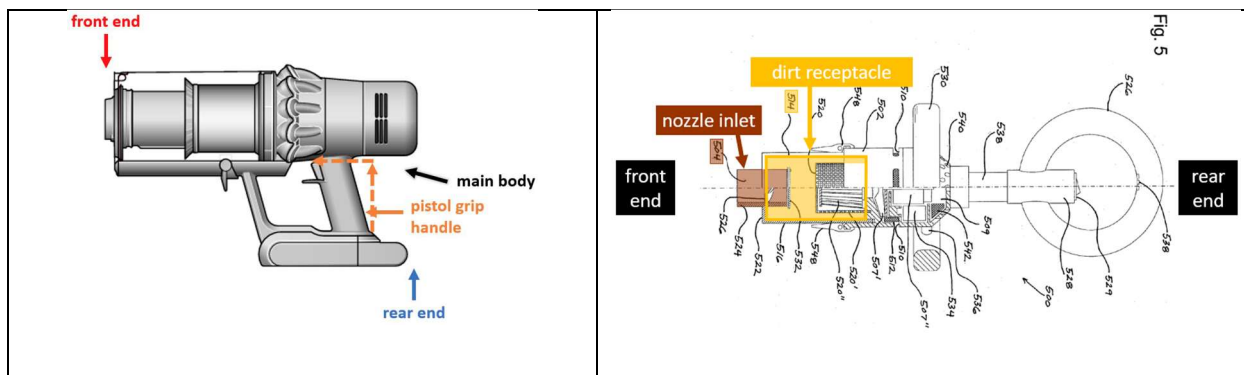


Ex1005, 22:5-6, Fig. 5.

106. In my opinion, a POSA would have understood that Butler’s “nozzle inlet 504” is a dirty air inlet at Butler’s front end, and “exhaust apertures 510” are clean air outlets. Further, in my opinion, a POSA would have understood that Butler has **front and rear ends** as shown above because “**nozzle inlet 504**” is at the end opposite Butler’s “rear grip 506.” Ex1005, 13:31-14:3, 29:1-5.

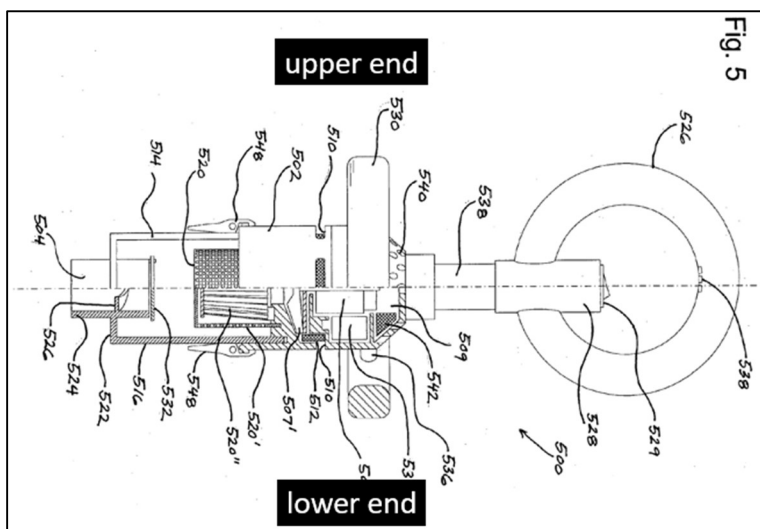
107. I have reviewed PO’s infringement contentions, and this is at least as much disclosure of these limitations in Butler as PO has accused of infringement in the related litigation, as shown in the annotated images below:

PO’s Infringement Contentions	Butler
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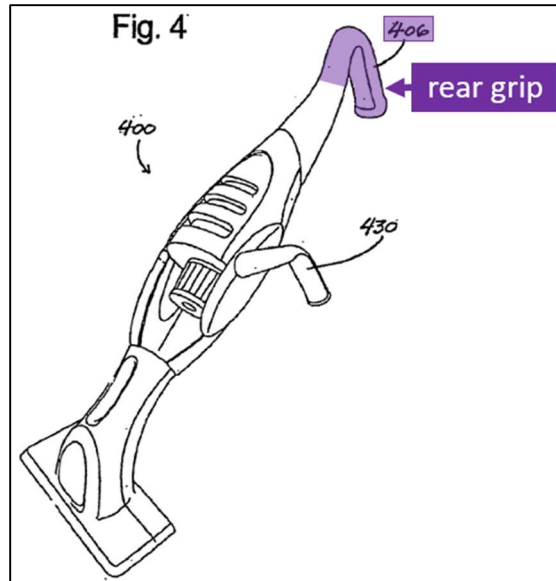
Ex1011, 5(PO's annotations); Ex1005, Fig. 5.

108. A POSA would have similarly understood that Butler's hand vacuum has an **upper end** and a **lower end**, as shown in the annotated image below:



Ex1005, Fig. 5.

109. A POSA would have understood that Butler teaches a pistol grip handle. Butler's hand vacuum cleaner "includes a pistol-grip style **rear grip 406**," as shown in the annotated image below:



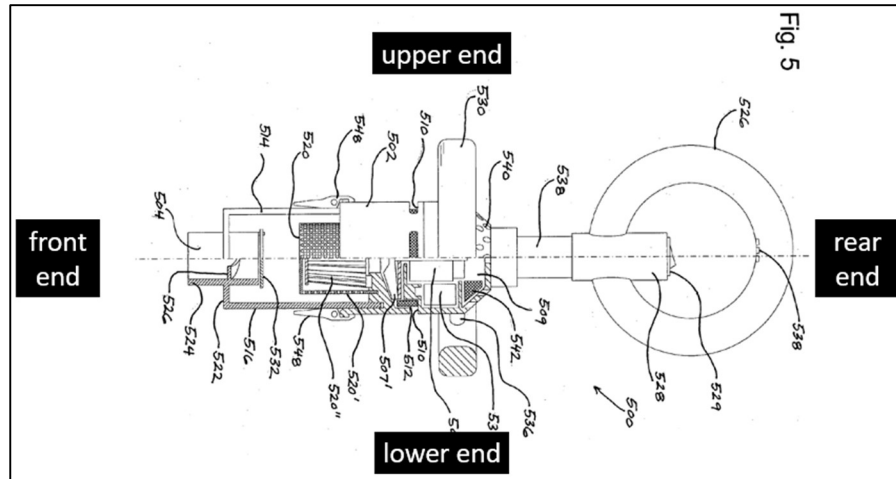
Ex1005, 19:22-24, Fig. 4.

110. A POSA would have understood that Butler's "pistol-grip style rear grip 406" is a pistol grip handle.
111. Further, Butler teaches that the rear grips are interchangeable: "the loop-shaped grips may be replaced by any combination of rear grip and foregrip that provide the user with hand positions to ergonomically maneuver the device," and "one exemplary variation of the grip construction" is "pistol-grip style rear grip 406." Ex1005, 19:9-12, 19:18-24.

c. [1a.1]/[8a.1]/[9a.1]/[10a.1]/[14a.1]/[15a.1]

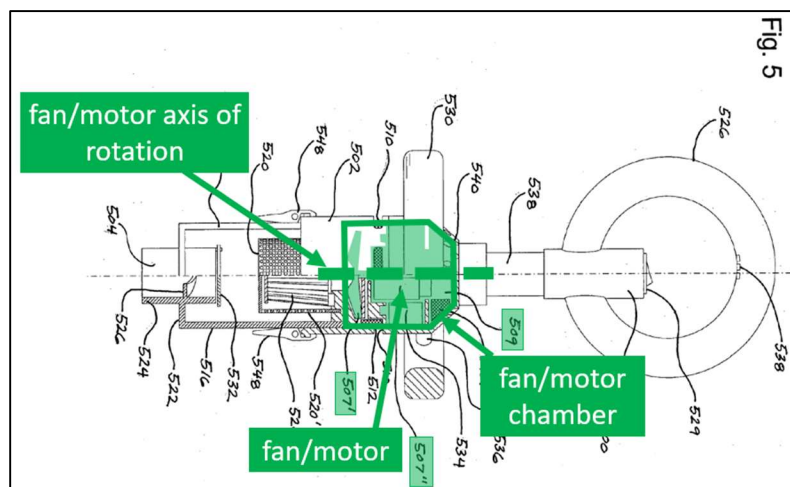
Reference Number	Claim Limitation
[1a.1]	“(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation;”
[8a.1]	“(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation; and,”
[9a.1]	“(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation; and,”
[10a.1]	“(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end;”
[14a.1]	“(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end; and,”
[15a.1]	“(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end; and,”

112. In my opinion, Butler teaches a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation (Limitations [1a.1]/[8a.1]/[9a.1]).
113. In my opinion, Butler teaches a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end (Limitations [10a.1]/[14a.1]/[15a.1]).
114. In my opinion, a POSA would have understood that Butler's hand vacuum cleaner has a main body comprising an **upper end**, a **lower end**, a **front end**, and a **rear end**, as shown in the annotated image below:



Ex1005, Fig. 5; Ground 1, Limitations [1a]/[8a]/[9a]/[10a]/[14a]/[15a].

115. In my opinion, a POSA would have understood that Butler’s hand vacuum main body houses a suction motor and fan assembly having a suction motor axis of rotation. Butler’s vacuum body has a “**fan/motor chamber 509** in which the **fan/motor 507** is located,” and has a **fan/motor axis of rotation**, as shown in the annotated image below:

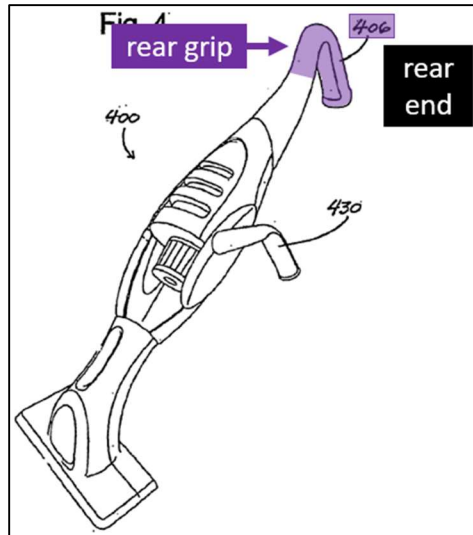


Ex1005, 20:12-14, Fig. 5.

116. In my opinion, a POSA would have understood that Butler’s “fan/motor

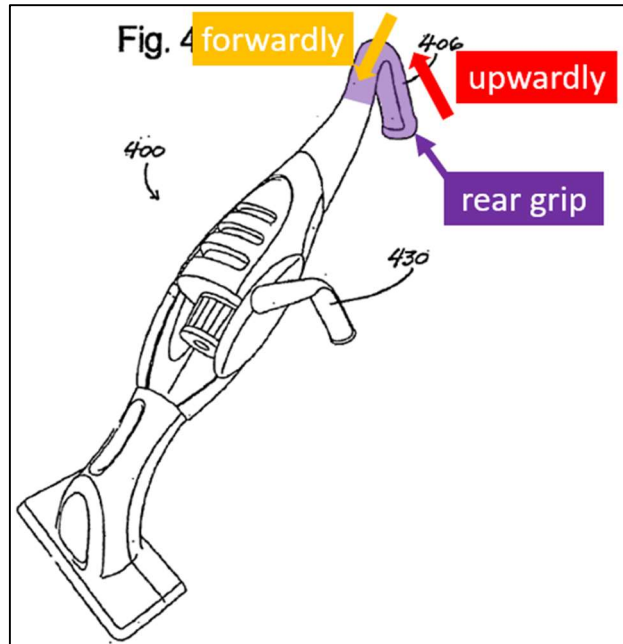
507” is a suction motor with a suction motor axis of rotation.

117. Regarding Limitations [10a.1]/[14a.1]/[15a.1], as I explained above, in my opinion, Butler teaches a pistol grip handle. Ground 1, Limitations [1a]/[8a]/[9a]/[10a]/[14a]/[15a]. A POSA would have understood that Butler’s pistol grip handle is provided at the rear end of the main body. Butler’s “pistol-grip style **rear grip 406**” is at the **rear end** of Butler’s main body, as shown in the annotated image below:



Ex1005, 19:22-24, Fig. 4.

118. In my opinion, Butler also teaches that the pistol grip handle extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end. When Butler’s handvac front end is forward of the rear end, the “pistol-grip style **rear grip 406**” extends **upwardly** and **forwardly**, as shown in the annotated image below:



Ex1005, Fig. 4.

d. [1a.2]/[8a.2]/[10a.2]/[14a.2]

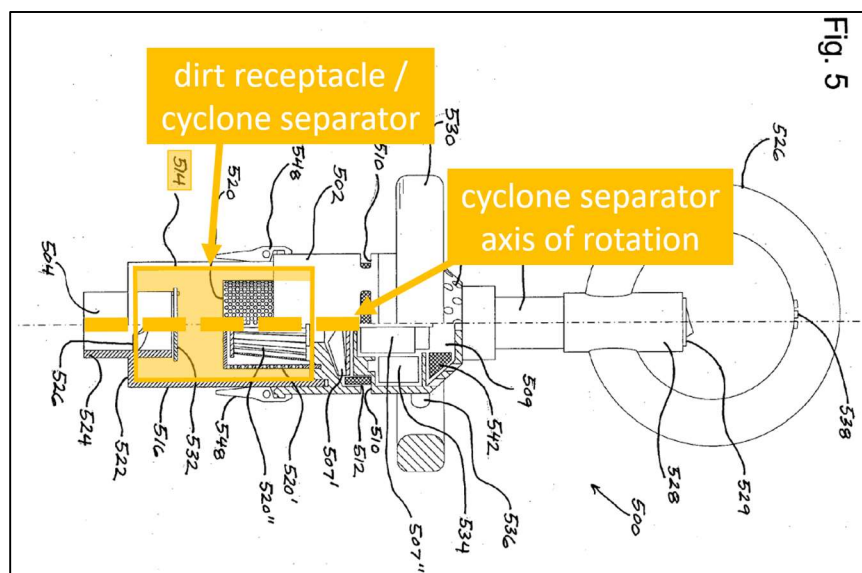
Reference Number	Claim Limitation
[1a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle; and”
[8a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle;”
[10a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation; and”
[14a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation; and”

119. In my opinion, Butler teaches a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle (Limitations [1a.2]/[8a.2]).

120. In my opinion, Butler teaches a cyclone unit comprising a cyclone chamber

having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation (Limitations [10a.2]/[14a.2]).

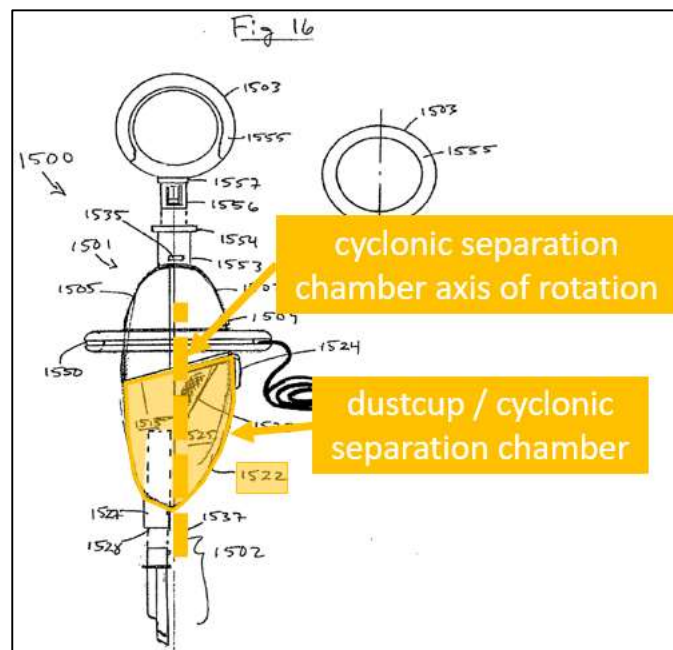
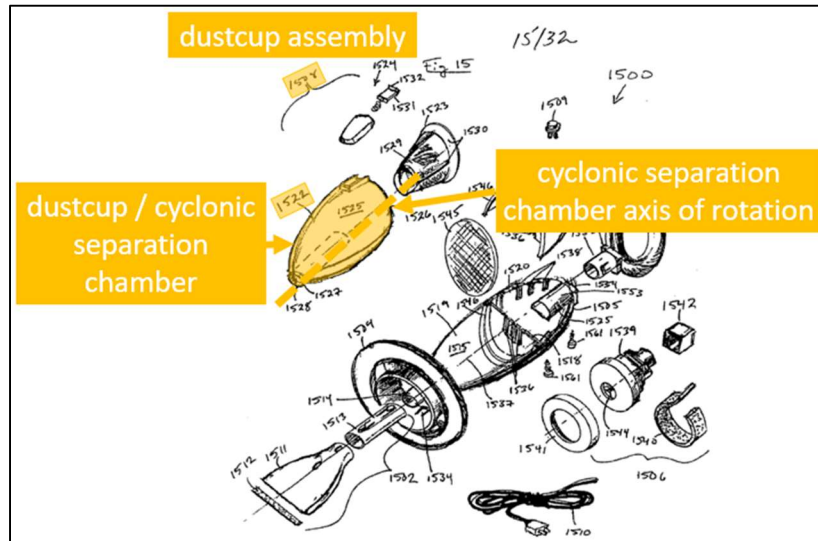
121. In my opinion, Butler teaches a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation. Butler's "**dirt receptacle** comprises a **cyclone separator**," which, in my opinion, a POSA would have understood is a cyclone unit including a cyclone chamber with a **cyclone separator axis of rotation**, as shown in the annotated image below:



Ex1005, Claim 11, Fig. 5.

122. Further, Butler teaches a "**dustcup assembly 1508** compris[ing] a **dustcup 1522**" that "may comprise ... a **cyclonic separation chamber**," which, in my opinion, a POSA would also understand is a cyclone unit including a

cyclone chamber with a **cyclonic separation chamber axis of rotation**,
as shown in the annotated images below:

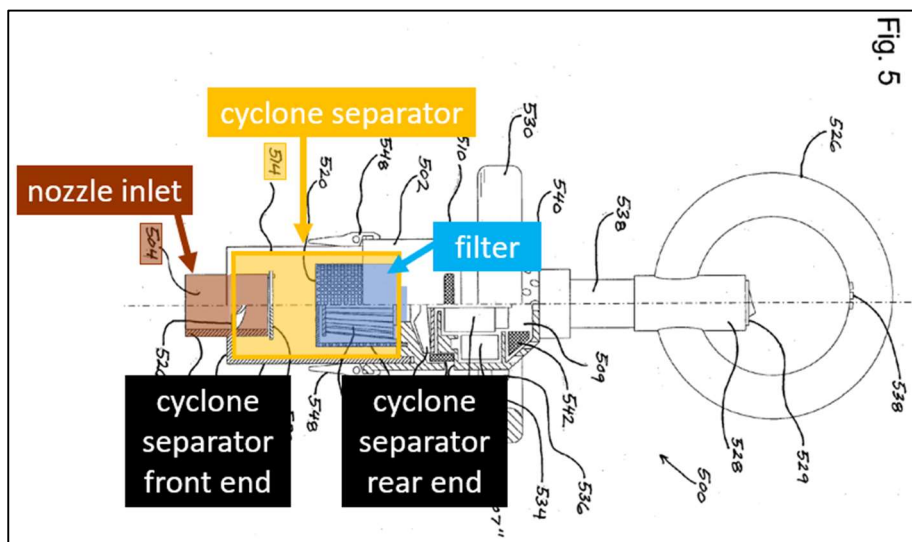


Ex1005, 35:27-36:4, Figs. 15-16.

123. Like Butler's grips, Butler teaches that its cyclonic separation units are interchangeable: "[t]he present invention may be used with any type of dirt

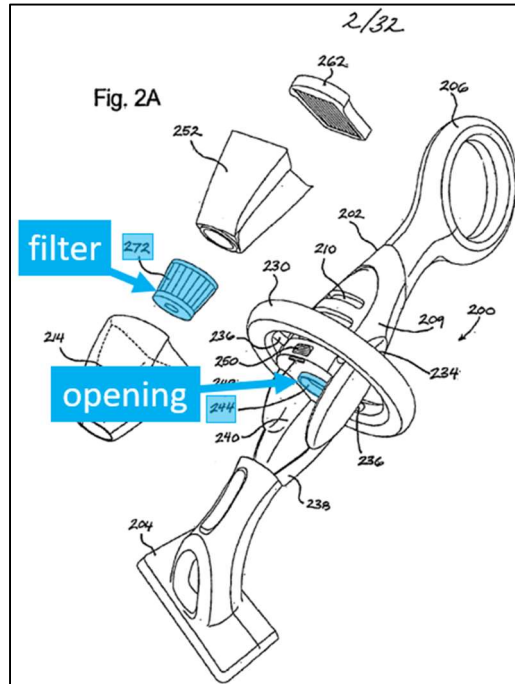
separation system,” and “it is envisioned that various different types of dirt receptacle ... may be interchangeable with one another to provide the user with various cleaning options.” Ex1005, 16:25-28.

124. In my opinion, Butler teaches a cyclone chamber front end and an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein air exits the cyclone chamber at the rear end of the cyclone chamber. In my opinion, a POSA would have understood that Butler’s “cyclone separator” comprising a cyclone chamber has a **front end** (including where air enters through “nozzle inlet 504”) and an axially spaced apart **rear end** (including where air exits through a “filter 520 compris[ing] ... fine filter 520'”), as shown in the annotated image below:



Ex1005, 21:24-28, Fig. 5.

125. Butler further teaches “frusto-conical **filter 272** ... located over the fan/motor inlet **opening 244**” that “prevent[s] dirt and debris that is not separated by cyclonic action from entering the fan/motor 207,” as shown in the annotated image below:



Ex1005, 18:10-12, Fig. 2A.

126. In my opinion, a POSA would have understood that Butler’s “filter 520,” “filter 272,” and “opening 244” are, individually and collectively, a cyclone air outlet provided at the rear end of the cyclone unit because air passes through them, and cyclonic filtering ends, as it exits the rear end of Butler’s “cyclone separator,” which is also the cyclone chamber’s rear end.

127. In my opinion, a POSA would have understood that Butler’s “**cyclonic separation chamber**” also has a **front end** and an axially spaced apart

15/32

filter assembly

rear end

cyclonic separation chamber

front end

inlet tube

1500

1509

1507

1501

1503

1546

1536

1520

1538

1534

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1539

1518

1501

1536

1537

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1506

1512

1511

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1500

1509

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1500

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1507

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1546

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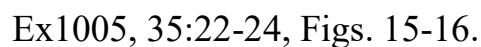
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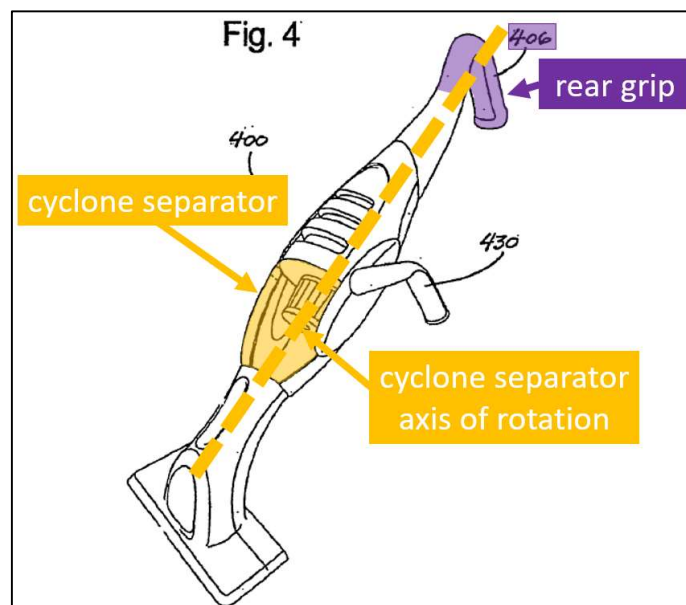
151



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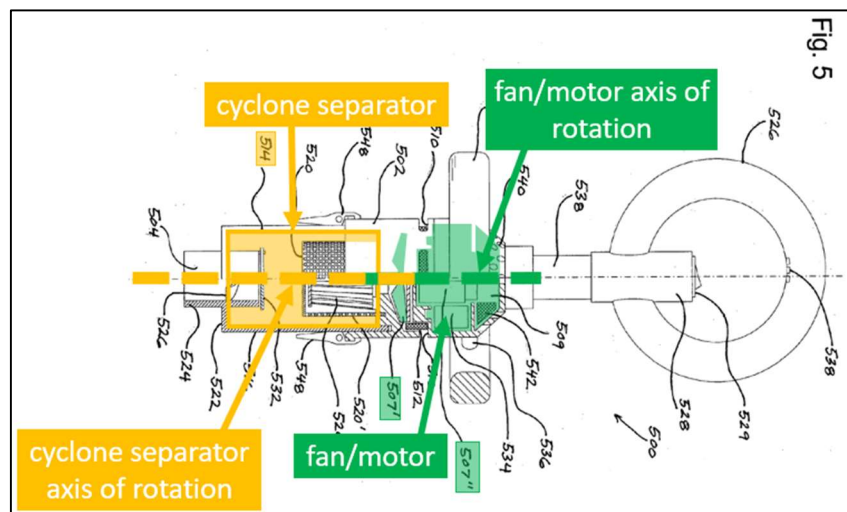
Butler's "inlet tube 1514" terminates (the "end" "adjacent to the dustcup chamber 1519 and forms an air passage into the dustcup chamber 1519") is a cyclone air inlet, because it is the inlet through which dirty air enters Butler's cyclone chamber; and "filter assembly 1523" is a cyclone air outlet provided at the rear end of the cyclone unit (and the rear end of the cyclone chamber) because air passes through it, and cyclonic filtering ends, as it exits Butler's "cyclonic separation chamber." Ex1005, 35:14-16, 35:22-24.

129. Regarding Limitations [1a.2]/[8a.2], in my opinion, Butler teaches that the cyclone axis of rotation intersects the pistol grip handle. Butler's "**cyclone separator**" **axis of rotation** and "**cyclonic separation chamber**" **axis of rotation** (collectively **cyclone separator axis of rotation**) intersects "pistol-grip style **rear grip 406**," as shown in the annotated image below:



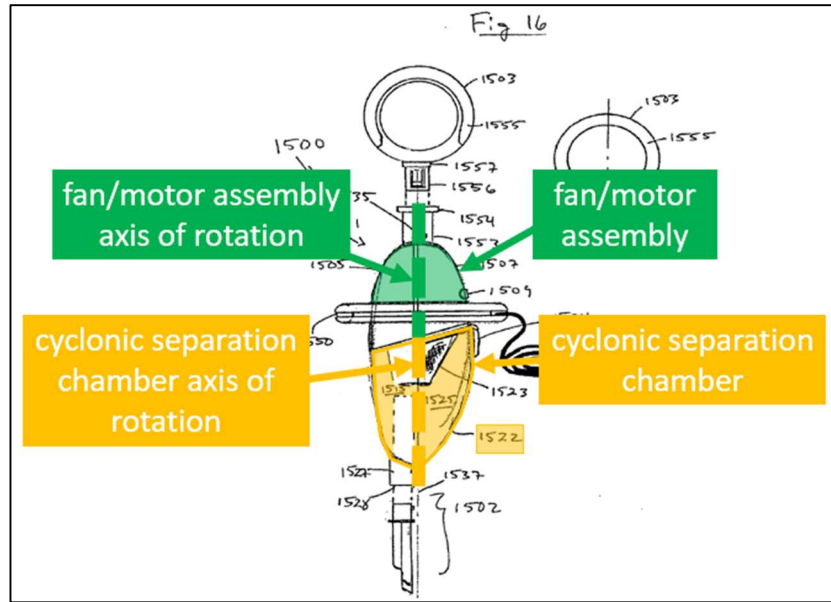
Ex1005, Fig. 4.

130. Regarding Limitations [10a.2]/[14a.2], in my opinion, Butler teaches the suction motor axis of rotation is generally parallel to the cyclone axis of rotation. In my opinion, a POSA would have understood that Butler's **fan/motor axis of rotation** is generally parallel to the **cyclone separator axis of rotation**, as shown in the annotated image below:



Ex1005, Fig. 5.

131. Further, in my opinion, a POSA would have understood that Butler's “**fan/motor assembly 1506[’s]**” **axis of rotation** is generally parallel to the **cyclonic separation chamber axis of rotation**, as shown in the annotated image below:



Ex1005, 35:4-6, Fig. 16.

132. To the extent Butler's fan/motor axis and cyclone separator axis are depicted as co-axial in Figures 5 and 16, in my opinion, a POSA would have understood that these axes are generally parallel because they extend in the same direction and maintain the same (zero) distance between them. Further, PO contends that co-axial axes meet this limitation in PO's infringement contentions. Ex1011, 7.

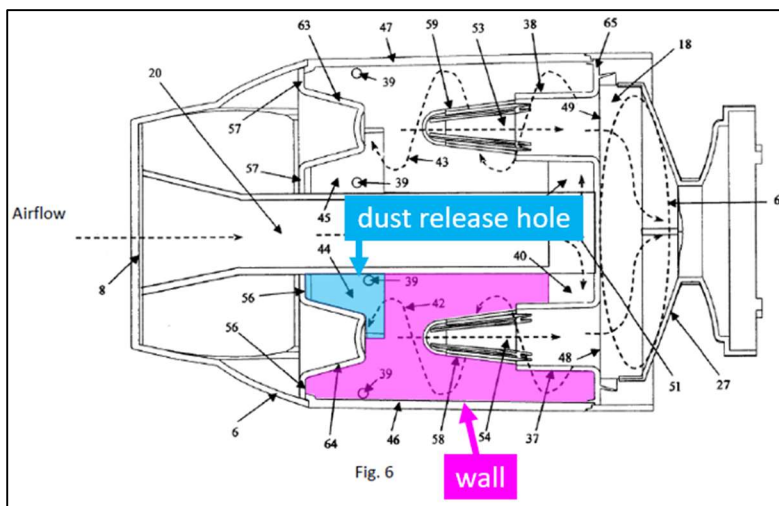
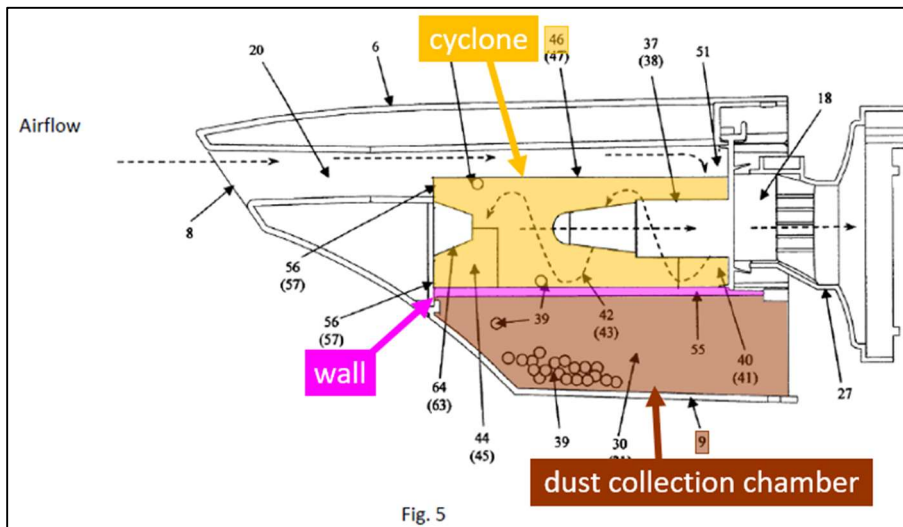
e. [9a.2]/[15a.2]

Reference Number	Claim Limitation
[9a.2]	“(ii) a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter”
[15a.2]	“(ii) a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter,”

133. In my opinion, the combined teachings of Butler and Jianan teaches a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter (Limitation [9a.2]).

134. In my opinion, the combined teachings of Butler and Jianan teaches a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter (Limitation [15a.2]).
135. As I explained above, in my opinion, Butler teaches a cyclone unit comprising a cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation, and wherein the cyclone axis of rotation intersects the pistol grip handle. Ground 1, Limitations [1a.2]/[8a.2]/[10a.2]/[14a.2].
136. In my opinion, Jianan teaches a dirt collection chamber that is exterior to the cyclone chamber. Jianan teaches a “wall 55” that separates “cyclone

46” (which, in my opinion, a POSA would have understood is positioned in a cyclone chamber) from the “independent **dust collection chamber 9**,” as shown in the annotated images below:

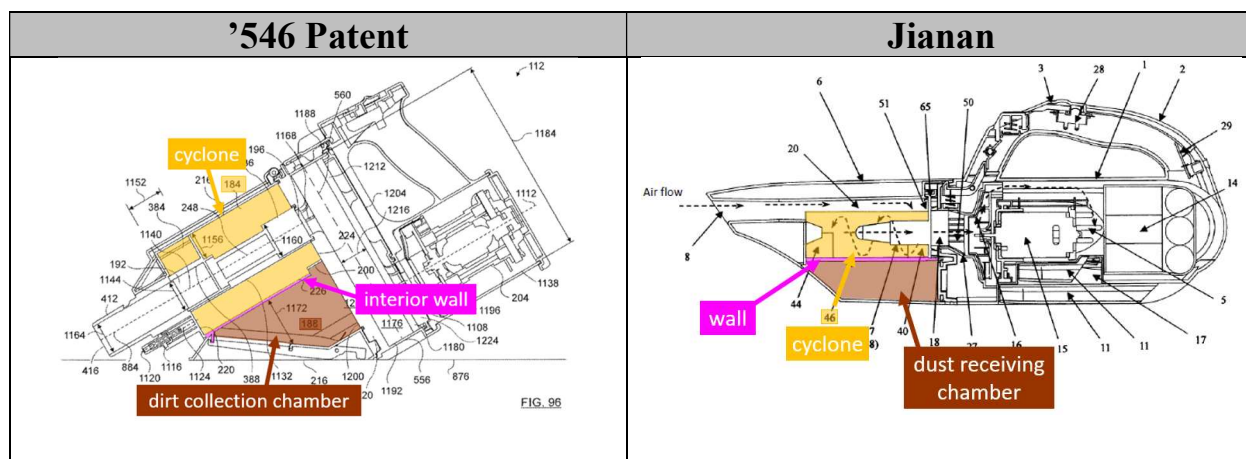


Ex1006, 9-10, Figs. 5-6.

137. As depicted above, “the **dust collection chamber 9** is connected to the cyclone body via the **dust release hole.**” Ex1006, 9. Jianan teaches that “[d]ust particles escape into the hole cutout” and “most of the dust collects

in [the] separate dust receiving chamber.” *Id.*, 5; *see also id.*, 10 (“This invention uses an independent dust storage device located far away from the cyclone, and cooperates with an efficient cyclone system.”). Thus, in my opinion, a POSA would have understood that Jianan’s “independent dust collection chamber 9” (dirt collection chamber) is exterior to Jianan’s “cyclone 46” positioned in a cyclone chamber.

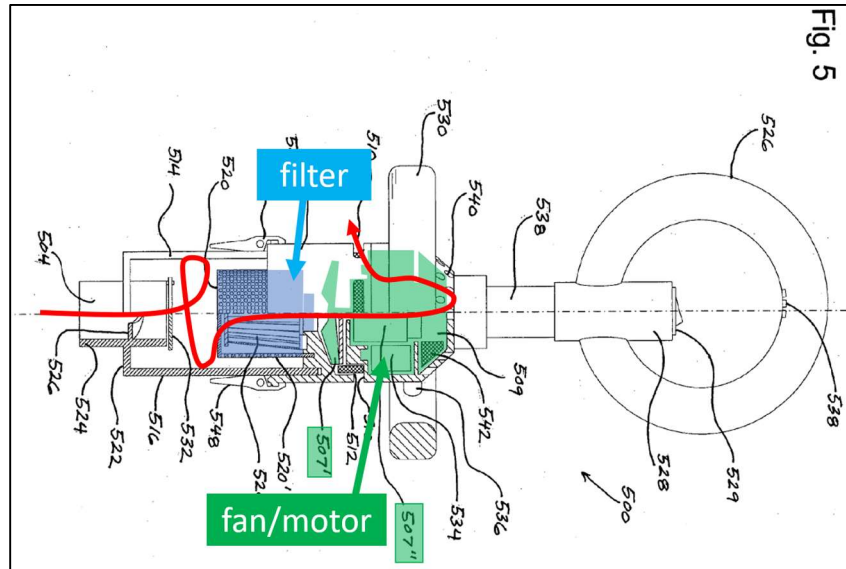
138. Further, this is at least as much disclosure of these limitations as the ’546 Patent, as shown in the annotated images below:



Ex1001, Fig. 96; Ex1006, Fig. 3; *see also* Ex1001, 12:41-42 (“As shown, a common interior wall 226 may divide cyclone chamber 184 from dirt collection chamber 188.”).

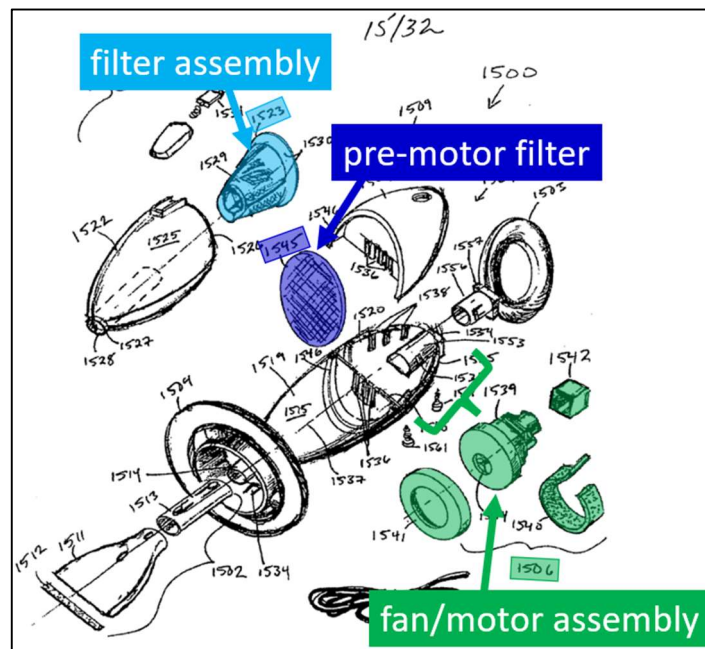
139. A POSA would have understood that Butler teaches a pre-motor filter. Butler’s “**filter 520** compris[ing] ... **fine filter 520**” is positioned forward of “**fan/motor 507**,” and filters out “fine particle[s]” before the “working

airflow” “cool[s] the **motor 507**,” as shown in the annotated image below:



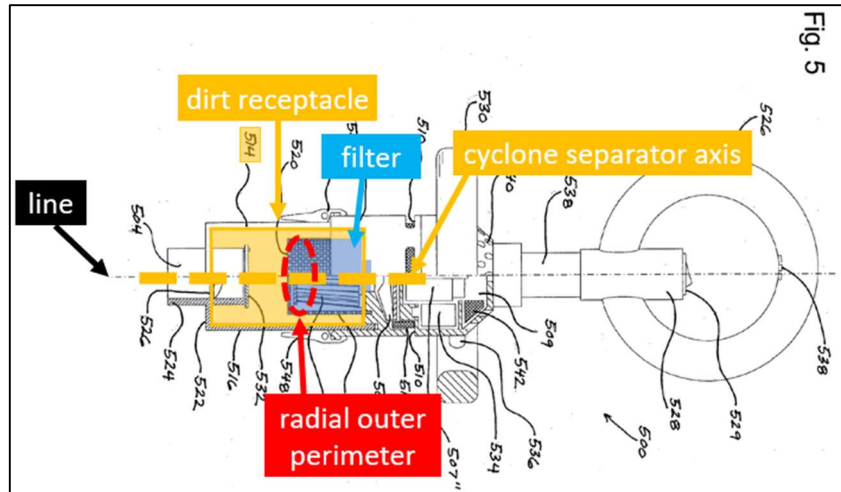
Ex1005, 20:14-26, 21:24-22:4, Fig. 5.

140. Butler also teaches a “**filter assembly 1523** compris[ing] a filter 1529” and “**pre-motor filter 1545**” positioned forward of “**fan/motor assembly 1506**,” as shown in the annotated image below:



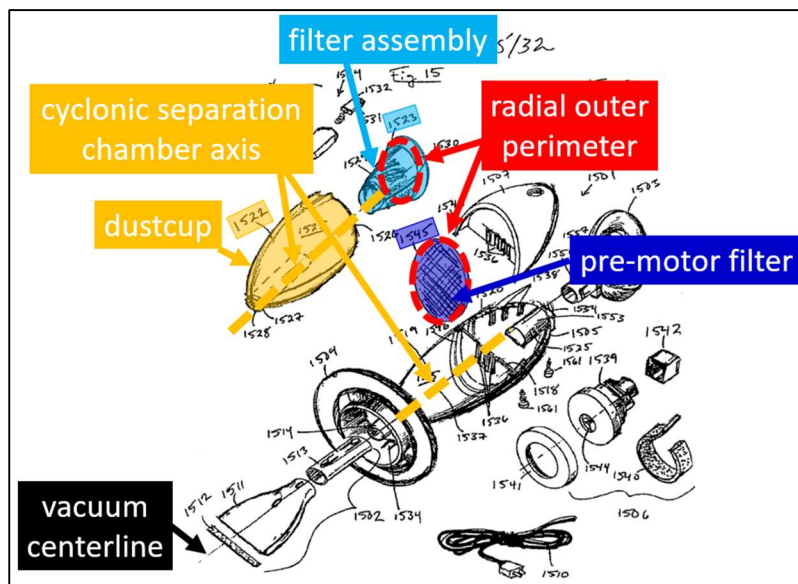
Ex1005, 35:20-24, 36:5-7, Fig. 15.

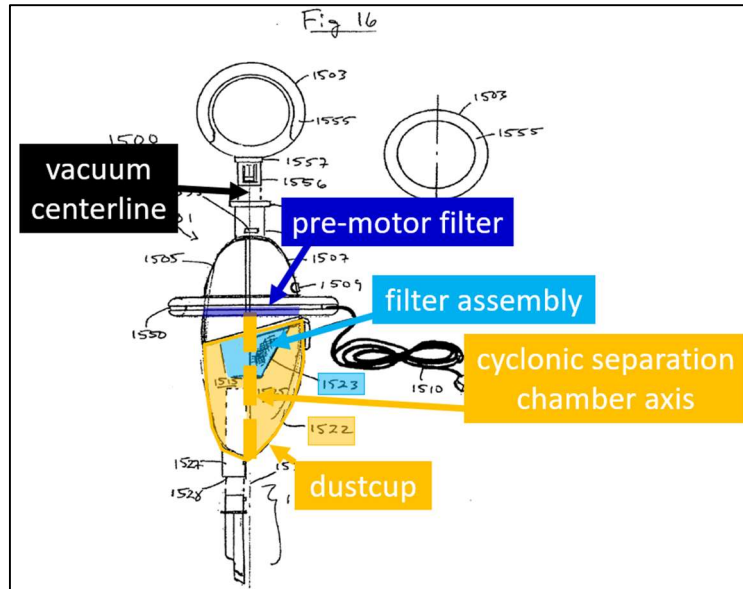
141. A POSA would have understood that each of these filters (filter 520, filter assembly 1523, and pre-motor filter 1545) is a pre-motor filter, because each filters air before it reaches the suction motor. Further, Butler teaches that “any alternative filter shape, material, construction or filtration grade may be used, and multiple filter layers may also be used.” Ex1005, 18:12-14. Thus, a POSA therefore would have understood that Butler teaches various physical filters that filter air upstream of Butler’s motor, which are interchangeable pre-motor filters.
142. In my opinion, Butler teaches a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter. In my opinion, a POSA would have understood that a **line** parallel to Butler’s **cyclone separator axis** extends through “**dirt receptacle 514**” (dirt collection chamber) and interior of a **radial outer perimeter** of “**filter 520**” (pre-motor filter), as shown in the annotated image below:



Ex1005, Fig. 5.

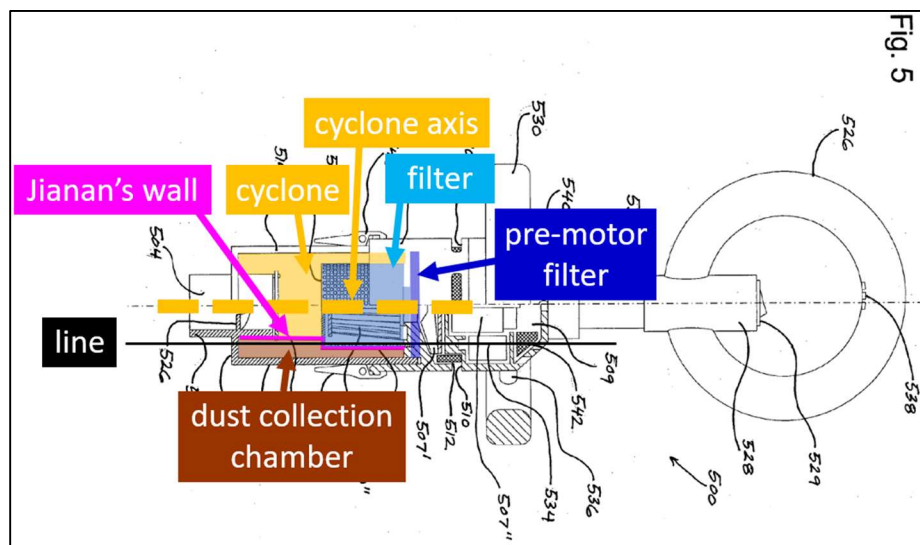
143. Likewise, Butler teaches a “**vacuum centerline 1537**” parallel to Butler’s **cyclonic separation chamber axis** that extends through the “**dustcup 1522**” (dirt collection chamber) and a location interior of each of a **radial outer perimeter** of “**filter assembly 1523**” and “**pre-motor filter 1545**,” as shown in the annotated images below:

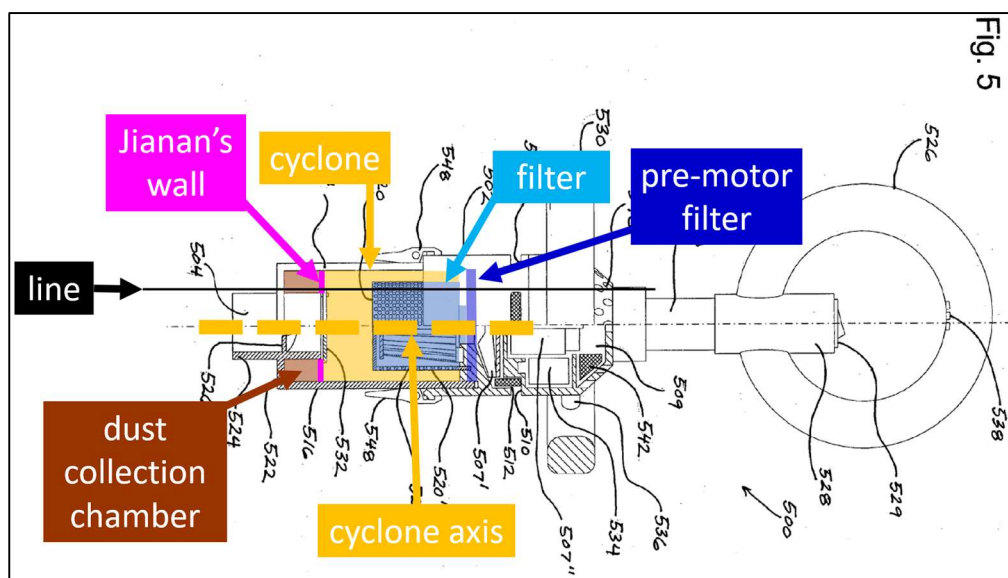
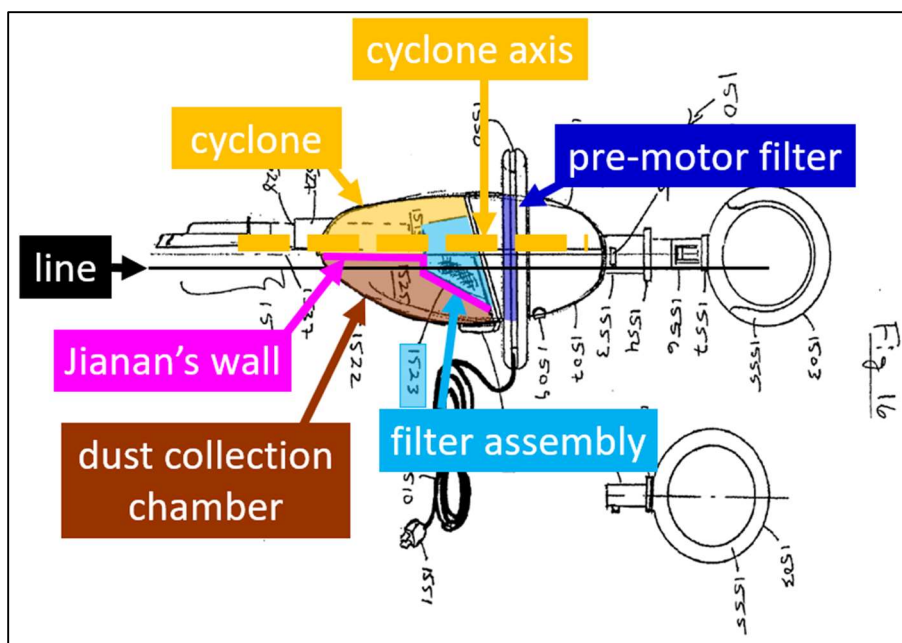


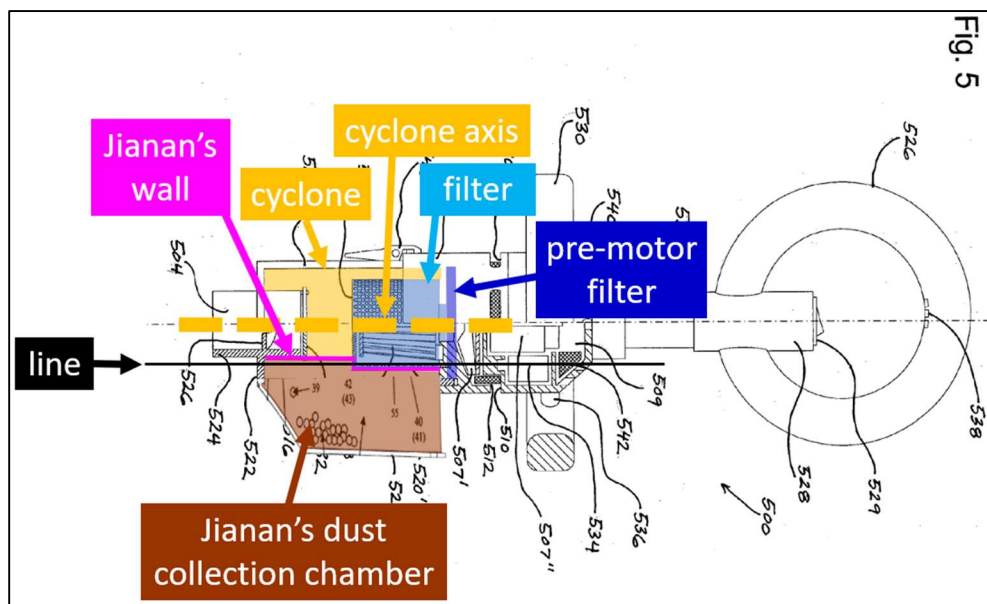
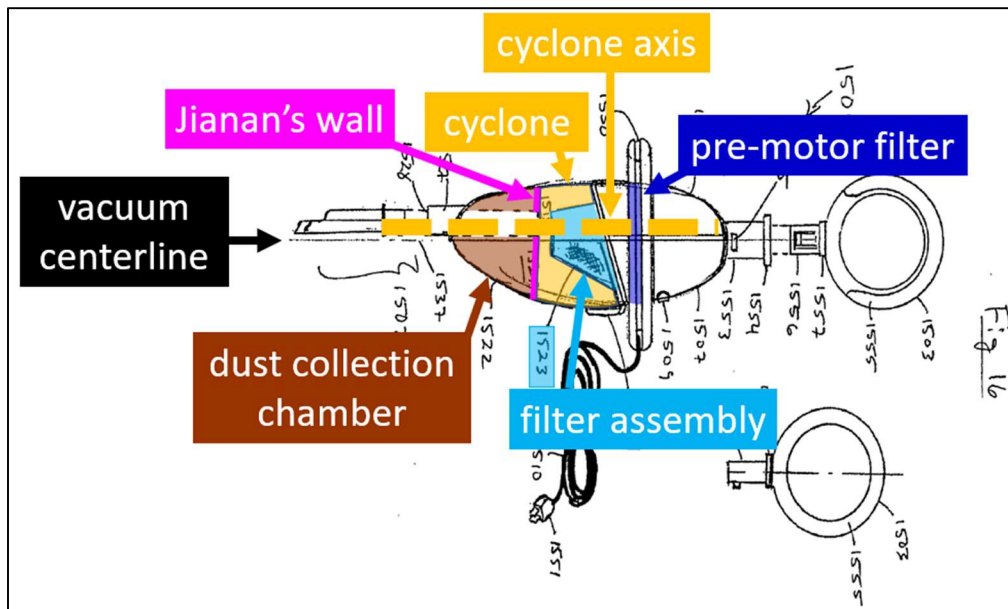


Ex1005, Figs. 15, 16(modified).

144. In my opinion, this limitation is also met when Butler’s “dirt receptacle compris[ing] a cyclone separator” is modified in view of Jianan’s “independent **dust collection chamber**” teachings, as shown in the annotated images below:







Ex1005, Figs. 5(modified), 16(modified); Ex1006, Fig. 5(modified).

145. As I explained above, in my opinion, a POSA would have been motivated to modify Butler's "dirt receptacle compris[ing] a cyclone separator" with Jianan's exterior dirt collection chamber teachings and would have reasonably expected success. Ground 1, §1.

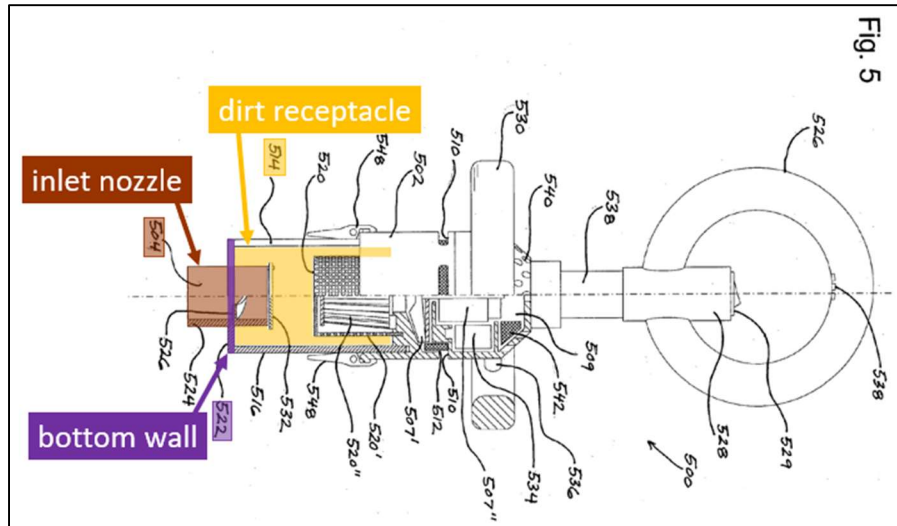
f. [1a.3]/[10b]

Reference Number	Claim Limitation
[1a.3]	“(iii) a dirt collection chamber that is exterior to the cyclone chamber and a forward end of the dirt collection chamber is openable;”
[10b]	“(b) a dirt collection chamber that is exterior to the cyclone chamber and a forward end of the dirt collection chamber is openable;”

146. In my opinion, the combined teachings of Butler and Jianan teaches a dirt collection chamber that is exterior to the cyclone chamber and a forward end of the dirt collection chamber is openable.

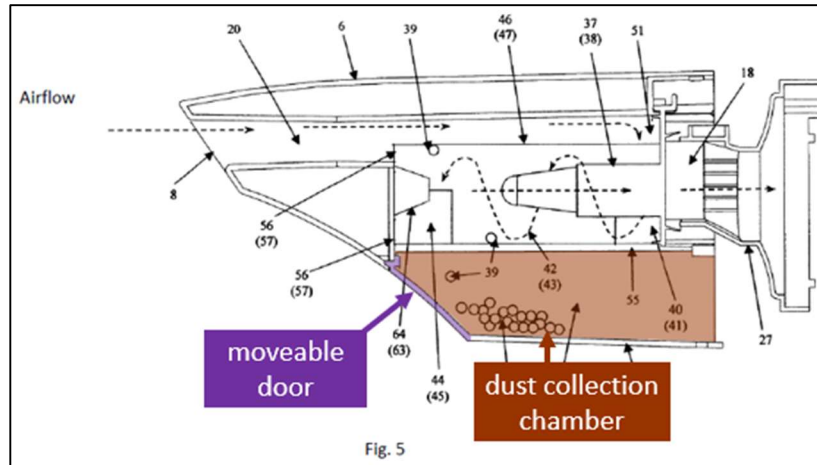
147. As I explained above, in my opinion, Butler in combination with Jianan teaches a dirt collection chamber that is exterior to the cyclone chamber. Ground 1, Limitations [9a.2]/[15a.2].

148. In my opinion, Butler further teaches a forward end of the dirt collection chamber is openable. Butler’s “dirt receptacle 214 may be covered by an access panel or door” to “facilitate the chamber’s emptying,” and the “bottom end” of “**dirt receptacle 514**,” i.e., “**bottom wall 522**,” is “removable from the device, along with the **inlet nozzle 504**,” as shown in the annotated image below:



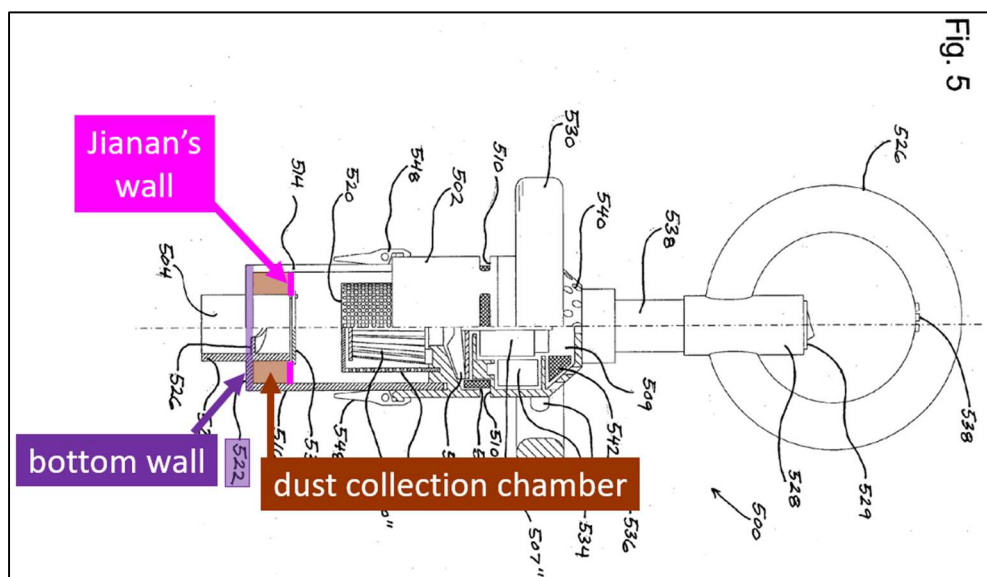
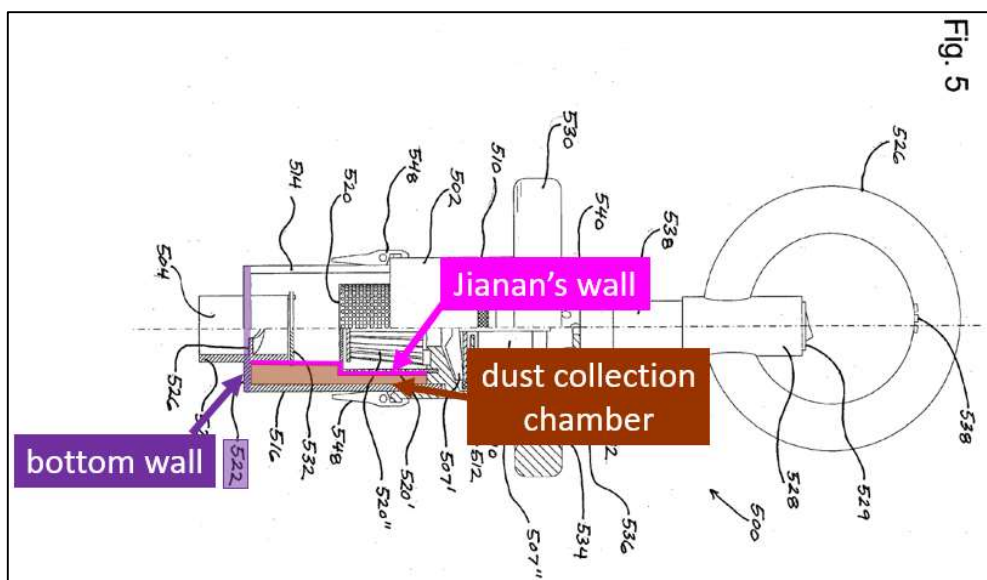
Ex1005, 18:26-30, 21:19-21, Fig. 5.

149. In my opinion, a POSA would have understood the “removable” front wall (“**bottom wall 522**”) of “**dirt receptacle 514[’s]**” forward end is an openable door. Ground 1, Limitations [1a]/[8a]/[9a]/[10a]/[14a]/[15a].
150. In my opinion, Jianan also teaches a forward end of the dirt collection chamber is openable. Jianan teaches the “dust collection chamber has at least one opening for emptying dirt.” Ex1006, claim 2. Jianan further teaches that in one embodiment, “the dust collection chamber” has a “dust collection chamber opening” that “provides a clean and fast dust removal process.” *Id.*, 10. However, Jianan also teaches an “alternative device in which the dust chamber” opening can be replaced with “an opening and closing device such as a” “**movable door** on the **dust collection chamber**,” as shown in the annotated image below:



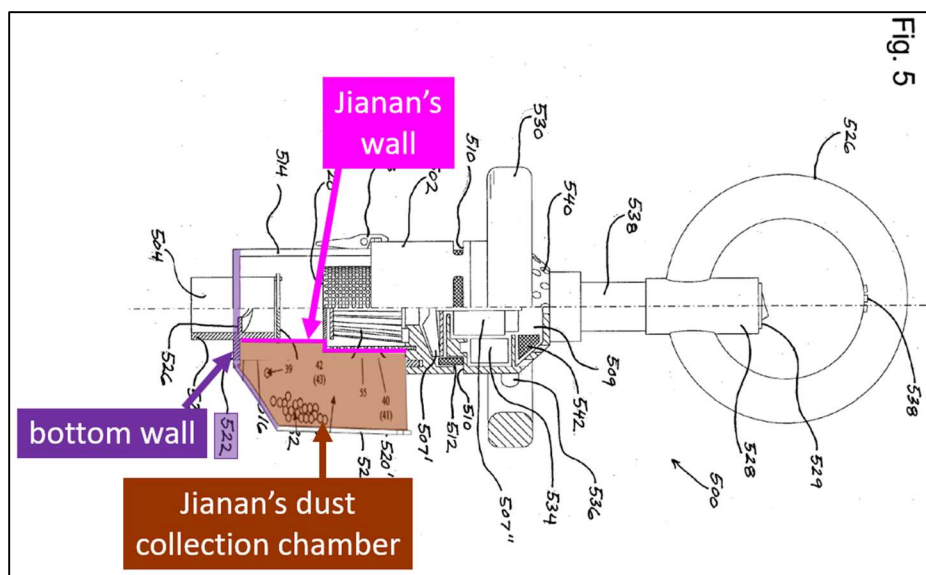
Ex1006, 10, claim 3, Fig. 5.

151. In my opinion, a POSA would have understood that one of a finite number of openable-door placements on the dirt-collection chamber is on the front end.
152. In my opinion, a POSA would have understood that this limitation is also met when Butler’s “dirt receptacle compris[ing] a cyclone separator” is modified in view of Jianan’s “independent **dust collection chamber**” teachings, as the forward end of the dirt collection chamber (“**bottom wall 522**”) remains openable, as shown in the annotated images below:



Ex1005, Fig. 5(modified).

153. Also, in my opinion, a POSA would have understood that Jianan’s “**dust collection chamber**” “**movable door**” would be openable with Butler’s “**bottom wall 522**,” as shown in the annotated image below:



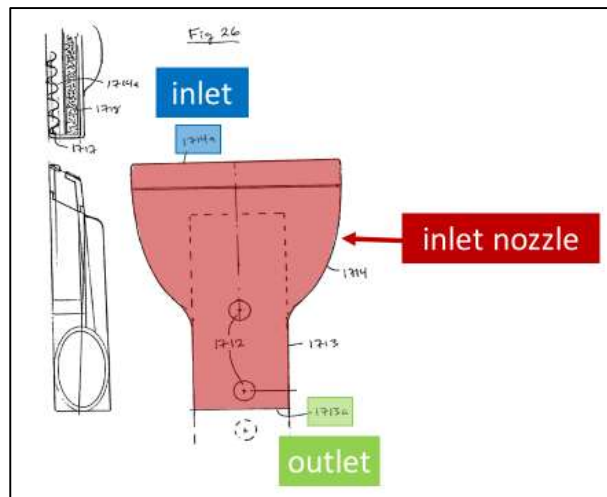
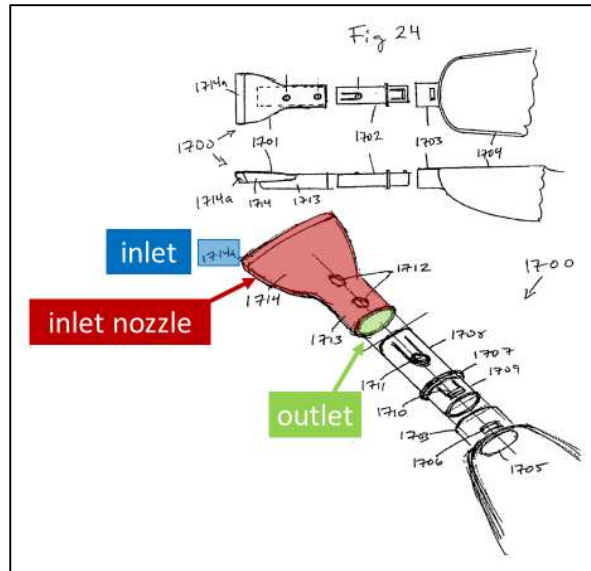
Ex1005, Fig. 5(modified); Ex1006, 10, claim 3, Fig. 5(modified).

154. As I explained above, in my opinion, a POSA would have been motivated to modify Butler's "dirt receptacle compris[ing] a cyclone separator" with Jianan's exterior dirt collection chamber teachings and would have reasonably expected success. Ground 1, §1.

g. [1b]/[8b]/[9b]/[14b]/[15b]/[10c]

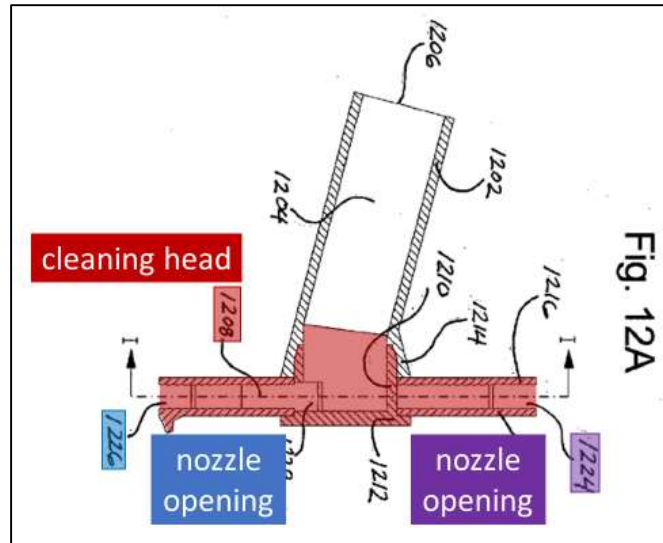
Reference Number	Claim Limitation
[1b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,”
[8b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,”
[9b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,”
[14b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,”
[15b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,”
[10c]	“(c) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,”

155. In my opinion, Butler teaches a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet (Limitations [1b]/[8b]/[9b]).
156. In my opinion, Butler teaches a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet (Limitations [14b]/[15b]/[10c]).
157. In my opinion, Butler teaches a surface cleaning head having a front end and a rear end. Butler teaches “**inlet nozzle 1701**” having “**inlet 1714a**” and “**outlet 1713a**,” as shown in the annotated images below:



Ex1005, 42:6-9, Figs. 24, 26.

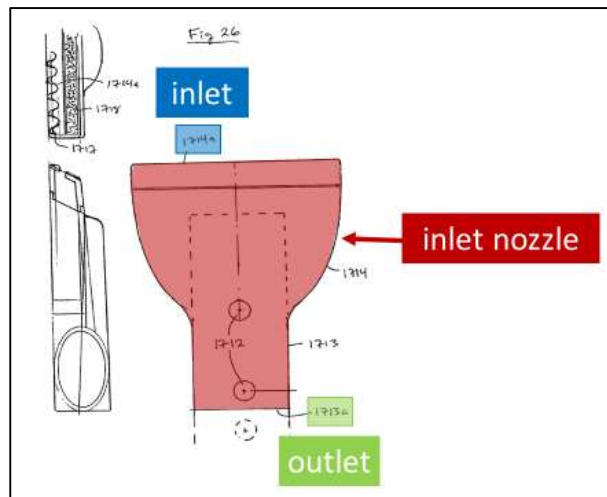
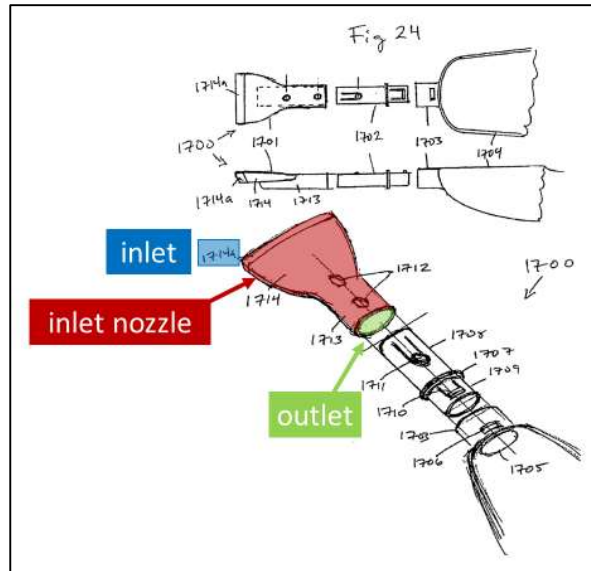
158. In my opinion, a POSA would have understood that Butler's **"inlet nozzle"** is a surface cleaning head, **"inlet"** is at a front end, and **"outlet"** is at a rear end.
159. Butler also teaches **"cleaning head 1208"** with **"nozzle opening 1226"** and **"nozzle opening 1224,"** as shown in the annotated image below:



Ex1005, 31:24-27, Fig. 12A.

160. A POSA would have understood that Butler’s “**cleaning head**” is also a surface cleaning head, “**nozzle opening**” is at a front end and “**nozzle opening**” is at a rear end. Butler teaches that its surface cleaning heads are interchangeable: “[a]ny type of cleaning device may be attached.”
Ex1005, 22:6-9.

161. A POSA would have understood that Butler teaches a surface cleaning head having a dirty air inlet and a surface cleaning head air outlet. Butler teaches that air flows into “**inlet nozzle 1701**” at “**inlet 1714a**” and exits “outlet duct 1713” at “**outlet 1713a** for the **inlet nozzle 1701**,” as shown in the annotated images below:

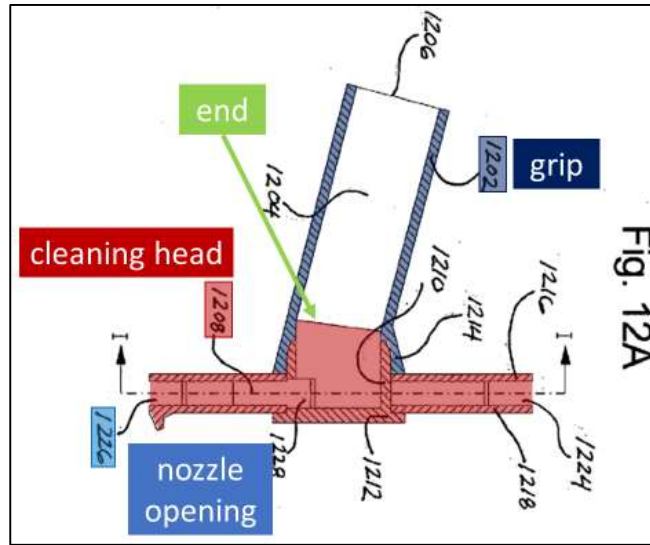


Ex1005, 42:6-9, Figs. 24, 26.

162. A POSA would have understood that Butler’s “**inlet**” is a dirty air inlet and Butler’s “**outlet**” is a surface cleaning head air outlet.

163. Further, Butler teaches that air flows into “**nozzle opening 1226**,” which “comprises an air passage” and is “placed in communication with the vacuum passage 1204” and the “**grip 1202**,” and air exits the “**cleaning head 1208**” at an “**end** to a cleaning head 1208” that is “attach[ed]” to

“grip 1202,” as shown in the annotated image below:



Ex1005, 31:6-27, Fig. 12A.

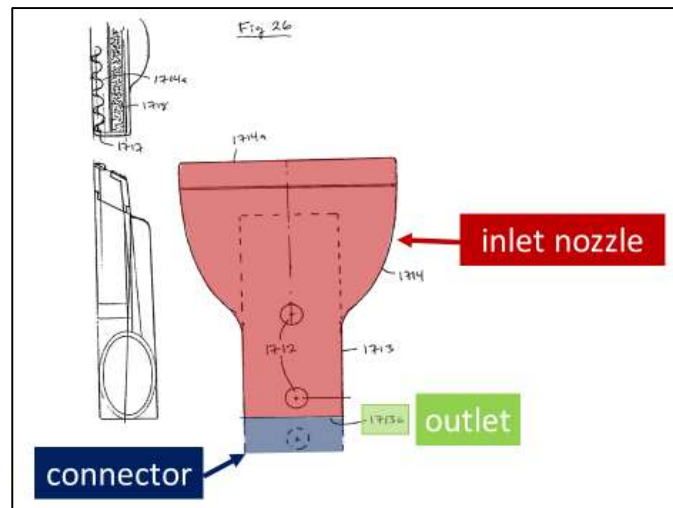
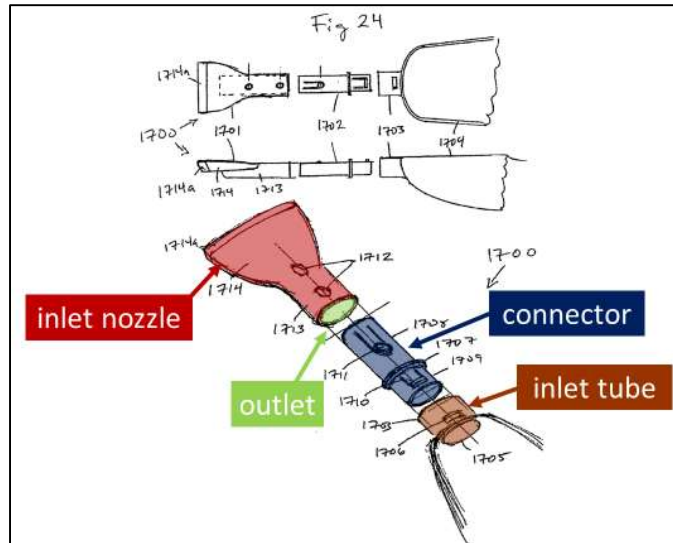
164. A POSA would have understood that Butler’s “**nozzle opening**” is also a dirty air inlet and Butler’s “**end**” is also a surface cleaning head air outlet.

h. [1c]/[8c]/[9c]/[14c]/[15c]/[10d]

Reference Number	Claim Limitation
[1c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner,”
[8c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner,”
[9c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner,”
[14c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis,”
[15c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis,”
[10d]	“(d) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis,”

165. In my opinion, Butler teaches a rigid air flow conduit that is removably

- mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner (Limitations [1c]/[8c]/[9c]).
166. In my opinion, Butler teaches a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis (Limitations [14c]/[15c]/[10d]).
167. In my opinion, Butler teaches a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner. Butler teaches that a “**nozzle connector 1702**” extends between “the **outlet 1713a** for the **inlet nozzle 1701**” and “**inlet tube 1703** located on the housing,” as shown in the annotated images below:



Ex1005, 41:8-11, 42:7-8, Figs. 24, 26.

168. Butler explains that “**inlet tube**” is “integrally formed with the housing 1704 and provides fluid communication between the vacuum dust receptacle (not shown) and the rest of the nozzle assembly 1700.” Ex1005, 41:15-18.

169. Butler also explains that “**connector 1702** is a hollow tube” “divided into two portions by a collar 1707:” an upstream “inlet portion 1708,” which is

“telescopically received within the **nozzle 1701**,” and a downstream “outlet portion 1709,” which is “telescopically received within or around the **inlet tube 1703**.” *Id.*, 41:19-29. The mounting includes “a flexible nozzle-attaching tab 1711 that corresponds to one or more apertures 1712 in the nozzle 1701,” such that the user may “depress this tab 1711 to remove the nozzle 1701 from the connector 1702.” *Id.*, 41:26-42:1. Likewise, “cantilever tab 1710” fits into the “inlet tube aperture 1706” of the hand vacuum cleaner and a user can depress the “cantilever tab 1710,” clicking it out of the “inlet tube aperture 1706” to remove the “connector 1702” from the “vacuum cleaner.” *Id.*, 41:19-26.

170. In my opinion, a POSA would have understood that Butler’s “connector” is a rigid airflow conduit; “inlet nozzle” is a surface cleaning head; “outlet” is a surface cleaning head air outlet; “inlet tube” is a handvac dirty air inlet; and Butler teaches a rigid airflow conduit (“connector”) that is removably mountable to the surface cleaning head and the hand vacuum cleaner and extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner.
171. Regarding Limitations [14c]/[15c]/[10d], in my opinion, a POSA would have understood that Butler’s **connector** has a **longitudinally extending connector axis**, which is a longitudinally extending conduit axis, as shown

Ex1005, Fig. 24.



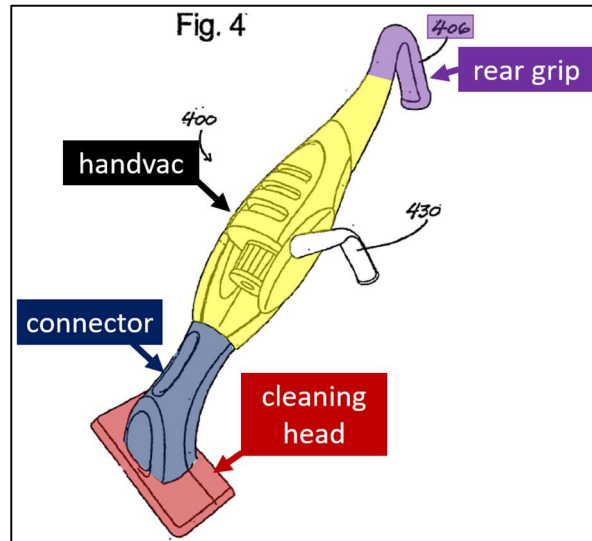
i. [1d]/[8d]/[9d]/[14d]/[15d]/[10e]

Reference Number	Claim Limitation
[1d]	“wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and”
[8d]	“wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and”
[9d]	“wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and”
[14d]	“wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and”
[15d]	“wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and”
[10e]	“wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and”

172. In my opinion, Butler teaches wherein the dirty air inlet of the hand

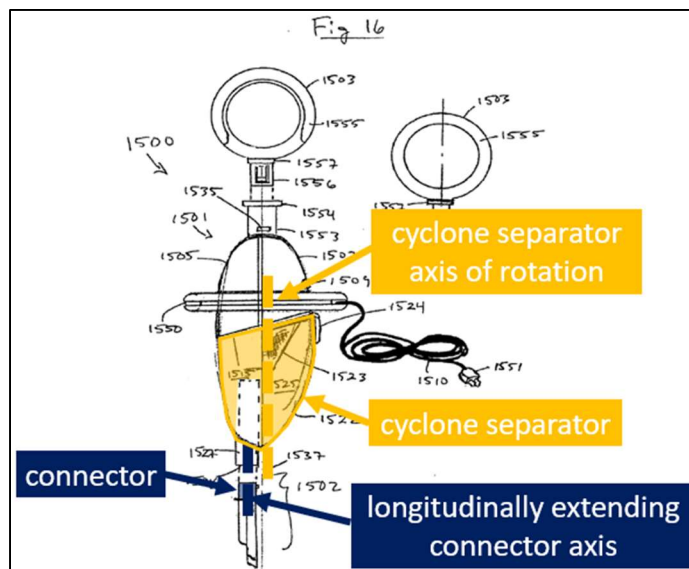
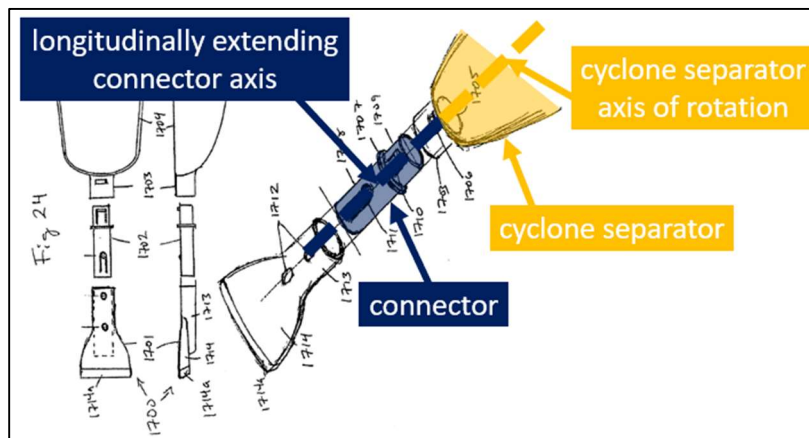
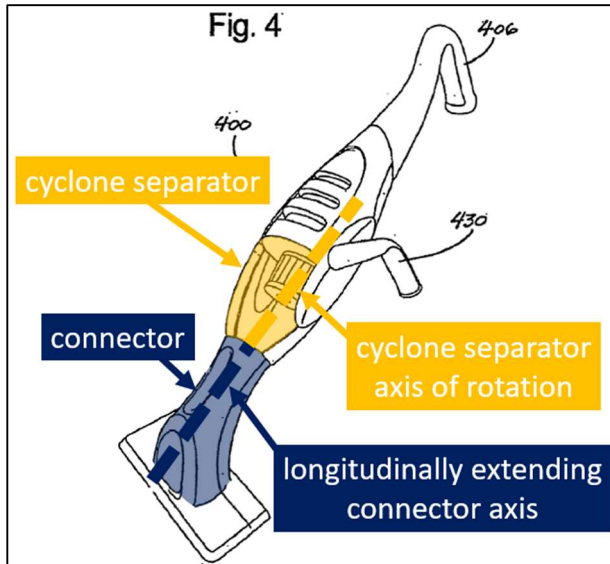
- vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus (Limitations [1d]/[8d]/[9d]).
173. In my opinion, Buter teaches wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation (Limitations [14d]/[15d]/[10e]).
174. As I explained above, in my opinion, Butler teaches the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit. Ground 1, Limitations [1c]/[8c]/[9c]/[14c]/[15c]/[10d].
175. A POSA would have understood that when Butler's hand vacuum is so mounted, the pistol grip handle is a driving handle for the surface cleaning apparatus. Butler's "pistol-grip style rear grip 406" is used to "ergonomically maneuver the device and rotate it into different positions

for cleaning horizontal and inclined surfaces,” as shown in the annotated image below:



Ex1005, 19:9-12, 19:22-24.

176. Regarding Limitations [14d]/[15d]/[10e], in my opinion, when Butler’s handvac is so mounted, the **longitudinally extending connector axis** is parallel to the **cyclone separator’s axis of rotation**, as shown in the annotated images below:



Ex1005, Figs. 4-5, 24, 16.

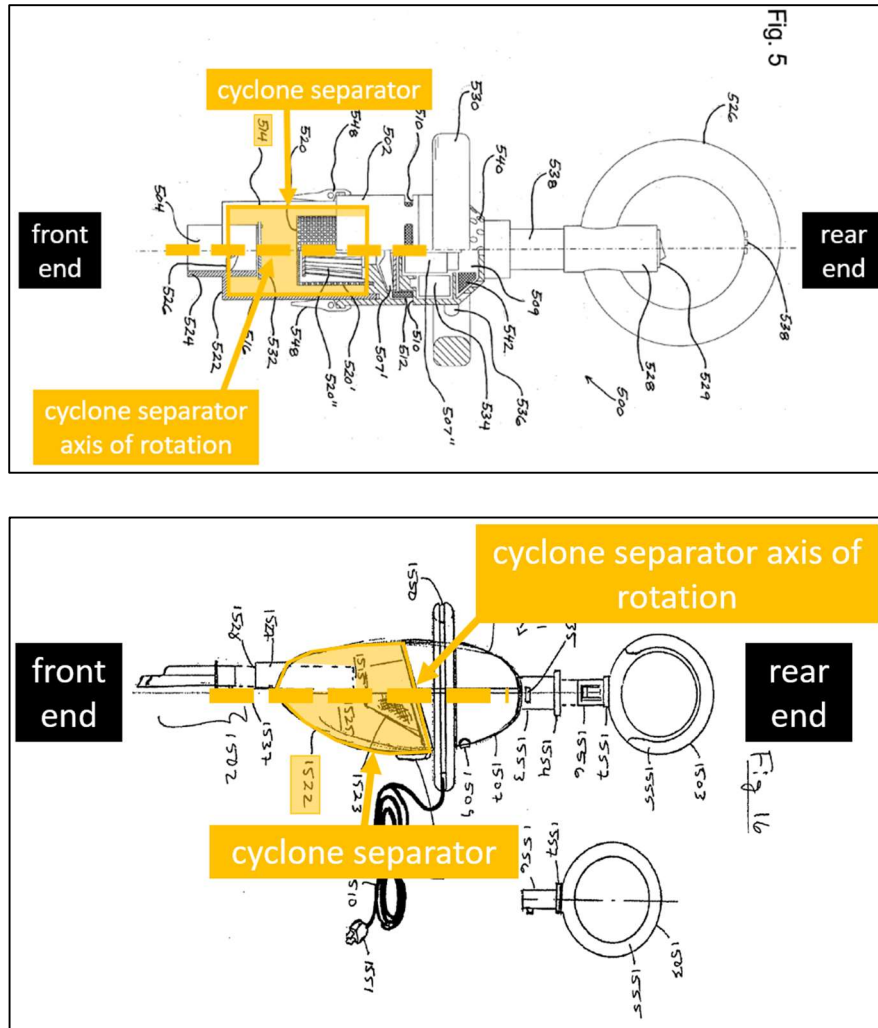
177. In my opinion, these limitations are also met when Butler is modified in view of Jianan. Ground 1, §1.

j. [1e]/[8e]/[9e]

Reference Number	Claim Limitation
[1e]	“wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal.”
[8e]	“wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal,”
[9e]	“wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal.”

178. In my opinion, Butler teaches wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal.

179. A POSA would have understood that when Butler’s handvac is positioned with the **front end** of the hand vacuum cleaner in front of the **rear end** of the hand vacuum cleaner, the **cyclone separator axis of rotation** is generally horizontal, as shown in the annotated images below:



Ex1005, Fig. 5.

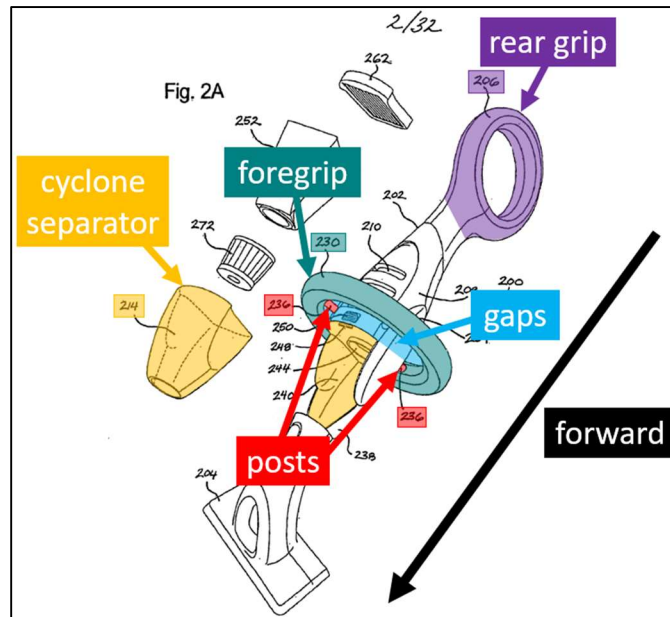
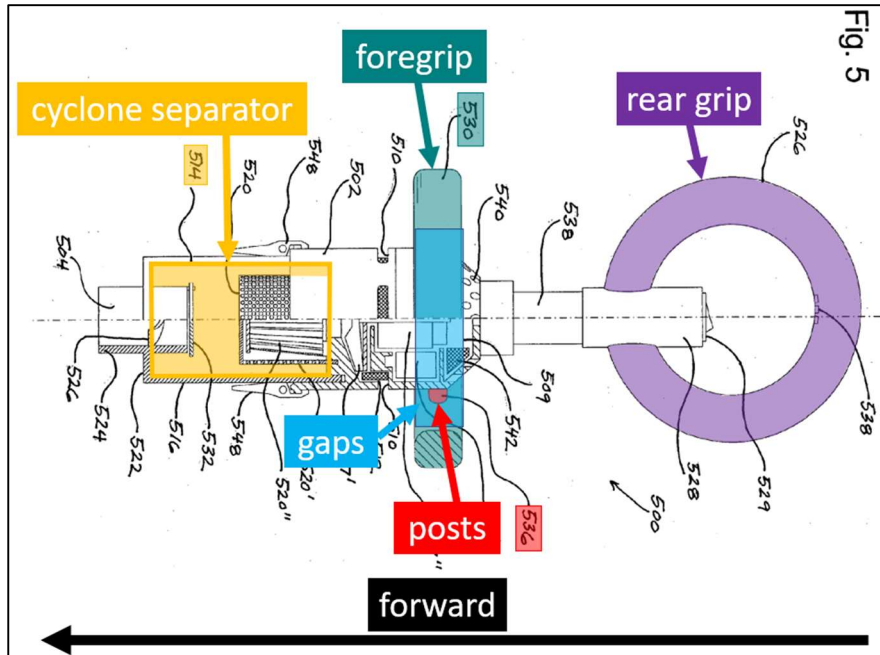
180. In my opinion, these limitations are also met when Butler is modified in view of Jianan. Ground 1, §1.

k. [14e]/[15e]/[10f]

Reference Number	Claim Limitation
[14e]	“wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone, and”
[15e]	“wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone.”
[10f]	“wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone.”

181. In my opinion, Butler teaches wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone.

182. In my opinion, Butler teaches a finger grip area provided at a location that is forward of the pistol grip handle and rearward of the cyclone. Butler teaches a “circular or looped” “**foregrip 530** [that] is attached to the housing 502 by a number of radially-extending **posts 536**” at a location rearward of the “**cyclone separator**” and forward of the “**rear grip 506**,” as shown in the annotated images below:



Ex1005, 20:4-6, 20:10-11, Figs. 2A, 5.

183. Butler teaches that the “radial posts ... provide one or more **gaps** between the foregrip 130 and the housing 102 into which the user may fit his or her fingers or hand.” Ex1005, 11:28-12:2. In my opinion, a POSA would have

understood that Butler's "gaps" between the "foregrip" and the "housing" are finger grip areas provided at a location forward of the "rear grip" and rearward of the "cyclone separator."

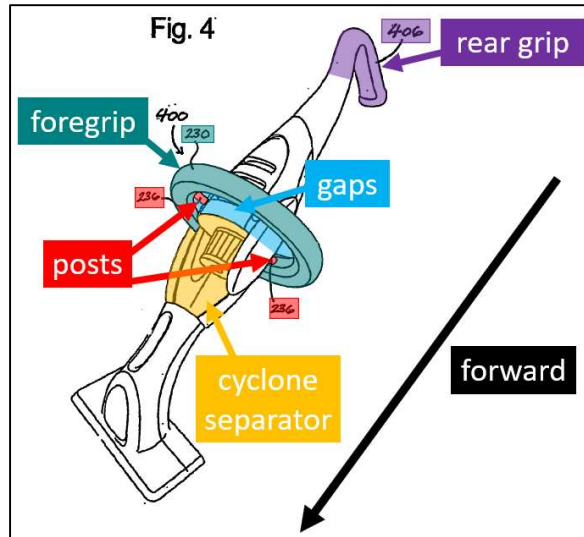
184. Butler further teaches that "circular or looped rear grip 506" can be exchanged for other rear grips, e.g., "pistol-grip style rear grip 406": "[o]f course, other grip shapes may be used, as explained previously herein." Ex1005, 19:18-24, 20:6-7.

185. Butler further teaches the interchangeability of its rear grips and foregrips:

In still other embodiments, the loop-shaped grips may be replaced by any combination of rear grip and foregrip that provide the user with hand positions to ergonomically maneuver the device and rotate it into different positions for cleaning horizontal and inclined surfaces.

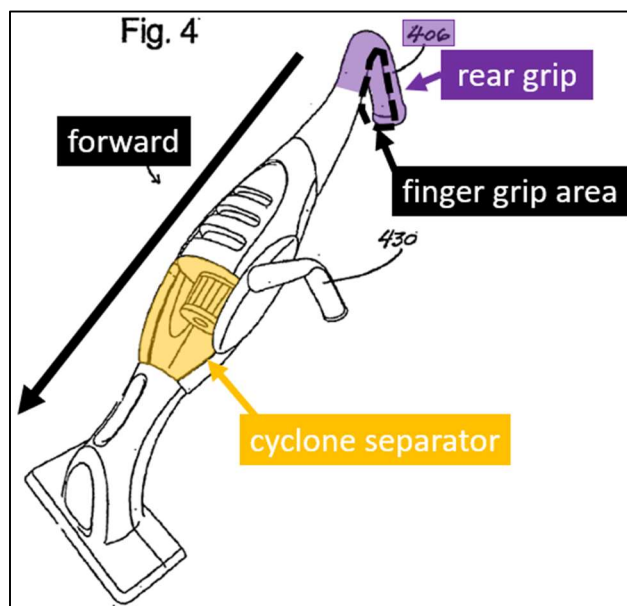
Id., 19:9-12.

186. Thus, when Butler's "pistol-grip style rear grip 406" replaces figure 2A's and figure 5's "circular or looped rear grip," in my opinion a POSA would have understood that Butler's "**gaps**" (finger grip areas) are still provided at a location that is forward of the "pistol-grip style **rear grip 406**" (pistol grip handle) and rearward of the "**cyclone separator**" (cyclone), as shown in the annotated image below:



Ex1005, Fig. 4(modified).

187. Likewise, in my opinion, a POSA would have understood that when a user grips Butler's "pistol-grip style **rear grip 406**," their fingers wrap around a **finger grip area** located **forward** of "**rear grip 406**," and rearward of the "**cyclone separator**," as shown in the annotated image below:



Ex1005, Fig. 4.

188. In my opinion, these limitations are also met when Butler is modified in view of Jianan. Ground 1, §1.

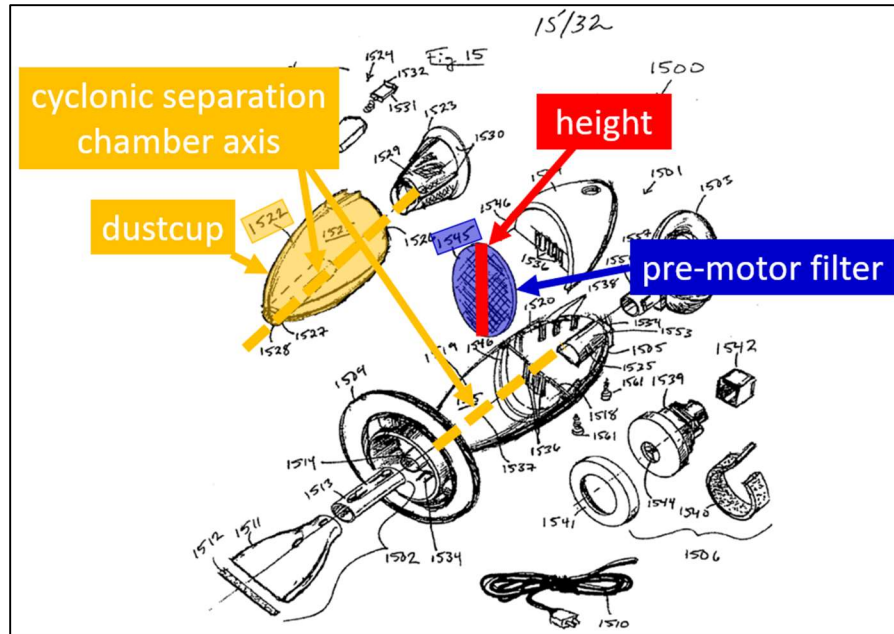
I. [8f]/[14f]

Reference Number	Claim Limitation
[8f]	“wherein a pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.”
[14f]	“wherein a pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.”

189. In my opinion, Butler teaches wherein a pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

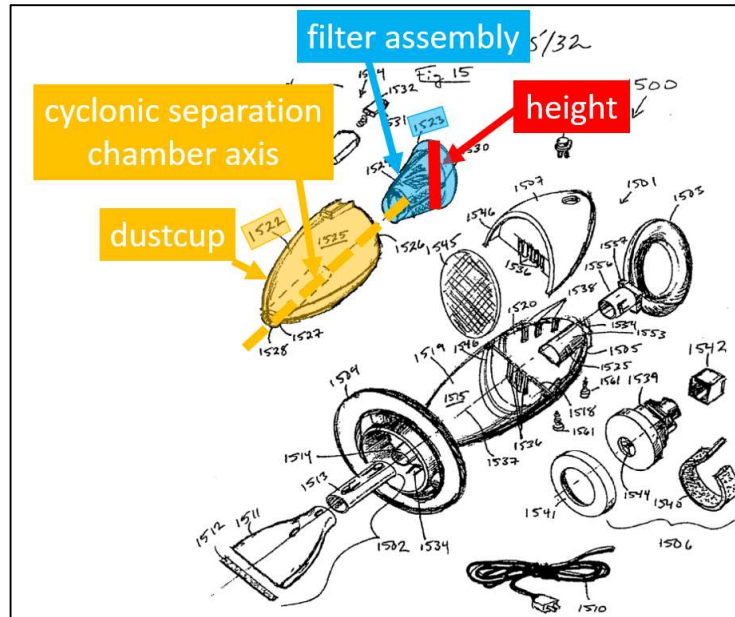
190. As I explained above, a POSA would have understood that Butler teaches several pre-motor filters. Ground 1, Limitations [1a.2]/[8a.2]/[10a.2]/[14a.2].

191. In my opinion, a POSA would have understood that Butler teaches a pre-motor filter having a height in a direction transverse to the cyclone axis. Butler’s “pre-motor filter 1545” has a height in a direction transverse to “dustcup 1522[’s]” cyclonic separation chamber axis, as shown in the annotated image below:



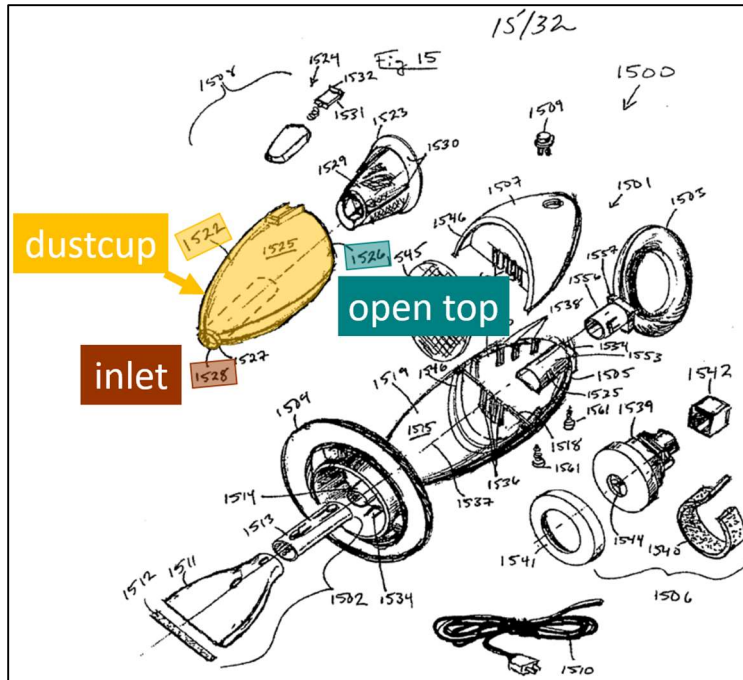
Ex1005, Fig. 15.

192. In my opinion, a POSA would have understood that Butler’s “pre-motor filter 1545” has a height in a direction transverse to the cyclone axis when the “dustcup 1522” is mounted to the hand vacuum cleaner.
193. Butler’s “**filter assembly 1523**” also has a height in a direction transverse to “**dustcup 1522[’s]**” **cyclonic separation chamber axis**, as shown in the annotated image below:



Ex1005, Fig. 15.

194. In my opinion, a POSA would have understood that Butler’s “filter assembly 1523” also has a height in a direction transverse to the cyclone axis when the “dustcup 1522” is mounted to the hand vacuum cleaner.
195. In my opinion, a POSA would have understood that Butler teaches the pre-motor filter height is larger than a diameter of the cyclone. Butler’s “**dustcup 1522** comprises one or more sidewalls 1525 that form an **open top 1526** and taper to an **inlet 1528**,” as shown in the annotated image below:



Ex1005, 35:28-30, Fig. 15.

196. In my opinion, a POSA would have understood that the cyclone positioned in “dustcup 1522[’s]” “cyclonic separation chamber” necessarily has a diameter smaller than the height of “dustcup 1522[’s]” “sidewall” located at “open top 1526,” including because cyclonic airflow occurs within the “sidewall[s]” of “dustcup 1522.”

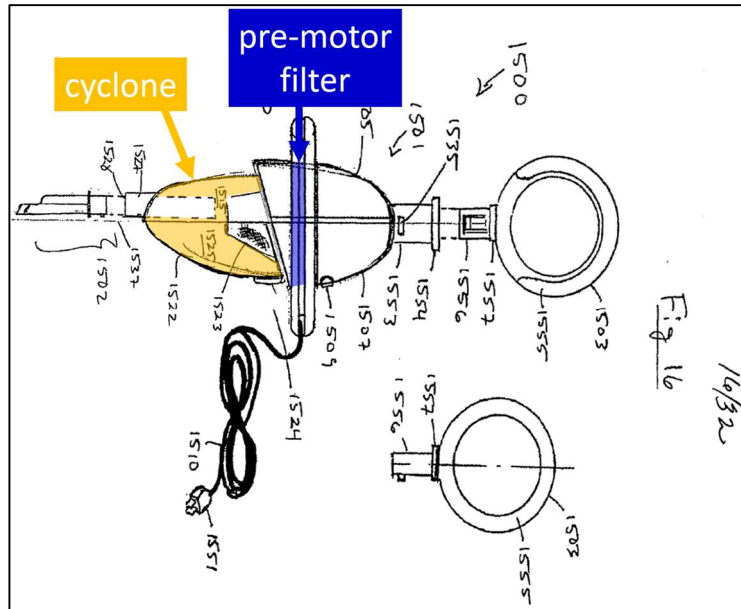
197. Further, Butler teaches that “the filter assembly 1523 comprises a filter 1529 and a frame 1530” that “sealingly engages with the open top 1526.”

Ex1005, 36:5-7. In my opinion, a POSA would have understood that Butler’s “pre-motor filter 1545” is positioned rearward of “filter assembly 1523” and covers “frame 1530.” *Id.*, 35:20-22, Fig. 15. Also, in my opinion, a POSA would have understood that the heights of Butler’s “filter

assembly 1523” and “pre-motor filter 1545” are the same or larger than the height of “dustcup 1522[’s]” “sidewall” located at “open top 1526,” and therefore that each of Butler’s “filter assembly 1523” and “pre-motor filter 1545” have a height larger than a diameter of the cyclone contained within the “sidewall.”

198. Likewise, in my opinion, a POSA would have understood that Butler’s “filter assembly 1523” and “pre-motor filter 1545” each have a height that is larger than the cyclone diameter that is located at “dustcup 1522[’s]” “taper[ed]” “inlet 1528,” which “is generally smaller than the open top 1526,” Ex1005, 35:28-36:2, and therefore that Butler teaches a pre-motor filter having a height that is larger than a diameter of the cyclone.
199. Further, in my opinion, a POSA would have been motivated to increase the amount of pre-motor filtration by increasing the size of Butler’s pre-motor filter 1545, which would also result in the pre-motor filter height being larger than a diameter of the cyclone. In my opinion, a POSA would have understood that increasing filter size (surface area and volume) increases the amount of air filtration and allows the filter to filter more particles before becoming clogged. Ex1028, 9:47-60. Also, in my opinion, a POSA would have been motivated to increase the amount of pre-motor filtration to increase the overall amount of filtration during

operation and to further protect the motor from being damaged by dirty air. In my opinion, a POSA would have also recognized that by increasing the area of the filter that the resistance to airflow through the filter would be decreased as well. In my opinion, a POSA would have understood that “pre-motor filter 1545” could be increased by enlarging Butler’s “housing 502” / “fan motor housing 1520” to accommodate the larger “**pre-motor filter 1545**,” as shown in the annotated image below:

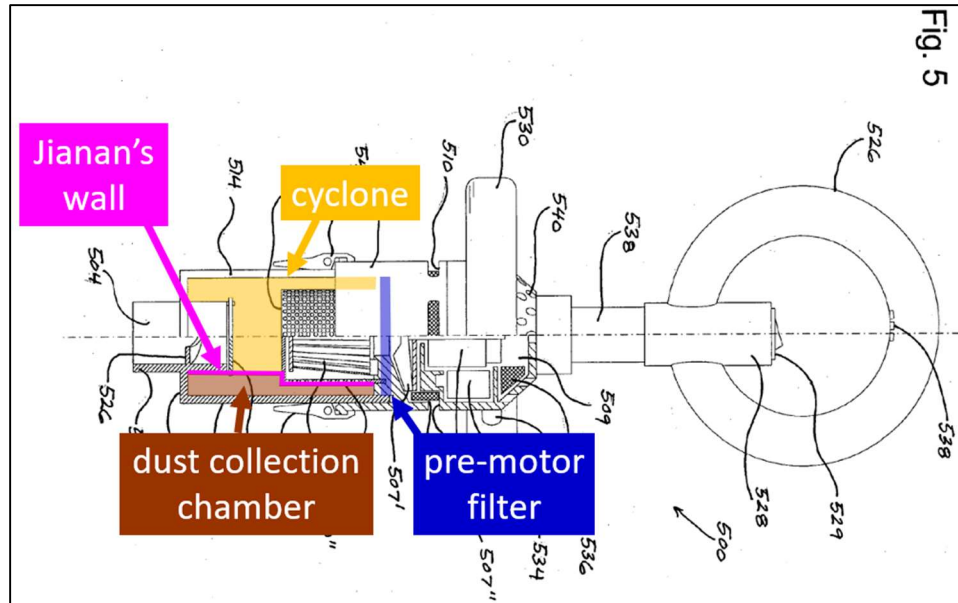


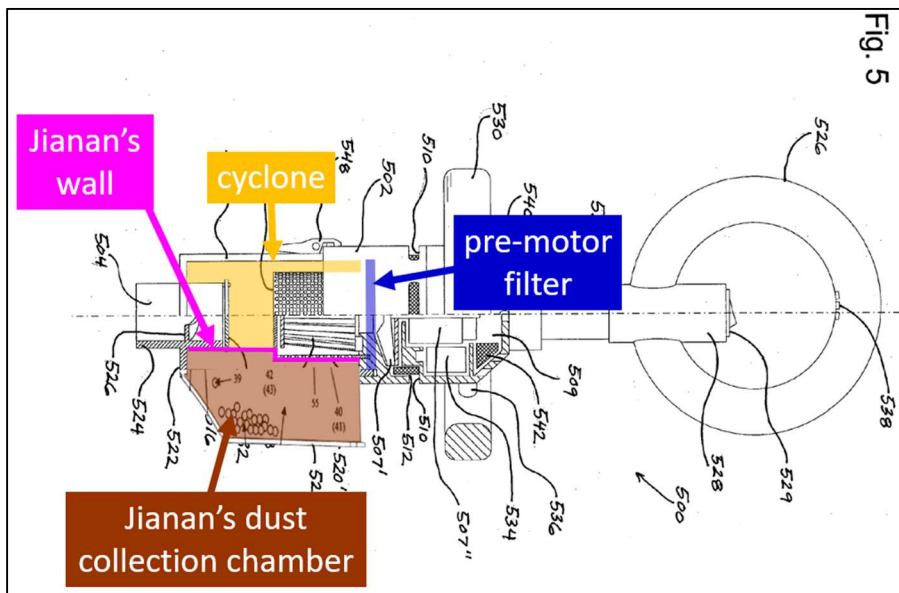
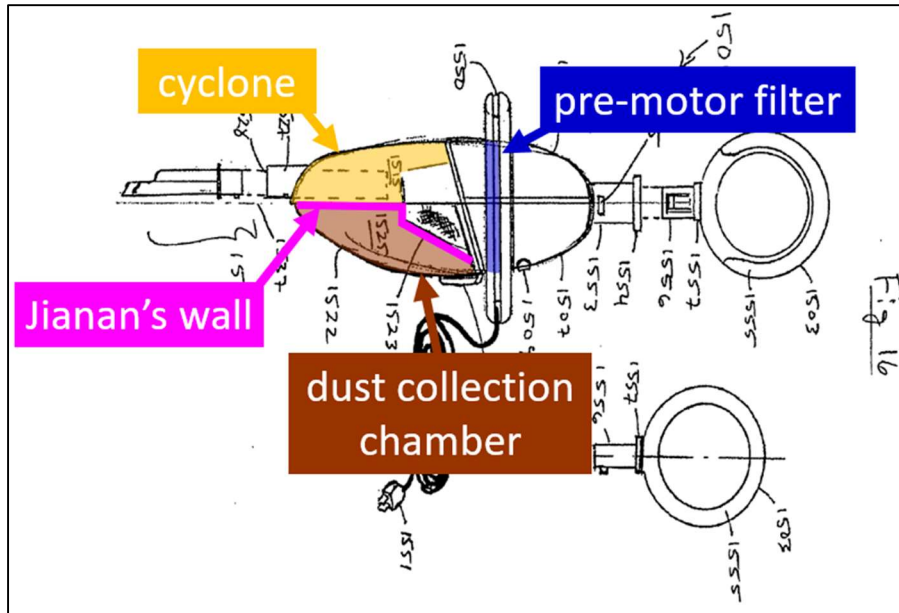
Ex1005, Fig. 16(modified).

200. In my opinion, when Butler is modified this way, the “**pre-motor filter 1545**” has a height larger than a diameter of the **cyclone**.
201. In my opinion, a POSA would have had a reasonable expectation of success making this modification because it would involve modestly

enlarging Butler's pre-motor filter and rear housing components, which would have been straightforward.

202. Also, in my opinion, this limitation is met when Butler's "dirt receptacle compris[ing] a cyclone separator" is modified in view of Jianan's "independent **dust collection chamber**" teachings, as the **pre-motor filter** 1545's height is larger than a diameter of the **cyclone**, which is contained in the cyclone chamber, as shown in the annotated images below:





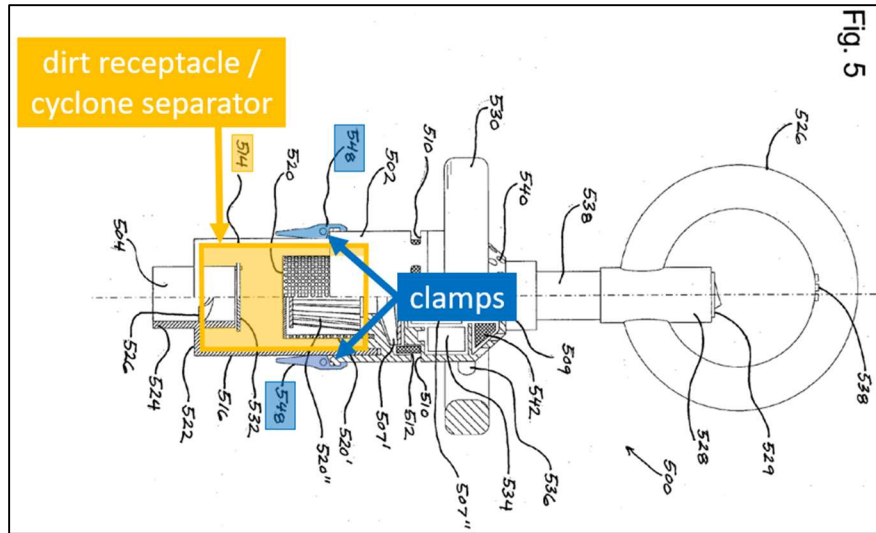
Ex1005, Figs. 5(modified), 16(modified); Ex1006, Fig. 5(modified).

203. In my opinion, a POSA would have been motivated to modify Butler's "dirt receptacle compris[ing] a cyclone separator" with Jianan's exterior dirt collection chamber teachings and would have reasonably expected success. Ground 1, §1.

3. [2]/[12]

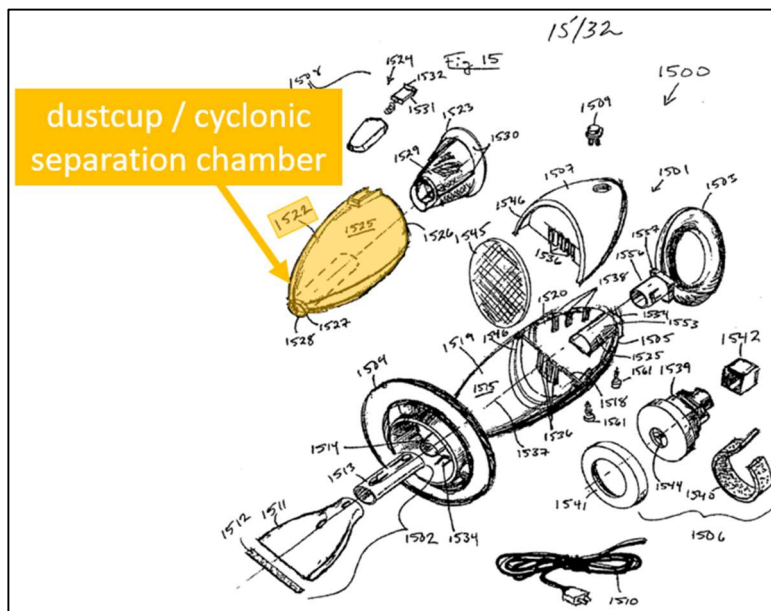
Reference Number	Claim Limitation
[2]	“The surface cleaning apparatus of claim 1 wherein the cyclone unit is removably mounted to the main body.”
[12]	“The surface cleaning apparatus of claim 10 wherein the cyclone unit is removably mounted to the main body.”

204. In my opinion, the combined teachings of Butler and Jianan render obvious the surface cleaning apparatus of claim 1 and Butler teaches the cyclone unit is removably mounted to the main body.
205. In my opinion, the combined teachings of Butler and Jianan render obvious the surface cleaning apparatus of claim 10 and Butler teaches the cyclone unit is removably mounted to the main body.
206. A POSA would have understood that Butler teaches that the cyclone unit is removably mounted to the main body. Butler’s “**dirt receptacle [514]** compris[ing] a **cyclone separator**” (cyclone unit) may be “removably attached at a bottom end of the housing 502” (removably mounted to the main body) by “[a] set of over-center **clamps 548** [that] are used to hold the **dirt receptacle 514** and housing 502 together,” as shown in the annotated image below:



Ex1005, 21:8-15, Fig. 5.

207. Likewise, Butler’s “**dustcup**” with a “**cyclonic separation chamber**” (cyclone unit) “is removably installed in the dustcup chamber 1519” of “[t]he body 1505,” as shown in the annotated image below:



Ex1005, 35:12-16, 36:2-4, Fig. 15.

208. In my opinion, these limitations are also met when Butler is modified in

view of Jianan. Ground 1, §1.

4. [3]

Reference Number	Claim Limitation
[3]	“The surface cleaning apparatus of claim 1 wherein the cyclone axis of rotation is generally parallel to the suction motor axis of rotation.”

209. In my opinion, the combined teachings of Butler and Jianan renders obvious the surface cleaning apparatus of claim 1 and Butler teaches the cyclone axis of rotation is generally parallel to the suction motor axis of rotation.

210. In my opinion, Butler teaches the limitations of this claim for the same reasons discussed for Limitations [1a.2]/[8a.2]/[10a.2]/[14a.2]. Ground 1, Limitations [1a.2]/[8a.2]/[10a.2]/[14a.2].

5. [4]

Reference Number	Claim Limitation
[4]	“The surface cleaning apparatus of claim 1 wherein, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the pistol grip handle extends upwardly and forwardly.”

211. In my opinion, the combined teachings of Butler and Jianan render obvious the surface cleaning apparatus of claim 1 and Butler teaches when the hand vacuum cleaner is positioned with the front end of the hand vacuum

cleaner in front of the rear end of the hand vacuum cleaner, the pistol grip handle extends upwardly and forwardly.

212. In my opinion, Butler teaches the limitations of this claim for the same reasons discussed for Limitations [1a.1]/[8a.1]/[9a.1]/[10a.1]/[14a.1]/[15a.1]. Ground 1, Limitations [1a.1]/[8a.1]/[9a.1]/[10a.1]/[14a.1]/[15a.1]

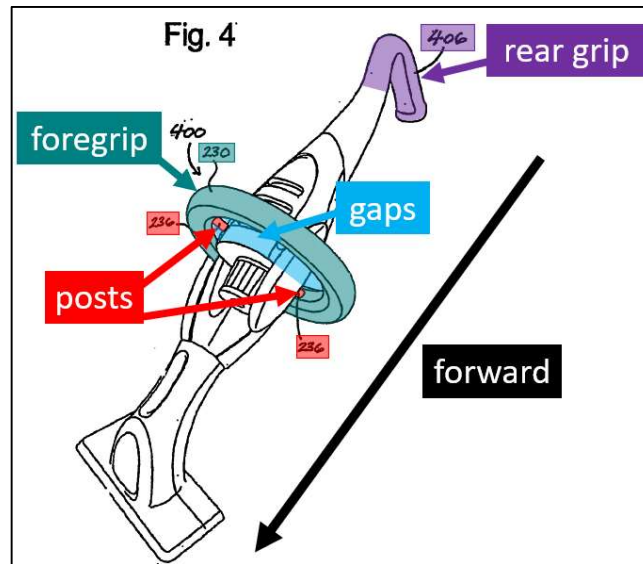
6. [5]

Reference Number	Claim Limitation
[5]	“The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.”

213. In my opinion, the combined teachings of Butler and Jianan renders obvious the surface cleaning apparatus of claim 1 and Butler teaches and renders obvious an enclosed finger grip area is provided on a forward side of the pistol grip handle.

214. As I explained above, in my opinion, Butler teaches multiple finger grip areas. Ground 1, Limitations [14e]/[15e]/[10f]. In my opinion, Butler further teaches an enclosed finger grip area is provided on a forward side of the pistol grip handle. Butler’s “gaps” (finger grip areas) are enclosed by the “circular or looped foregrip,” “radial posts,” and the “housing,” and are provided on a forward side of “pistol-grip style rear grip 406,” as

shown in the annotated image below:



Ex1005, Fig. 5.

215. In my opinion, a POSA would have understood that Butler’s “gaps” are on a forward side of “pistol-grip style rear grip 406,” i.e., the side closest to Butler’s forward end.
216. Further, in my opinion, Butler renders obvious an enclosed finger grip area provided on a forward side of the pistol grip handle. Butler explains that “the loop-shaped grips may be replaced by any combination of rear grip and foregrip that provide the user with hand positions to ergonomically maneuver the device,” and the “pistol-grip style rear grip 406” is “one exemplary variation of the grip construction.” Ex1005, 19:9-12, 19:18-24.
- In my opinion, a POSA reading this teaching would have been motivated to look for other rear grips that “provide the user with hand positions to

ergonomically maneuver the device,” including pistol grips having an enclosed finger area. Also, in my opinion, a POSA would have understood that such grips beneficially protect a user’s fingers from, for example, being hit or pinched by furniture or other obstacles during use of Butler’s cleaner, while retaining their ergonomic hand position. And, in my opinion, a POSA would have understood that such grips were well known in the art, including as taught by Butler with Butler’s loop-shaped rear grip, which is a grip having an enclosed finger grip area. Ex1005, Figs. 2A, 5. In my opinion, a POSA therefore would have found it obvious to modify Butler’s “pistol-grip style rear grip 406” to have an enclosed finger grip area provided forward of the pistol grip style handle. A POSA would have had a reasonable expectation of success because it would have been a straightforward modification of a simple component that Butler teaches can be modified, using an enclosed-grip design that Butler also teaches.

7. [6]

Reference Number	Claim Limitation
[6]	“The surface cleaning apparatus of claim 1 wherein the cyclone axis of rotation intersects the finger grip area.”

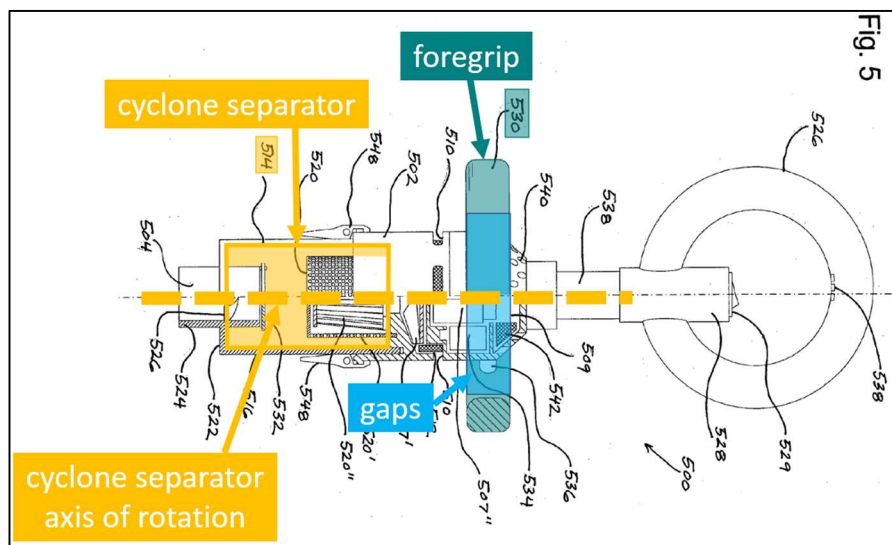
217. In my opinion, the combined teachings of Butler and Jianan render obvious the surface cleaning apparatus of claim 1 and Butler teaches the cyclone axis of rotation intersects the finger grip area.

218. As I described above, in my opinion, Butler teaches, and the combination of Butler and Jianan teaches a cyclone axis of rotation and a finger grip area.

Ground 1, Limitations

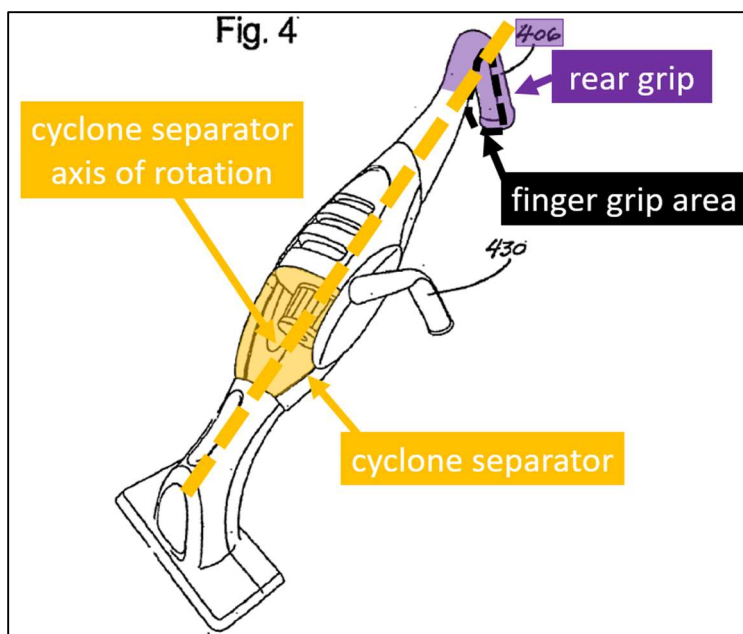
[1a.2]/[8a.2]/[9a.2]/[10a.2]/[14a.2]/[15a.2]/[14e]/[15e]/[10f].

219. In my opinion, a POSA would have understood that Butler teaches that the cyclone axis of rotation intersects the finger grip area. Butler's **cyclone separator axis of rotation** intersects the "gaps" of Butler's "foregrip," as shown in the annotated image below:



Ex1005, Fig. 5.

220. Likewise, in my opinion, Butler's **cyclone separator axis of rotation** intersects the finger grip area of **rear grip 406**, as shown in the annotated image below:



Ex1005, Fig. 4.

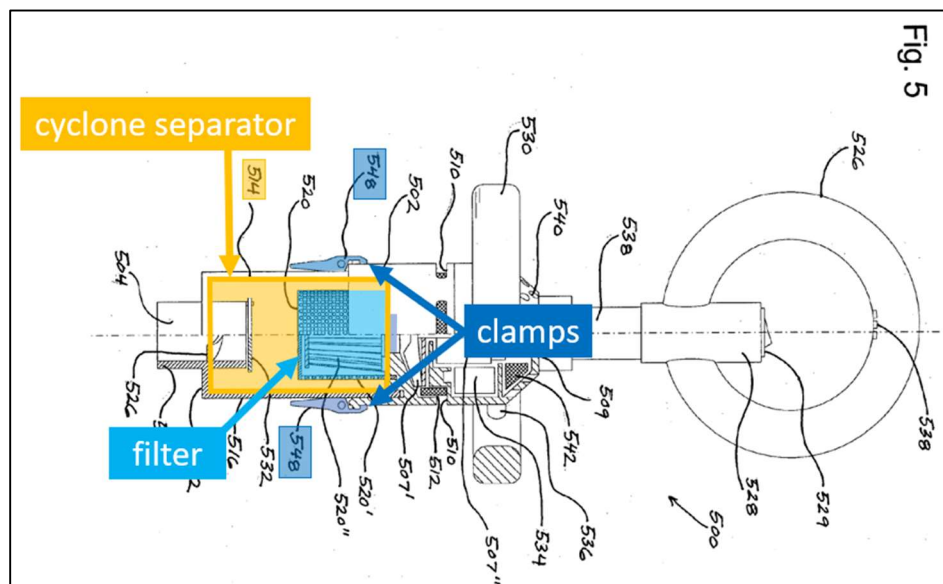
221. In my opinion, these limitations are also met when Butler is modified in view of Jianan. Ground 1, §1.

8. [7]/[13]

Reference Number	Claim Limitation
[7]	“The surface cleaning apparatus of claim 2 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body.”
[13]	“The surface cleaning apparatus of claim 10 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body.”

222. In my opinion, the combined teachings of Butler and Jianan render obvious the surface cleaning apparatus of claim 2 and Butler teaches a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is

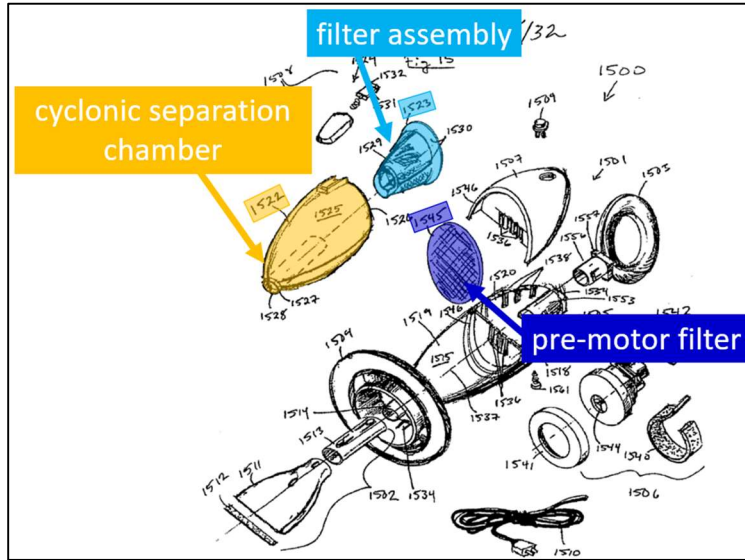
- removed from the main body.
223. In my opinion, the combined teachings of Butler and Jianan render obvious the surface cleaning apparatus of claim 10 and Butler teaches a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body.
224. In my opinion, Butler teaches a pre-motor filter that is accessible when the cyclone unit is removed from the main body. In my opinion, a POSA would have understood that, when Butler's "**cyclone separator**" is "remov[ed]" by unclamping "[a] set of over-center **clamps 548**," "**filter 520** compris[ing] ... **fine filter 520'**" is accessible, as shown in the annotated image below:



Ex1005, 21:8-15, 21:24-28, Fig. 5.

225. Further, when Butler's "**cyclonic separation chamber**" is "remov[ed]"

1545" are each accessible, as shown in the annotated image below:



Ex1005, 35:12-16, 35:20-24, 36:2-7, Fig. 15.

226. In my opinion, these limitations are also met when Butler is modified in view of Jianan. Ground 1, §1.

9. [11]

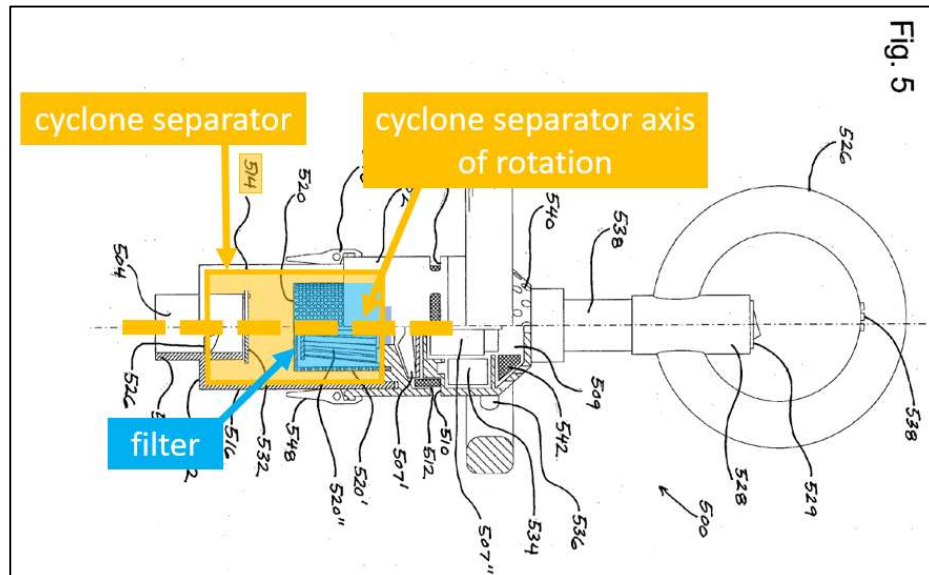
Reference Number	Claim Limitation
[11]	“The surface cleaning apparatus of claim 10 further comprising a pre-motor filter, wherein the cyclone axis of rotation intersects the pre-motor filter.”

227. In my opinion, the combined teachings of Butler and Jianan render obvious the surface cleaning apparatus of claim 10 and Butler teaches a pre-motor filter, wherein the cyclone axis of rotation intersects the pre-motor filter.

228. As I explained above, in my opinion, Butler teaches a pre-motor filter.

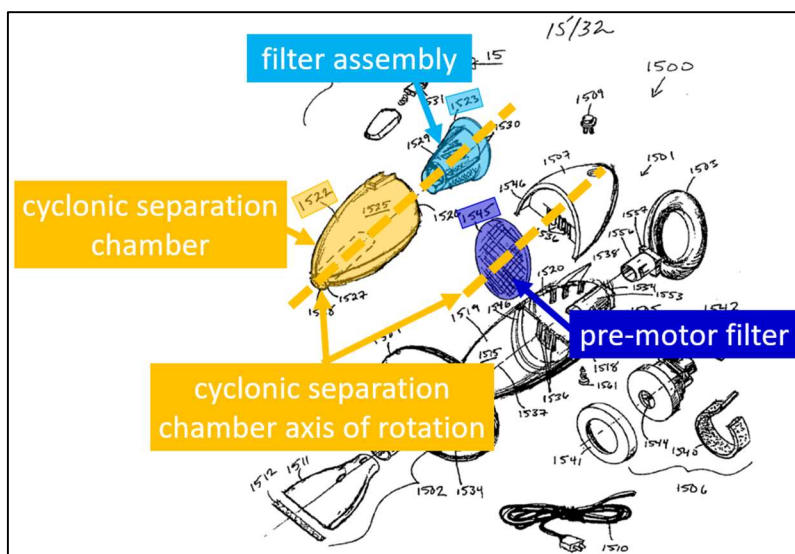
Ground 1, Limitations [9a.2]/[15a.2].

229. Further, in my opinion, Butler's **cyclone separator axis of rotation** intersects "**filter 520** compris[ing] ... **fine filter 520'**," as shown in the annotated image below:



Ex1005, 21:24-28, Fig. 5.

230. In my opinion, Butler's cyclonic separation chamber axis of rotation also intersects both "**filter assembly 1523**" and "**pre-motor filter 1545**," as shown in the annotated image below:



Ex1005, Fig. 15.

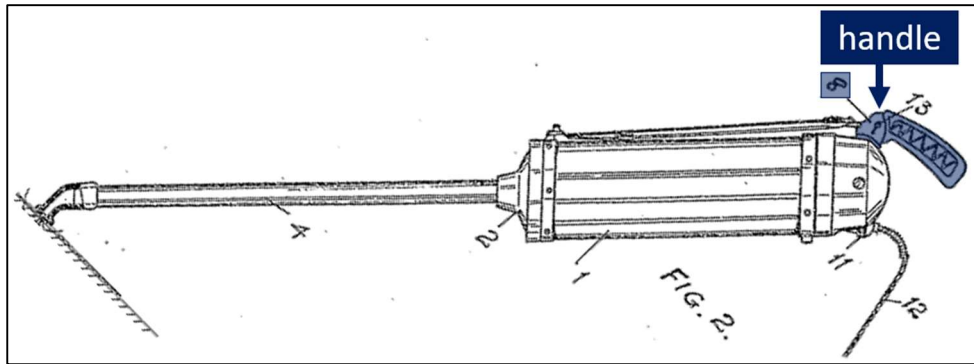
231. In my opinion, these limitations are also met when Butler is modified in view of Jianan. Ground 1, §1.

B. Ground 2: IPVG in Combination with Conrad335 Renders Obvious Claims 1-15

1. A POSA Would Have Combined IPVG and Conrad335

a. Scope and Content of the IPVG and Conrad335 Prior Art References

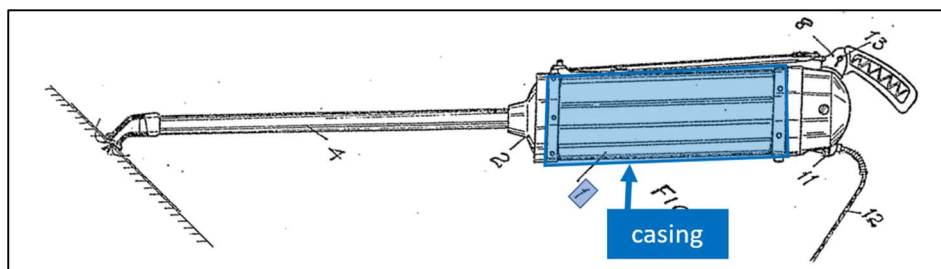
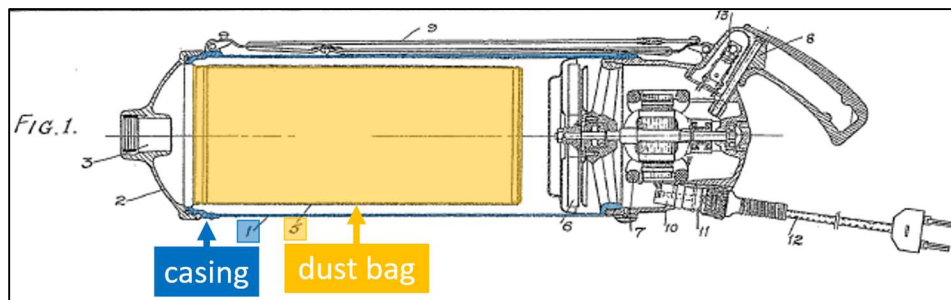
232. As noted briefly above in the Background of the Prior Art section, IPVG teaches a “portable dust suction apparatus” from 1928. Ex1007, 1:22-33. IPVG’s “portable dust suction apparatus” has “a **handle [8]**,” as shown in the annotated image below:



Ex1007, 1:22-33, Fig. 2.

233. In my opinion, a POSA would have understood that a “portable dust suction apparatus” having a handle and a configuration as illustrated in the figure above is a hand vacuum.

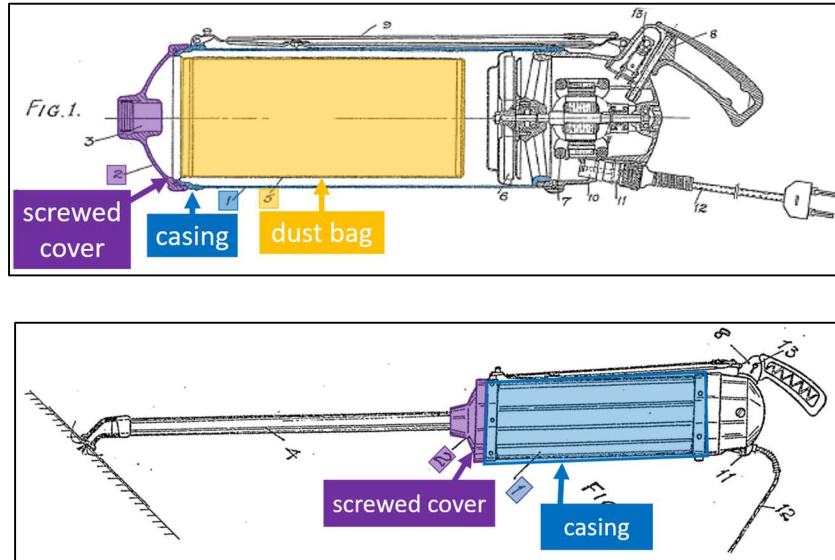
234. IPVG’s vacuum uses “**dust bag or like member [5],**” stored in “**casing 1,**” to filter dust, as shown in the annotated images below:



Ex1007, 1:51-57, Figs. 1-2.

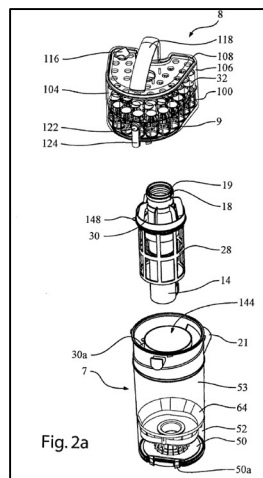
235. IPVG teaches that its vacuum is emptied by removing “**screwed cover 2**”

(which “close[s]” “**casing 1** ... at the front end”) and removing “**dust bag 5**,” as shown in the annotated images below:



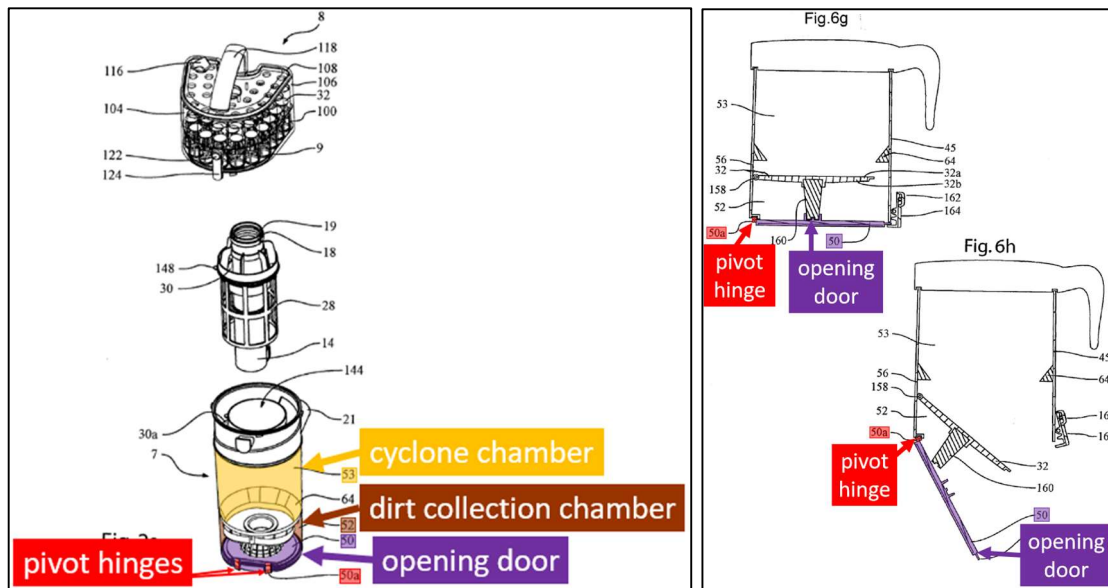
Ex1007, 1:51-57, Figs. 1-2.

236. As described briefly above in the background of the prior art section, Conrad335 is a U.S. patent application publication from 2007. Ex1008, Cover. Conrad335 teaches a “cyclone separator” for vacuums, including a “stick” or “hand vacuum,” as shown in the figure below:



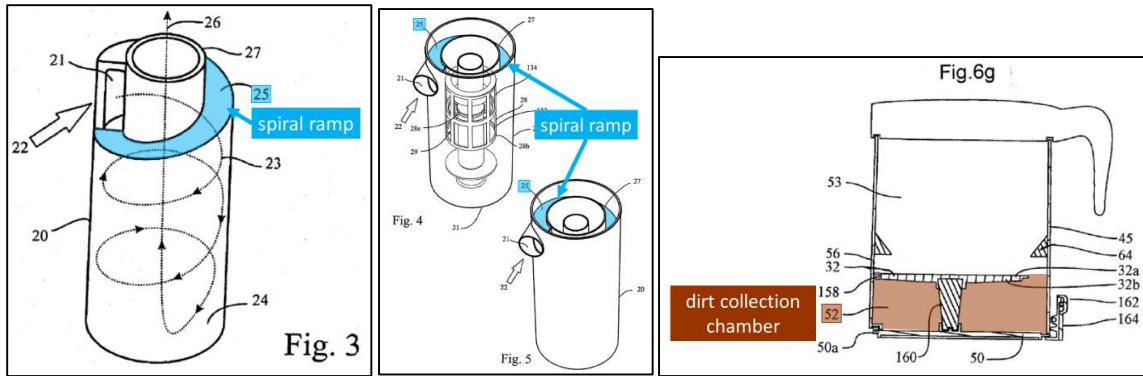
Ex1008, Abstract, ¶376, Fig. 2a.

237. Conrad335's "cyclone separator" has "a **cyclone chamber [53]** and a **dirt collection chamber [52]**," that is sealed by "**opening door 50**," with "**pivot hinges 50a**" for emptying collected dirt, as shown in the annotated images below:



Ex1008, Abstract, ¶¶23, 339, Figs. 2a, 6g-6h.

238. Conrad335 teaches that "**spiral ramp 25** ... create[s] cyclonic circulation 23 in cyclone separator 20," causing "particles ... to be disentrained from the fluid flow stream and accumulate within the lower region," which Conrad335 calls the "**dirt collection chamber [52]**," as shown in the annotated images below:



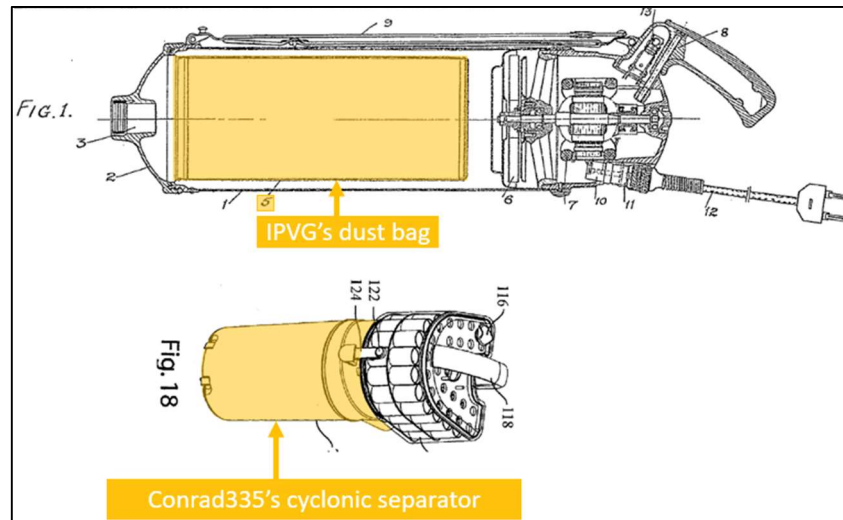
Ex1008, Abstract, ¶¶283-84, Figs. 3-6g.

b. A POSA Would Have Been Motivated to Combine the Teachings of IPVG and Conrad335

239. Having reviewed the teachings of both IPVG and Conrad335, in my opinion, a POSA would have been motivated to modify IPVG to achieve the stated benefits of Conrad335’s cyclonic-separation system and hinged door. Conversely, in my opinion, a POSA reading Conrad335—including its teaching that “[its] cyclonic embodiments ... may be used in conjunction with ... a hand vacuum” (Ex1008 ¶376)—would have been motivated to incorporate Conrad335’s cyclonic-separation unit into hand vacuums such as IPVG’s. Specifically, in my opinion, a POSA would have been motivated to combine the teachings of IPVG and Conrad335 as follows:

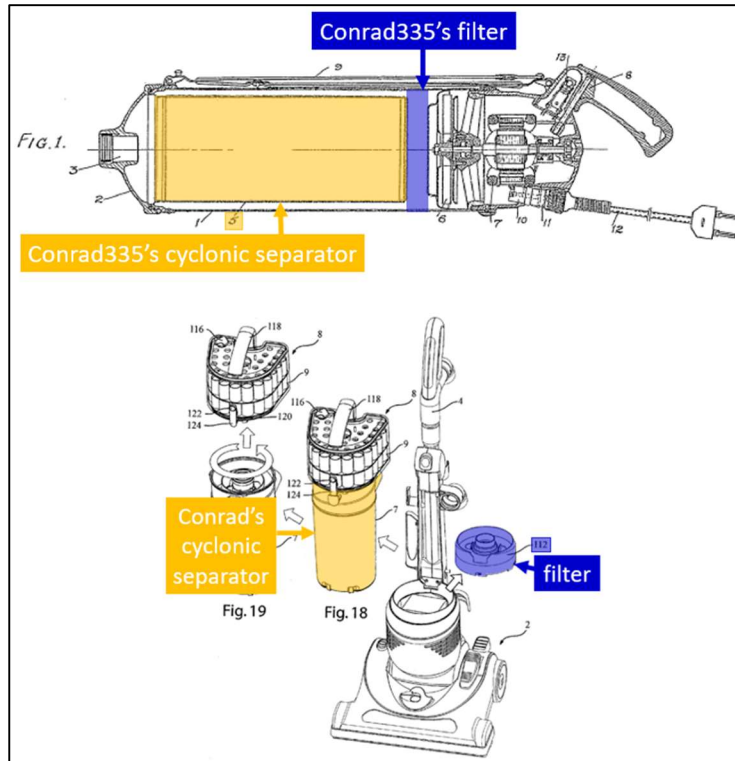
240. In my opinion, a POSA would have been motivated to modify IPVG’s dust-separation unit (“**dust bag 5**”) to use a cyclonic-filtration unit, such as Conrad335’s “**cyclone separator**,” as shown in the annotated image

below:



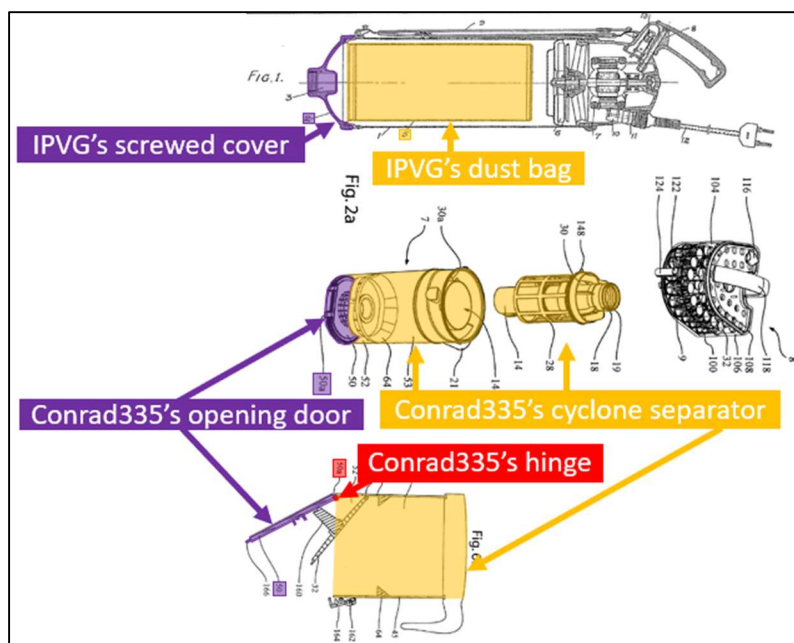
Ex1007, Fig. 1; Ex1008, Fig. 18.

241. In my opinion, when making this modification, a POSA would have been further motivated to include a pre-motor filter positioned downstream of the cyclonic separator, such as Conrad335's pre-motor “**filter 112**,” as shown in the annotated image below:



Ex1007, Fig. 1(modified); Ex1008 ¶373, Figs. 18-19.

242. In my opinion, a POSA also would have been motivated to modify IPVG's screwed-open door (“**screwed cover 2**”) to use a pivot-open door, such as Conrad335’s “**opening door 50**” with “**pivot hinges 50a**,” as shown in the annotated image below:



Ex1007, Fig. 1; Ex1008, Abstract, ¶¶23, 339, Figs. 2a, 6h.

243. In my opinion, a POSA would have been motivated to combine IPVG and Conrad335 as described for multiple reasons. First, a POSA would have understood that IPVG and Conrad335 are analogous art. IPVG teaches a “portable dust suction apparatus” that uses an air-filtration unit (“dust bag or like member [5]”) contained within a cylindrical chamber (“casing 1”) that is sealed at one end by an openable door (“casing 1 [is] closed at the front end by a screwed cover 2”), Ex1007, 1:10-12, 1:51-57, 2:9-20. Likewise, Conrad335 teaches a “portable vacuum cleaner” that uses an air-filtration unit (a “cyclone separator”) that is sealed at one end by an openable door (“opening door 50”), Ex1008, Abstract, ¶¶23, 84, 339.

244. Second, in my opinion, Conrad335 and IPVG each provide motivations for

this combination. IPVG teaches that its air-filtration unit is “a dust bag or like member through which the air stream passes.” Ex1007, 1:22-33, claim 1. In my opinion, a POSA would have looked for “like members” for filtering air, including cyclonic air-filtration. Also, in my opinion, a POSA would have understood that cyclonic filtration had certain advantages over dust-bag filtration, including (1) no bag needs to be replaced, reducing recurring costs; (2) cyclonic cleaners experience comparatively less suction loss as they fill; and (3) cyclonic cleaners give the user a visual indication of how full the container is and when to empty. In my opinion, these advantages were well-known in the art at the time the ’546 Patent’s priority application was filed. For example, in 1955, a French patent taught that “[b]y application of the ‘Whirlwind’ principle,” i.e., cyclonic filtration, “the materials are deposited in the bottom of the container, after having separated from the air, before it passes through the filter screen,” which “prevent[s] clogging” and creates “stable suction,” and by using a transparent cyclonic chamber, “the user is able, when stopped, to see where the filling of the container is” and “can therefore better judge when it must be emptied.” Ex1013, 1. And a 2002 PCT Publication explained that “so-called bagless vacuum cleaners,” or “cyclonic” cleaners, “are becoming increasingly popular” because they “avoid[ed] the use of a filter bag as the

primary form of separation” and thus “maintain a consistently high level of suction, even as the collecting chamber fills with dirt.” Ex1014, 1:5-10. Further, Conrad335 teaches that its cyclonic-separator “may be used ... to create ... a stick” or “hand vacuum.” Ex1008 ¶376. In my opinion, a POSA would have looked for hand/stick vacuum references that could use Conrad335’s cyclonic-filtration teachings, including IPVG’s. As Conrad335 teaches, “[c]yclonic vacuum cleaners are known in the art,” and one “advantage” of Conrad335’s design is that its chamber is transparent so, “when the dirt collection bin is full, a user ... will have a visual signal to empty the cyclonic stage.” Ex1008 ¶¶2, 112.

245. Further, during the ’546 Patent’s prosecution, the Examiner found—and the Applicant did not dispute—that “it would have been obvious to one skilled in the art at the time of the invention to substitute [a] cyclone unit ... for [a non-cyclonic] separation assembly ... since the cyclone unit ... is used for the same purpose of separating dust particles from air as the separation assembly.” Ex1004, 445-46, 473-86.
246. Third, in my opinion, a POSA would have been motivated to include a pre-motor filter positioned downstream of the cyclone unit when implementing Conrad335’s cyclonic-filtration teachings into IPVG. In my opinion, a POSA would have understood that using such a filter had certain

advantages, including (1) protecting the suction motor from debris that remained entrained in the airflow, increasing component longevity, reducing losses in suction motor efficiency, and reducing recurring costs, and (2) more effective air treatment. In my opinion, these advantages were well-known at the time '546 Patent's priority application was filed. As one example, in 2007 Jianan disclosed a "filter" located "downstream" of the "cyclones" and explained that "[t]he filter removes any matter from the air that has not been separated by the cyclone," such as "sharp or hard objects" and "very fine dust," and "acts as a safety guard for the impeller and motor." Ex1006, 4-5, 10, Figs. 2a-3, 5-6.

247. Fourth, in my opinion, a POSA would have known that Conrad335's hinged "opening door 50" had certain advantages over IPVG's "screwed cover 2," including ease of opening for cleaner emptying, and would have been motivated to incorporate Conrad335's hinged-door teachings into IPVG. Unlike IPVG's emptying process, which involves a user unscrewing "screwed cover 2," removing "dust bag 5," and carrying the dirty dust bag to the trashcan, a cleaner having Conrad335's "opening door 50" may be emptied by simply holding the cleaner over a trashcan and pivoting the door open "such as by pushing [a] button." Ex1007, 1; Ex1008 ¶339. By contrast to IPVG's "screwed cover 2," in my opinion, a

- POSA would have understood that Conrad335's "opening door 50" can empty dirt more quickly, conveniently, and hygienically.
248. Fifth, this combination would have involved a simple substitution of known elements for others to obtain predictable results. IPVG teaches a cleaner having a dust-separation unit (a dustbag) with a door covering one end that opens with screws. Ex1007, Fig. 1. Conrad335 teaches a dust separation unit (cyclonic airflow and a downstream pre-motor filter) with door covering one end that opens with a hinge. Ex1008, Fig. 2a. In my opinion, a POSA would have understood that the simple substitution of these styles of dust-separation units and openable doors would achieve the predictable results of filtering air and permitting one end of the dust-separation unit to be opened for emptying. Further, as I depicted above, IPVG and Conrad335 are directed to vacuums having a similar orientation of separation unit relative to door, which, in my opinion, would have further motivated a POSA to make the substitution. Ex1007, Fig. 1; Ex1008, Figs. 2a, 6h.
249. Sixth, it would have been at least obvious to try this combination. In my opinion, a POSA would have understood that there were a finite number of identified dust-separation solutions, including dust bags (as IPVG teaches) and cyclonic separators (as Conrad335 teaches). And, in my

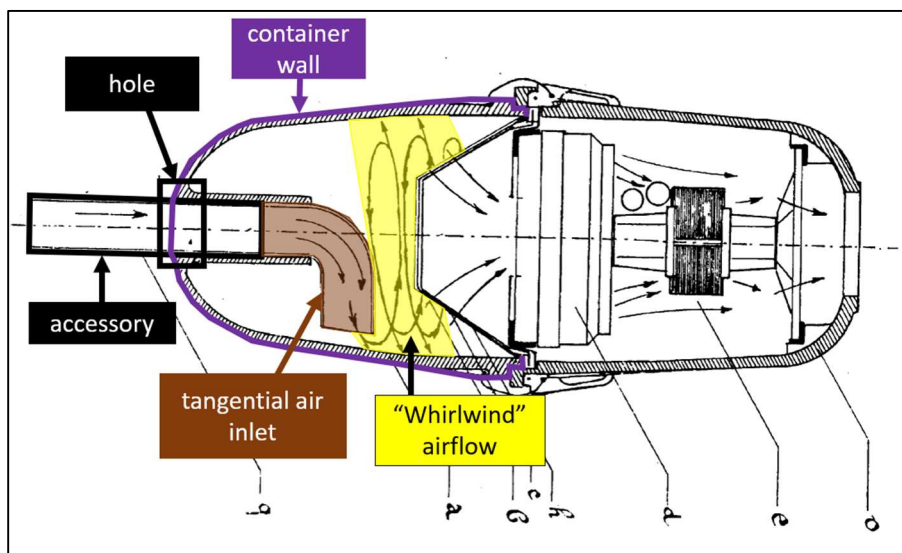
opinion, a POSA would have understood that there are a finite number of identified openable-door solutions, including screwed doors (as IPVG teaches) and hinged doors (as Conrad335 teaches), and, in my opinion, it would have been obvious to try to achieve the known benefits described above.

c. A POSA Would Have Had A Reasonable Expectation of Success Combining the Teachings of IPVG and Conrad335

250. In my opinion, a POSA would have reasonably expected success combining IPVG's and Conrad335's teachings as described. In my opinion, a POSA would have understood that these two types of dust-separation units could have been used interchangeably, and that these two openable doors could also have been used interchangeably. Also, in my opinion, a POSA would have further expected success for the reasons I stated above, including because such modification involved a simple substitution of known elements that perform similar functions in similar ways, and because of the express motivations found in Conrad335 and IPVG to perform such substitutions.

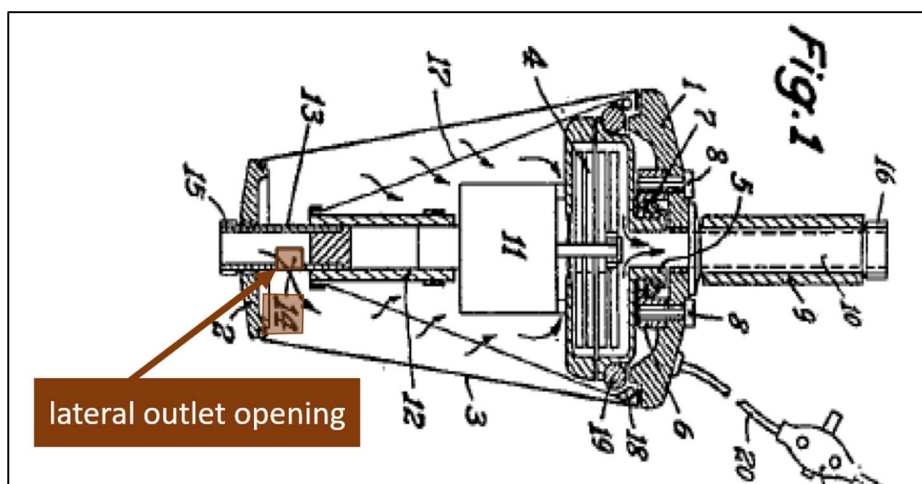
251. Further, in my opinion, a POSA would have reasonably expected success incorporating Conrad335's cyclonic-separation teachings, including "filter 112," into IPVG because, in my opinion, it was well-known that front-

located air inlets (such as IPVG's) create cyclonic separation by using a tangential opening. As Conrad335 explains, "a spiral or tangential inlet" can create a cyclone. Ex1008 ¶224. In my opinion, front-located tangential air inlets have been used for cyclonic cleaners since well before the '546 Patent. For example, a 1955 French patent taught a "**tangential[]**" **air inlet** and removable **accessory** attached thereto through a **hole** in the "detachable" front "**wall of the ... container**" that created cyclonic airflow ("the 'Whirlwind' principle"), as shown in the annotated image below:



Ex1013, 1, Fig. 1.

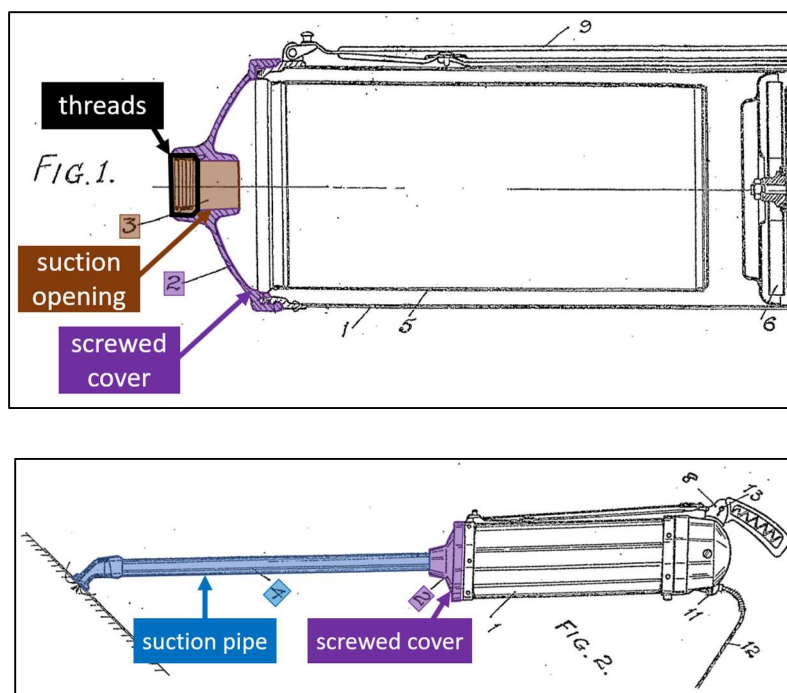
252. Similarly, a 1938 Swiss patent disclosed a cleaner with a front-mounted accessory and air inlet, which contained "**lateral outlet opening 14**" that, in my opinion, a POSA would have understood created cyclonic airflow, as shown in the annotated image below:



Ex1010, 2, Fig. 1.

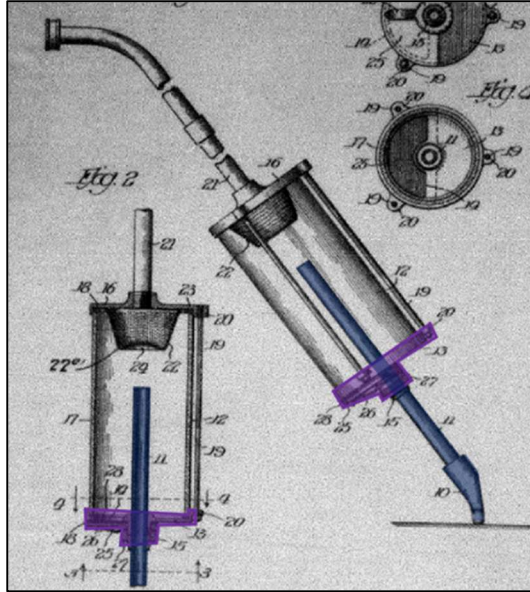
253. In my opinion, a POSA would have understood that the same configuration would create cyclonic airflow in the combined teachings of IPVG and Conrad335 by simply incorporating a tangential cyclone air inlet, such as Conrad335’s “inlet 21” (Ex1008 ¶283), and that such a pipe would connect IPVG’s air inlet with Conrad335’s tangential “inlet 21.”

254. Finally, in my opinion, a POSA would have reasonably expected success incorporating Conrad335’s hinged lid and lid-opening mechanism into IPVG’s vacuum cleaner. IPVG teaches a **threaded “suction opening 3”** to which **“a suction pipe 4”** with corresponding mating threads can be attached for use and detached to allow **“screwed cover 2”** to be removed for emptying the cleaner, as shown in the annotated images below:



Ex1007, 1:51-57, Figs. 1-2.

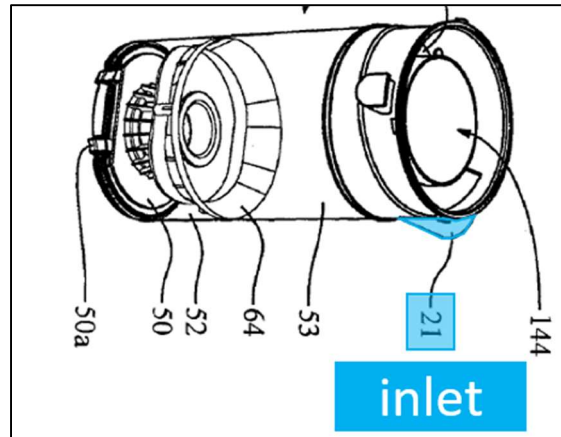
255. Conrad335 teaches that its cyclone-separator teachings “may be used ... with ... a stick” or a “hand vacuum,” for which, in my opinion, front-mounted accessories were common. Ex1008 ¶376. Butler teaches a cyclonic hand vacuum with removable accessories such as an “inlet nozzle” and/or “nozzle connector,” that are removably “attached to the housing ... by snap engagement” for easy attachment and removal. Ground 1; Ex1005, 27:12, 34:28-30, 35:8-11, Figs. 9A, 15; *see also id.*, 10:28-11:2, 37:16-18, 38:25-39:1. Further, **accessories** projecting through **openable front doors** in cleaners have existed for over a century, as shown in the annotated image below:



Ex1015, Figs. 1-2 (1915).

256. In my opinion, a POSA would have understood that front-mounted accessories could be detachable, as IPVG teaches to allow Conrad335's door to pivot open.

257. In my opinion, a POSA also would have understood that IPVG's "suction pipe 4" could alternatively attach to a cyclone air inlet positioned on the outside of the dirt separation unit, such as Conrad335's "inlet 21," as shown in the annotated image below:



Ex1008, Fig. 2a.

1. [1]/[8]/[9]/[10]/[14]/[15]

a. [1pre]/[8pre]/[9pre]/[10pre]/[14pre]/[15pre]

Reference Number	Claim Limitation
[1pre]	“A surface cleaning apparatus comprising:”
[8pre]	“A surface cleaning apparatus comprising:”
[9pre]	“A surface cleaning apparatus comprising:”
[10pre]	“A surface cleaning apparatus comprising:”
[14pre]	“A surface cleaning apparatus comprising:”
[15pre]	“A surface cleaning apparatus comprising:”

258. To the extent the preambles are limiting, in my opinion, IPVG teaches a surface cleaning apparatus.

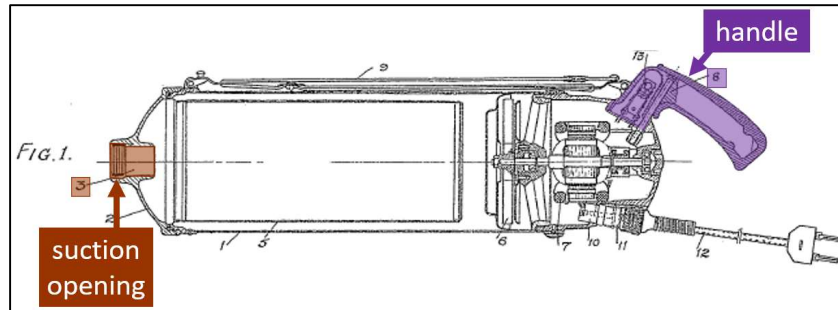
259. IPVG teaches a “portable dust suction apparatus.” Ex1007, 1:10-21. A POSA would have understood that this is a surface cleaning apparatus.

260. Likewise, Conrad335 teaches “[a] surface cleaning apparatus.” Ex1008, Abstract.

b. [1a]/[8a]/[9a]/[10a]/[14a]/[15a]

Reference Number	Claim Limitation
[1a]	“(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle, the hand vacuum cleaner comprising:”
[8a]	“(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle, the hand vacuum cleaner comprising:”
[9a]	“(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle, the hand vacuum cleaner comprising:”
[10a]	“(a) a hand vacuum cleaner comprising:”
[14a]	“(a) a hand vacuum cleaner comprising:”
[15a]	“(a) a hand vacuum cleaner comprising:”

261. In my opinion, IPVG teaches a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle
262. In my opinion, a POSA would have understood that IPVG teaches a hand vacuum cleaner. IPVG teaches a “portable dust suction apparatus” that “may be readily lifted” by a “**handle [8]**” that the operator holds with a single hand “during manipulation of the apparatus,” as shown in the annotated image below:

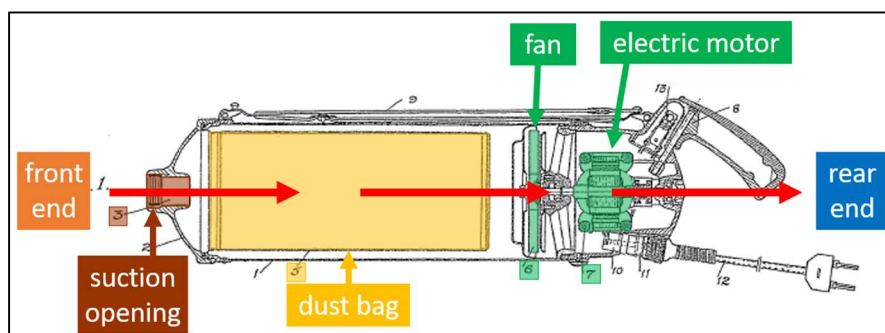


Ex1007, 1:10-33, claims 1-2, Fig. 1.

263. In my opinion, a POSA would have understood that this is a hand vacuum cleaner.

264. Likewise, Conrad335 teaches a “hand vacuum.” Ex1008 ¶¶1, 376.

265. Regarding Limitations [1a]/[8a]/[9a], in my opinion, a POSA would have understood that IPVG’s hand vacuum has a front end having a dirty air inlet, a rear end, and a clean air outlet. IPVG’s hand vacuum cleaner has a “casing 1 closed at the **front end** by a screwed cover 2.” Ex1007, 1:51-57. In use, air flows in “**suction opening 3**” (located at the “**front end**”) through “**dust bag 5**, and a **fan 6** driven by an **electric motor 7**,” and out “the exhaust or blowing end of the casing,” which is at the “**rear**” **end**, as shown in the annotated image below:

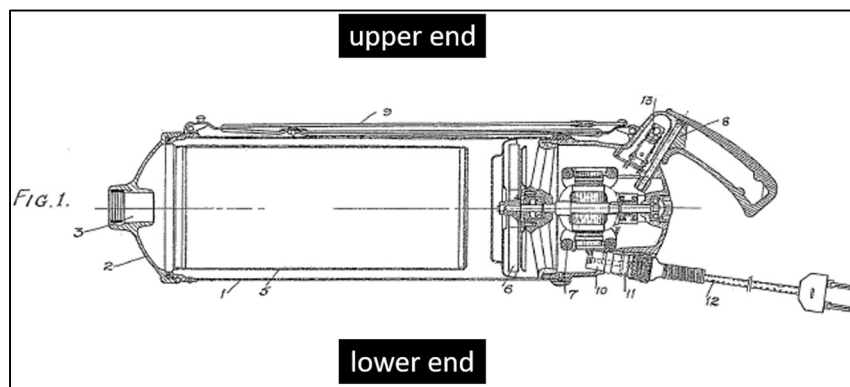


Ex1007, 1:51-62, 1:92-2:2, Fig. 1.

266. In my opinion, a POSA would have understood that IPVG's "suction opening 3" is a dirty air inlet, and IPVG's "exhaust or blowing end of the casing" is a clean air outlet.

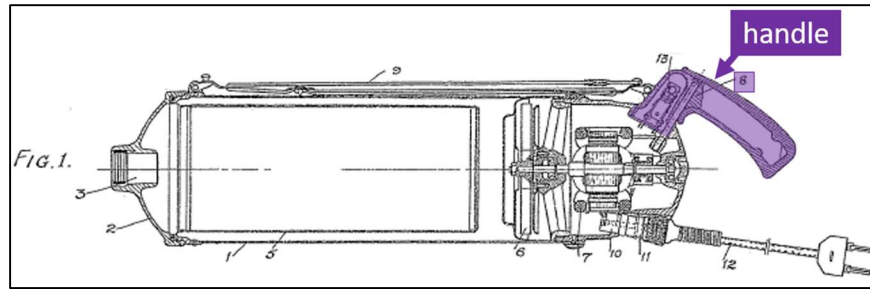
267. Likewise, in my opinion, a POSA would have understood that Conrad335 teaches a dirty air inlet and a clean air outlet. Conrad335 has a "dirty air inlet" and uses cyclonic separation to clean the air that then "travels ... to a fluid flow motor that is preferably a suction motor 15 prior to exiting vacuum cleaner 1." Ex1008 ¶274.

268. In my opinion, a POSA would have understood that IPVG's vacuum has an **upper end** and a **lower end**, as shown in the annotated image below:



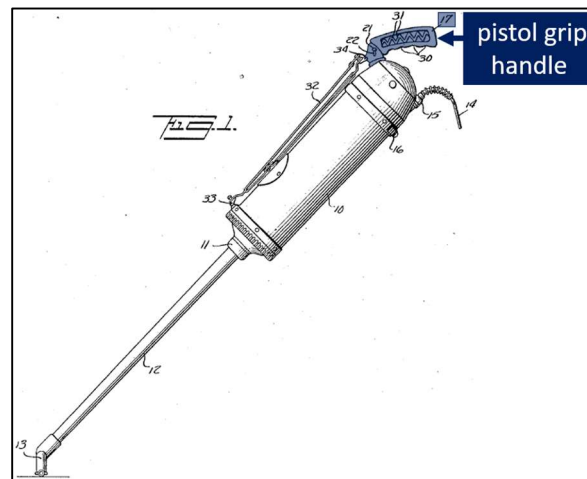
Ex1007, Fig. 1.

269. In my opinion, IPVG teaches a pistol grip handle. In my opinion, a POSA would have understood that IPVG's "**handle 8**" is a pistol grip handle, as shown in the annotated image below:



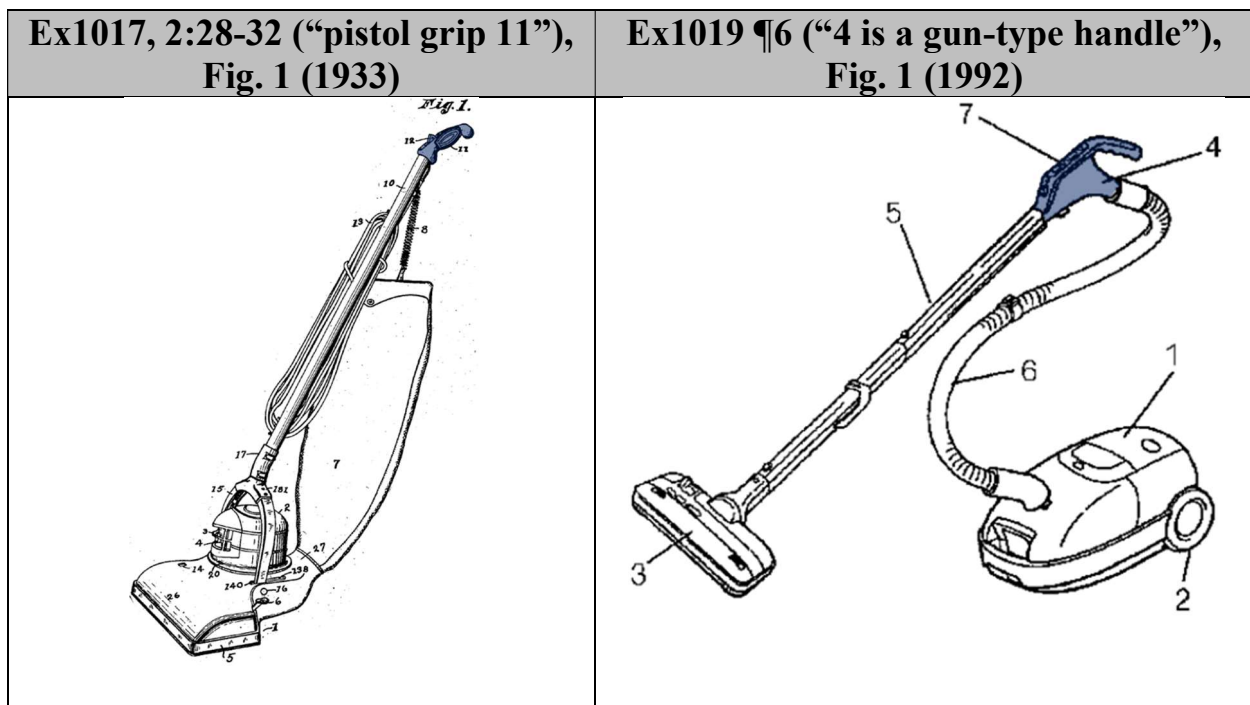
Ex1007, Fig. 1.

270. For example, in 1933, U.S. Patent No. 1,908,834 to Engberg et al. (“Engberg”) disclosed a vacuum nearly identical to IPVG with a “[h]andle 17 hav[ing] the general form of a pistol grip,” which looks nearly identical to IPVG’s handle, as shown in the annotated image below:



Ex1016, 1:53-54, Fig. 1.

271. Likewise, various other prior-art handles that, in my opinion, resemble IPVG’s handle have been described as **pistol grip vacuum handles**, as shown in the annotated images below:



272. Further, in my opinion, a POSA would have understood that pistols with handles like IPVG’s handle have existed for centuries, as shown in the image below:



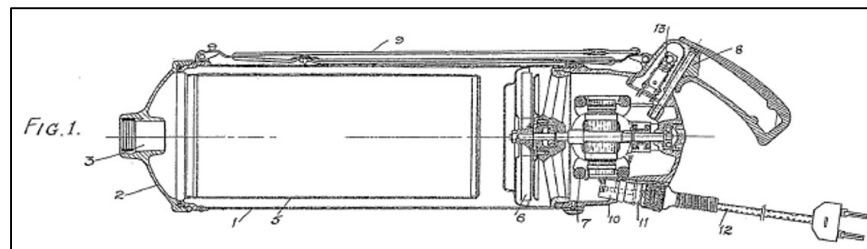
273. Thus, in my opinion, a POSA would have understood that IPVG’s “handle 8” is a pistol grip handle.

274. In my opinion, a POSA would have been motivated to combine the teachings of IPVG and Conrad335 and would have reasonably expected success, Ground 2, §1, and would have been motivated to use an airflow passage from a dirty air inlet to a clean air outlet. In my opinion, the combined teachings likewise meet these limitations because the air flows from a dirty air inlet, such as IPVG's "suction opening 3" (when modified to create cyclonic airflow) to a clean air outlet, such as IPVG's "exhaust."

c. [1a.1]/[8a.1]/[9a.1]/[10a.1]/[14a.1]/[15a.1]

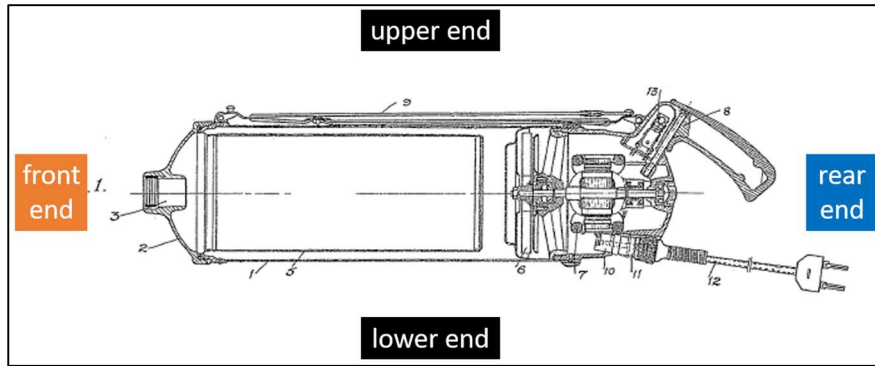
Reference Number	Claim Limitation
[1a.1]	“(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation;”
[8a.1]	“(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation; and,”
[9a.1]	“(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation; and,”
[10a.1]	“(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end;”
[14a.1]	“(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end; and,”
[15a.1]	“(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end; and,”

275. In my opinion, IPVG teaches a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation (Limitations [1a.1]/[8a.1]/[9a.1]).
276. In my opinion, IPVG teaches a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle is provided at the rear end of the main body and extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end (Limitations [10a.1]/[14a.1]/[15a.1]).
277. In my opinion, a POSA would have understood that IPVG's vacuum has a main body, as shown in the figure below:



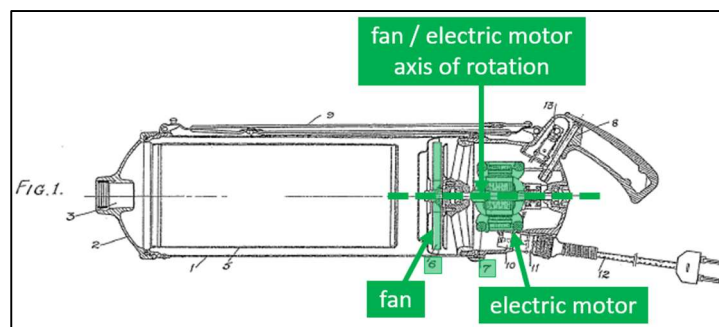
Ex1007, Fig. 1.

278. In my opinion, IPVG's main body comprises an **upper end**, a **lower end**, a "**front end**," and a "**rear**" end, as shown in the annotated image below:



Ex1007, Fig. 1; Ground 2, Limitations [1a]/[8a]/[9a]/[10a]/[14a]/[15a].

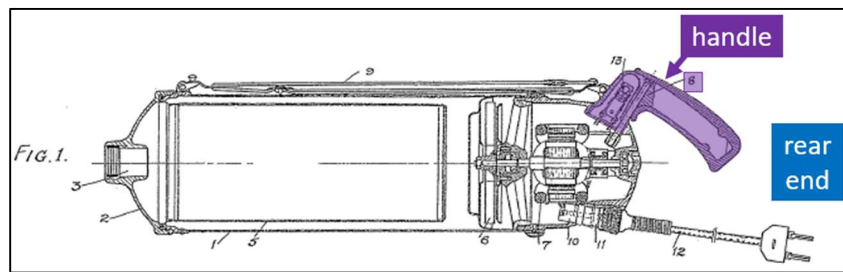
279. In my opinion, a POSA would have understood that IPVG’s main body houses a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation. IPVG’s main body houses “**fan 6** driven by an **electric motor 7**,” which, in my opinion, has a **fan / electric motor axis of rotation**, as shown in the annotated image below:



Ex1007, 1:51-57, Fig. 1.

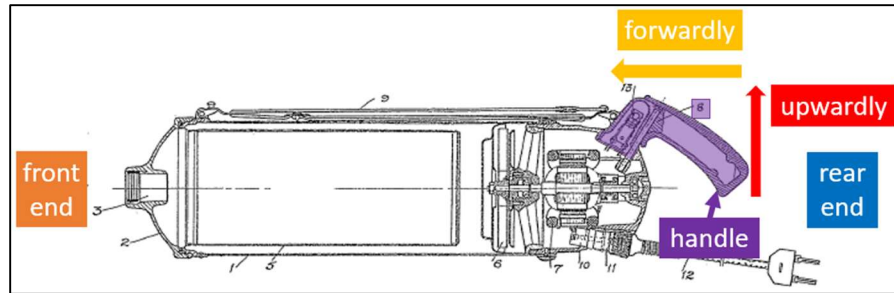
280. In my opinion, a POSA would have understood that IPVG’s “fan 6” and “electric motor 7” are a suction motor and fan assembly with an axis of rotation.

281. Likewise, Conrad335's main body houses "a suction motor 15." Ex1008, ¶274.
282. Regarding Limitations [10a.1]/[14a.1]/[15a.1], as I explained above, in my opinion, IPVG teaches a pistol grip handle. Ground 2, Limitations [1a]/[8a]/[9a]/[10a]/[14a]/[15a].
283. Further, a POSA would have understood that IPVG's pistol grip "**handle 8**" is provided at the "**rear**" **end** of the main body, as shown in the annotated image below:



Ex1007, Fig. 1; Ground 1, Limitations [1a]/[8a]/[9a]/[10a]/[14a]/[15a].

284. In my opinion, IPVG teaches the pistol grip handle extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end. In my opinion, a POSA would have understood that when IPVG's vacuum is positioned with the "**front end**" forward of the "**rear**" **end**, pistol grip "**handle 8**" extends **upwardly** and **forwardly**, as shown in the annotated image below:



Ex1007, Fig. 1.

d. [1a.2]/[8a.2]/[9a.2]/[10a.2]/[14a.2]/[15a.2]

Reference Number	Claim Limitation
[1a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle; and”
[8a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle;”
[9a.2]	“(ii) a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter;”
[10a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis

	of rotation is generally parallel to the cyclone axis of rotation; and”
[14a.2]	“(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation; and”
[15a.2]	“(ii) a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter,”

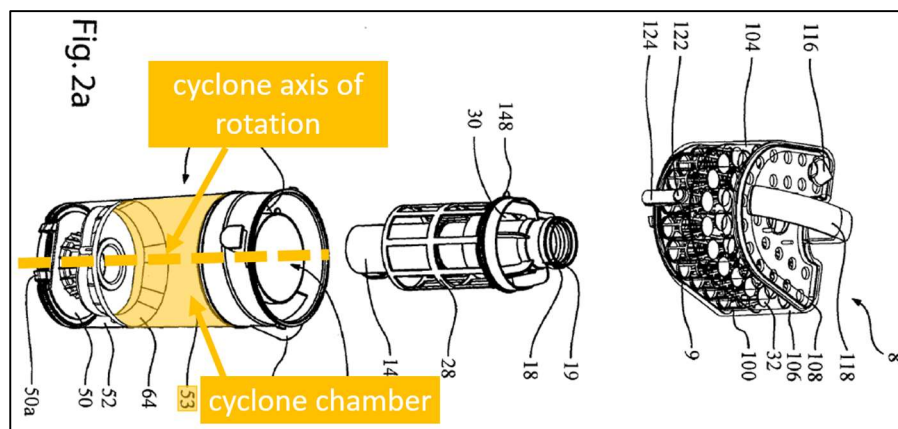
285. In my opinion, the combined teachings of IPVG and Conrad335 teaches a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle (Limitations [1a.2]/[8a.2]).

286. In my opinion, the combined teachings of IPVG and Conrad335 teaches a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the

- cyclone unit, wherein the cyclone axis of rotation intersects the pistol grip handle and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter (Limitation [9a.2]).
287. In my opinion, the combined teachings of IPVG and Conrad335 teaches a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation (Limitations [10a.2]/[14a.2]).
288. In my opinion, the combined teachings of IPVG and Conrad335 teaches a cyclone unit comprising a cyclone chamber and a dirt collection chamber that is exterior to the cyclone chamber, the cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation and a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter (Limitation [15a.2]).
289. IPVG teaches a “dust bag 5” “through which the suction air stream passes,”

which, in my opinion, a POSA would have understood is an air-filtration unit. Ex1007, 1:51-57, claim 1.

290. In my opinion, Conrad335 teaches a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation. Conrad335 teaches “cyclone separator 20,” which includes “a cyclonic region or **cyclone chamber 53**” with, in my opinion, a **cyclone axis of rotation**, as shown in the annotated image below:



Ex1008 ¶318, Fig. 2a.

291. In my opinion, a POSA would have understood that Conrad335’s “cyclone separator 20” is a cyclone unit and includes a cyclone in “cyclone chamber 53” with an axis of rotation:

In accordance with another aspect, which may be used individually or with any other aspect, a cyclone separator 20 may have air inlet 21 that is located on the top of the separator 20, see for example FIGS. 3, 3 a and 3 b. The inlet 21 may be round, oval, square, rectangular, ellipsoid or any other shape in

transverse section to the direction of flow, but a rectangular shape, as exemplified in the Figures, is preferred. The particle laden fluid represented by arrow 22 enters into the air inlet 21 and is directed by the spiral ramp 25 that defines inlet 21 so as to create cyclonic circulation 23 in cyclone separator 20. The spiral ramp 25 can be configured to occupy an arc of from 10° to 360° of the perimeter of the circumference of the cyclone separator 20 as seen from above. Preferably, the spiral ramp 25 extends through an arc from 15 to 360° and, more preferably from 25° to 270° and, most preferably from 25° to 90°. In the embodiment of FIG. 3a, air or fluid inlet 21 extends through an arc of 90° and in the embodiment of FIG. 3b, air inlet extends through an arc of 270°. The spiral ramp 25 may be configured in either a clockwise or counterclockwise direction. As exemplified in the drawings, at least a portion of, and preferably all of, inlet 21 is positioned exterior to the cyclone chamber, which chamber is located inside cyclone separator 20. For example, the inlet may be on the outer surface of cyclone separator 20 but is preferably positioned at the top of cyclone separator 20.

Ex1008 ¶283

Cyclonic circulation 23 in cyclone separator 20 causes at least a portion of the particles 24 within the particle laden fluid stream 22 to be disentrained from the fluid flow stream and accumulate within the lower region of the cyclone separator 20. The fluid stream 26, which exits the cyclone separator 20 through the fluid outlet 27 that is located adjacent to the inlet 21, has a reduced

concentration of the particles 24 than particle laden fluid stream 22. It is understood that this construction can be applied to a single cyclone or a plurality of cyclones in parallel. In another embodiment, it will be appreciated that outlet 27 may be provided in the bottom of cyclone separator 20 or any other location known in the art.

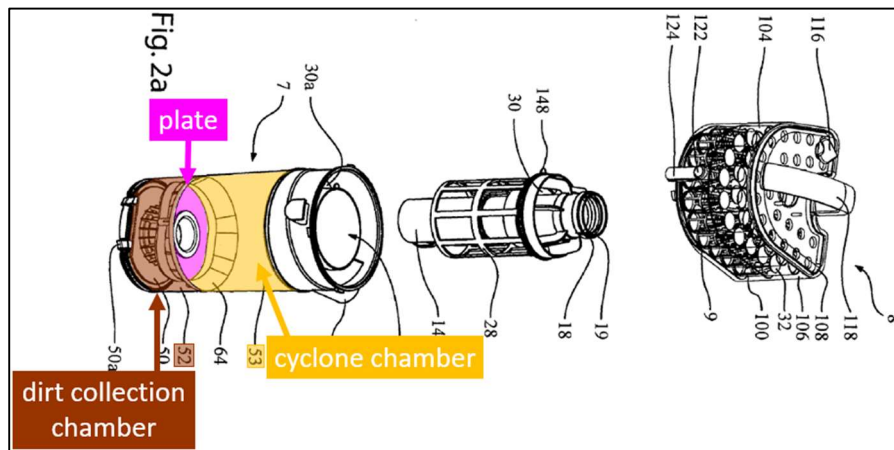
Id., ¶284.

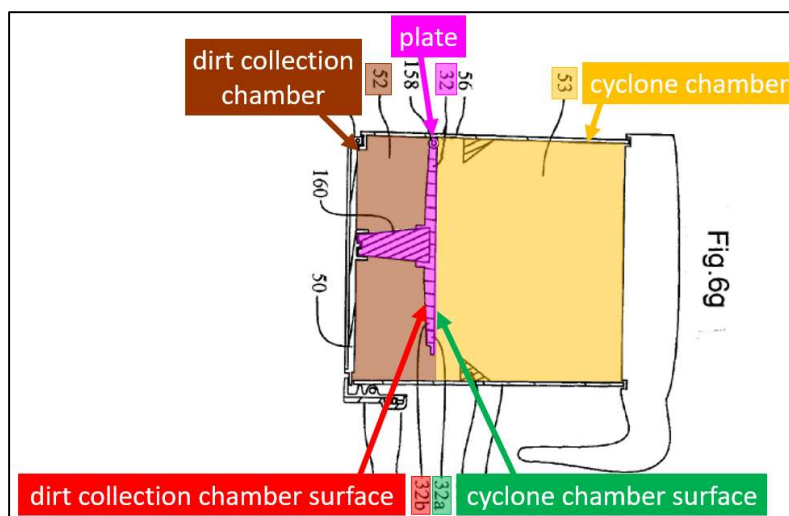
In accordance with another aspect, which may be used individually or with any other aspect, improved configurations for a plate 32 that is included in a cyclone separator 20 to divide the interior of a cyclone separator 20 into a cyclonic region or cyclone chamber 53 and a dirt collection region or chamber are provided, see for example FIG. 6a. As illustrated therein, plate 32 has an upper or cyclone chamber surface 32a, a lower or dirt collection chamber surface 32b and a peripheral wall 32c. Each of these different configurations beneficially assist in capturing different particle sizes. For example, the peripheral wall 32c of plate 33 is flat (i.e. it may extend generally vertically). Plate 33 is preferred for use in a cyclone separator 20 to capture general particles found in carpets and homes where the particle size is 3 or more microns. Alternately, the peripheral wall 32c may meet upper and/or lower surfaces 32a, 32b at an angle. See for example plates 34, 35 and 36. As shown, plate 35 comprises an upper portion and a lower portion that intersect at an intermediate location along the thickness of the plate so as to define a sharp edge (e.g. it is generally V shaped). As the size of the particles

decreases, plates 33, 34 and 35 are more effective in that the discontinuity at the outer perimeter improves ultra fine particle separation. Alternately, the peripheral edge may be curved (e.g. it may bow out in the centre so as to be generally C shaped as shown in plate 37). When the specific gravity of the particles being removed from the fluid stream is similar to the specific gravity of the fluid, curved surfaces such as 37, 38, 39, 40, and 41 tend to provide more efficient separation.

Id., ¶318.

292. Regarding Limitations [9a.2]/[15a.2], in my opinion, Conrad335 teaches a dirt collection chamber that is exterior to the cyclone chamber. In Conrad335, a “**plate 32** ... divide[s] the interior of a cyclone separator 20 into a cyclonic region or **cyclone chamber 53** and a **dirt collection region or chamber [52]**,” as shown in the annotated images below:



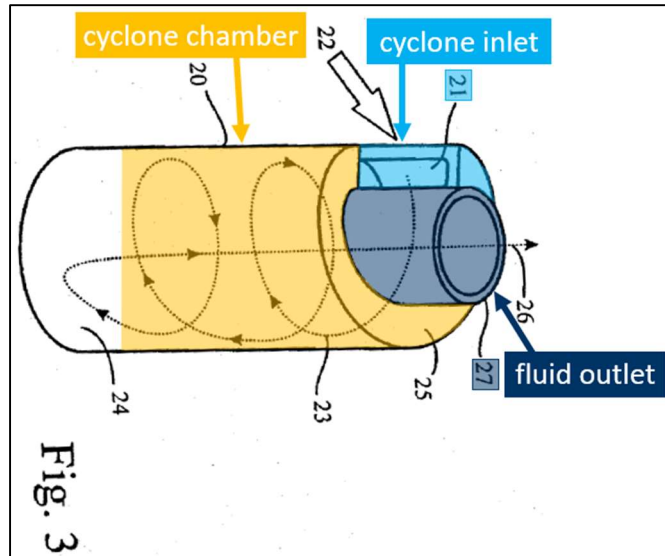


Ex1008 ¶318, Figs. 2a, 6g.

293. Conrad335 further teaches that “**plate 32** has an upper or **cyclone chamber surface 32a**, [and] a lower or **dirt collection chamber surface 32b**.”

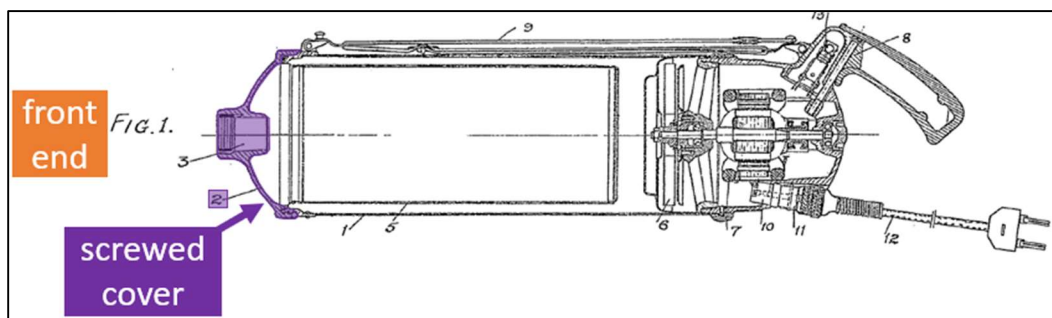
Ex1008 ¶318. In my opinion, a POSA would have understood that Conrad335’s “dirt collection region or chamber [52]” is thus exterior to the “cyclone chamber 53.”

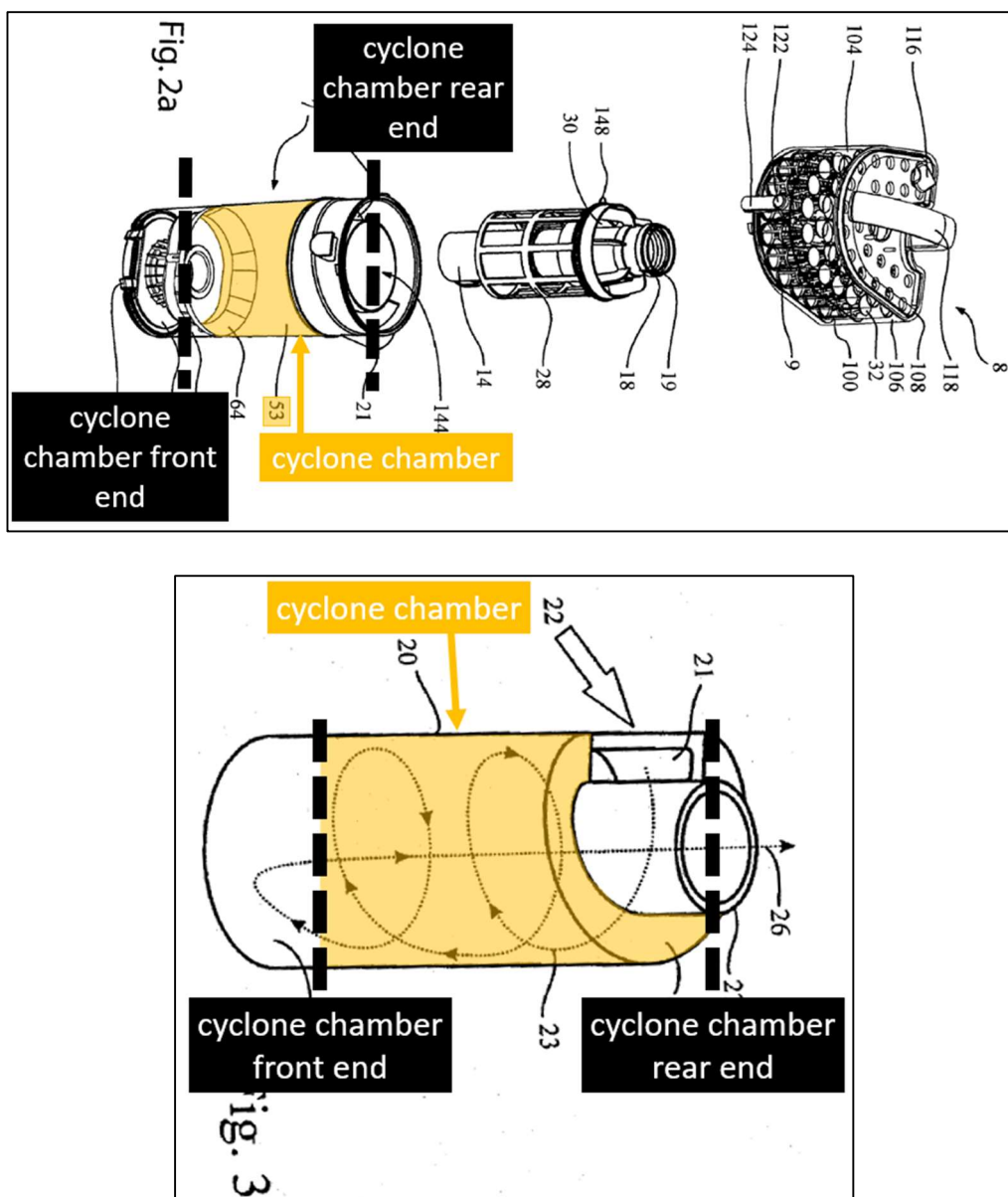
294. In my opinion, Conrad335 teaches the cyclone chamber having a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit, wherein air exits the cyclone chamber at the rear end of the cyclone chamber. A POSA would have understood that Conrad335’s “**cyclone chamber 53**” has a “**cyclone inlet 21**,” which is a cyclone air inlet, and “**fluid outlet 27**,” which is a cyclone air outlet, as shown in the annotated image below:



Ex1008 ¶¶284, 324, Fig. 3.

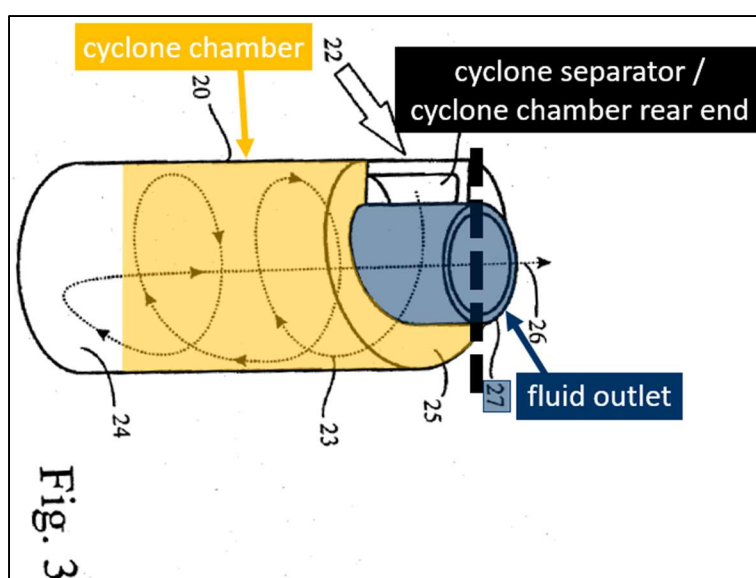
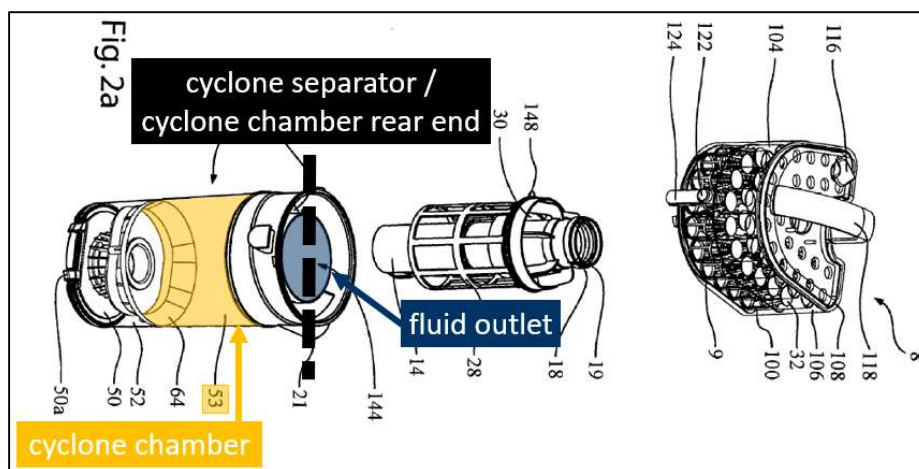
295. In my opinion, when Conrad335's "cyclone separator 20," including "cyclone chamber 53" is incorporated into IPVG's vacuum, Conrad335's cyclone chamber has a **front end** at IPVG's "**front end**" (near "**screwed cover 2**"), which is at the cleaner front end, and an axially spaced apart **rear end** at the opposite end, as shown in the annotated images below:





Ex1007, Fig. 1; Ex1008, Figs. 2a, 3.

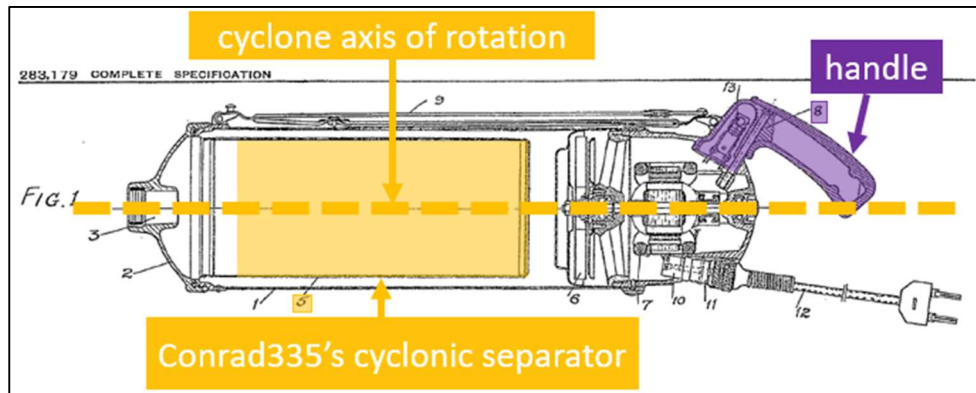
296. Further, in my opinion Conrad335's “**fluid outlet 27**” (where air exits the “**cyclone chamber 53**”) is located at the **rear end** of the “cyclone separator 20” (cyclone unit) and “**cyclone chamber 53**,” as shown in the annotated images below:



Ex1008, Figs. 2a, 3.

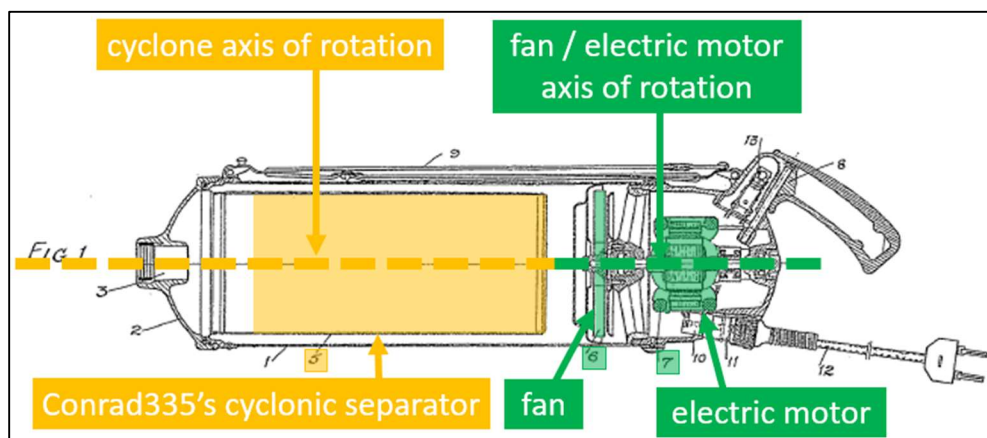
297. Regarding Limitations [1a.2]/[8a.2]/[9a.2], in my opinion, IPVG combined with Conrad335 teaches the cyclone unit axis of rotation intersects the pistol grip handle. In my opinion, when Conrad335's "cyclone separator 20" teachings are incorporated into IPVG's vacuum, Conrad335's "cyclone chamber 53[s]" cyclone axis of rotation intersects IPVG's pistol grip "handle 8," as shown in the annotated image

below:



Ex1007, Fig. 1(modified).

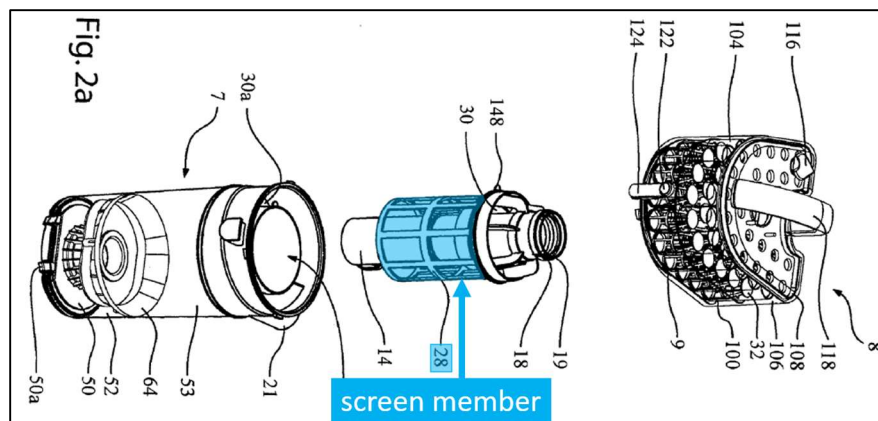
298. Regarding Limitations [10a.2]/[14a.2]/[15a.2], in my opinion, IPVG combined with Conrad335 teaches that the suction motor axis of rotation is generally parallel to the cyclone axis of rotation. In my opinion, when Conrad335's "cyclone separator 20" teachings are incorporated into IPVG's vacuum, IPVG's **fan / electric motor axis of rotation** is generally parallel to Conrad335's **cyclone axis of rotation**, as shown in the annotated image below:

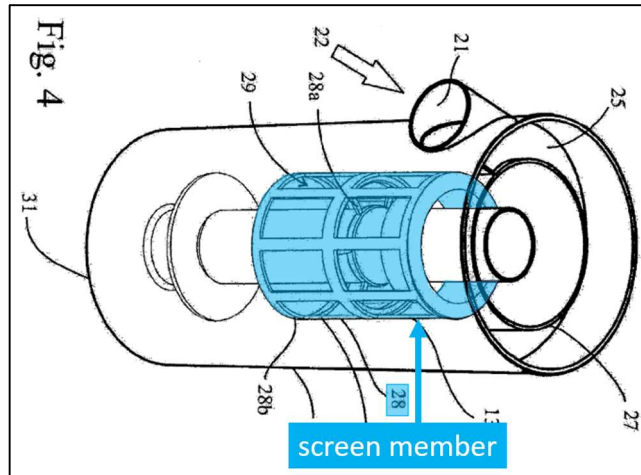


Ex1007, Fig. 1(modified).

299. To the extent the IPVG-Conrad335 combination's fan/motor axis and cyclone separator axis are co-axial, in my opinion, a POSA would have understood that these axes are generally parallel because they extend in the same direction and maintain the same (zero) distance between them. Further, PO contends that co-axial axes meet this limitation in PO's infringement contentions. Ex1011, 7.

300. Regarding Limitations [9a.2]/[15a.2], in my opinion, IPVG combined with Conrad335 teaches a line that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter. A POSA would have understood that Conrad335 teaches a pre-motor filter. Conrad335's "cyclone separator 20" includes "a **screen member 28** [that] is preferably constructed from a fine mesh" "to assist in the entrapment of fibers, hairs or particles," as shown in the annotated images below:

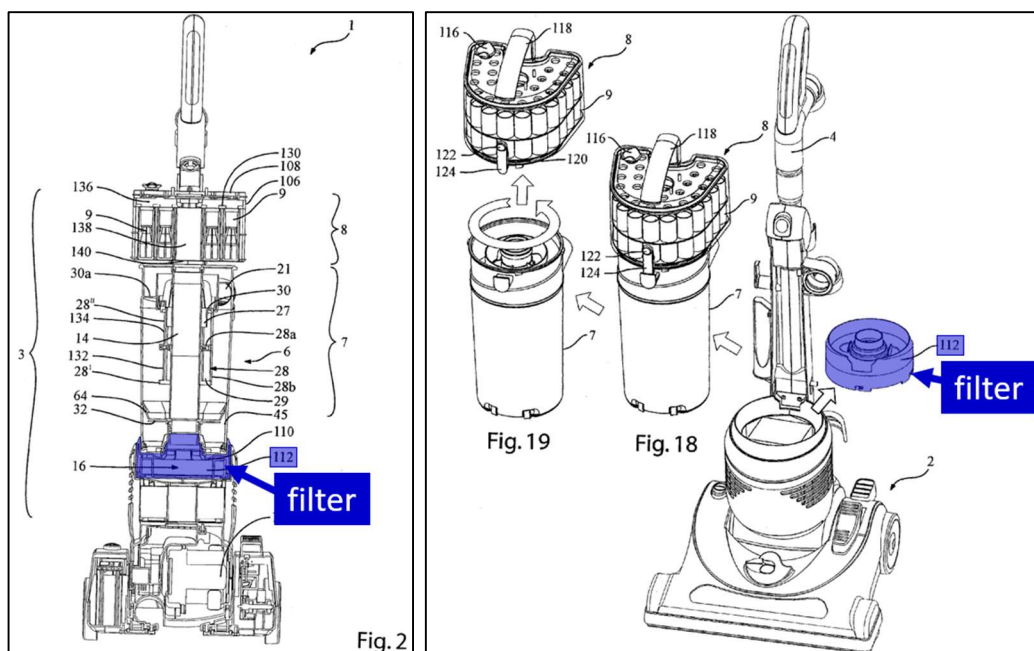




Ex1008 ¶¶287-288, Figs. 2a, 4.

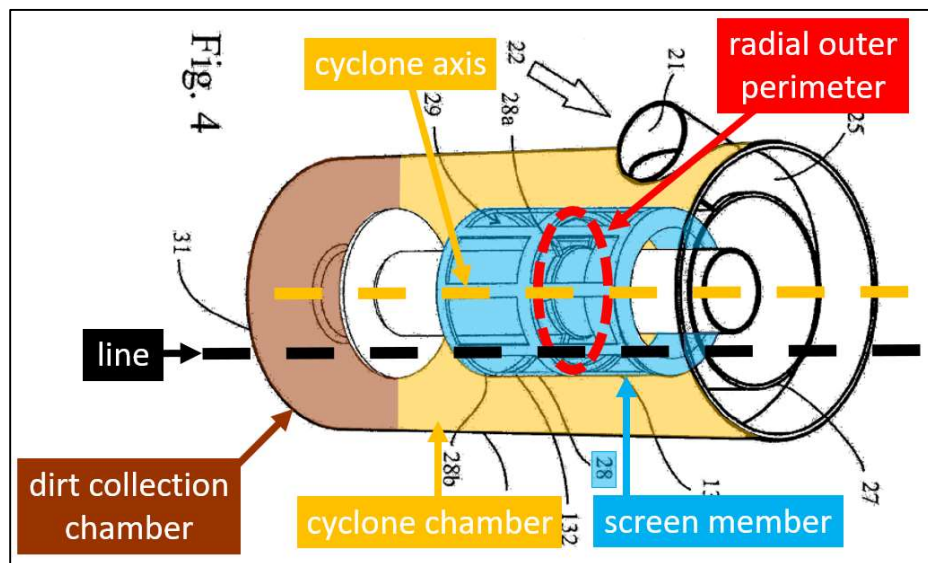
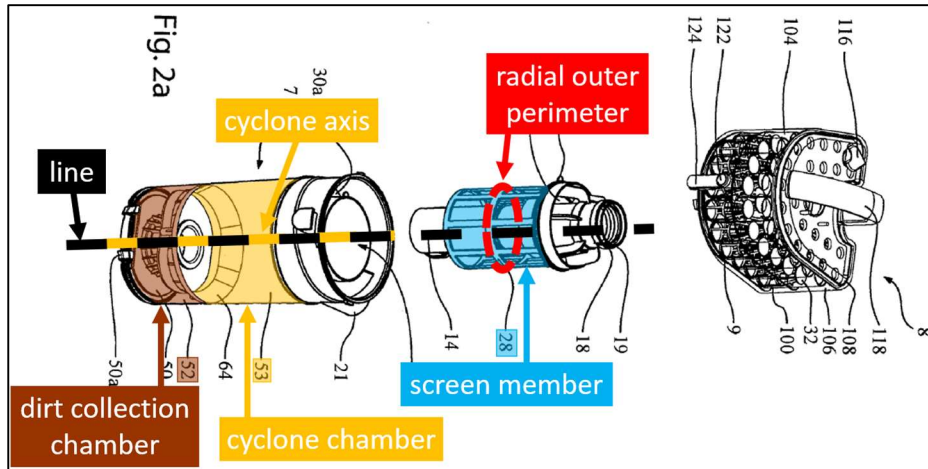
301. Conrad335 explains that “[a]ccordingly, the air that is traveling through the cyclone chamber towards the cyclone outlet must travel through the ... screen member 28” before it reaches the “suction motor 15 prior to exiting vacuum cleaner 1.” Ex1008 ¶¶274, 290. Thus, in my opinion, a POSA would have understood that Conrad335’s “screen member 28” is a pre-motor filter.

302. Conrad335 further teaches “a **filter 112** may be provided in a housing 110,” which “is a pre-motor filter,” as shown in the annotated images below:



Ex1008 ¶373, Figs. 2, 18-19.

303. In my opinion, Conrad335 teaches a line that is that is parallel to the cyclone axis extends through the dirt collection chamber and a location interior of a radial outer perimeter of a pre-motor filter. A **line** that is parallel to Conrad335's **cyclone axis** extends through "**dirt collection chamber 52**" and a location interior to the **radial outer perimeter** of "**screen member 28**" and "**filter 112**," as shown in the annotated images below:



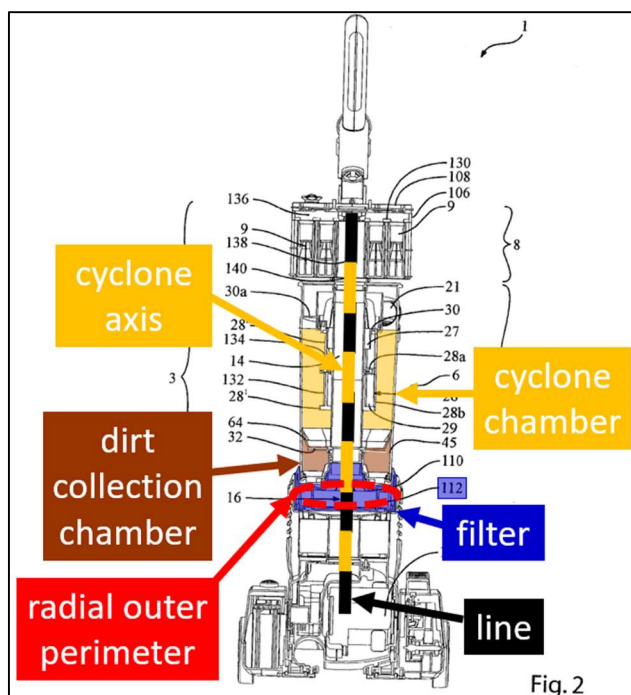


Fig. 2

Ex1008, Figs. 2-2a, 4.

304. In my opinion, a POSA would have been motivated to modify IPVG's "dust bag 5" with Conrad335's cyclone-separator and pre-motor filter teachings and would have reasonably expected success. Ground 2, §1. Also, in my opinion, the combined teachings meet these limitations because they incorporate Conrad335's cyclone-separator and pre-motor filter teachings, including "screen member 28" and "filter 112."

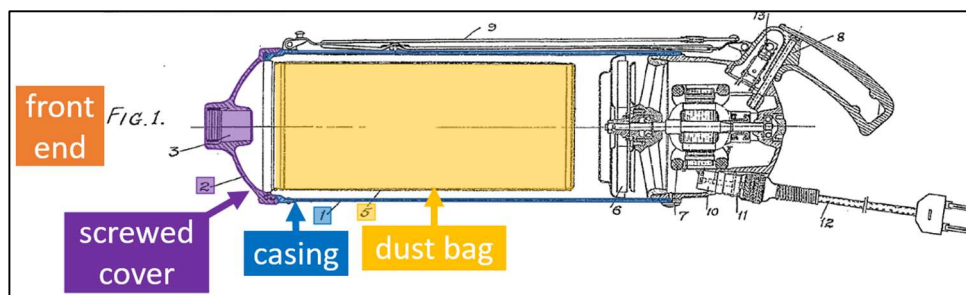
e. [1a.3]/[10b]

Reference Number	Claim Limitation
[1a.3]	“(iii) a dirt collection chamber that is exterior to the cyclone chamber and a forward end of the dirt collection chamber is openable;”
[10b]	“(b) a dirt collection chamber that is exterior to the cyclone chamber and a forward end of the dirt collection chamber is openable;”

305. In my opinion, the combined teachings of IPVG and Conrad335 teaches a dirt collection chamber that is exterior to the cyclone chamber and a forward end of the dirt collection chamber is openable.

306. As I explained above, Conrad335 teaches a dirt collection chamber that is exterior to the cyclone chamber. Ground 1, Limitations [1a.2]/[8a.2]/[9a.2]/[10a.2]/[14a.2]/[15a.2].

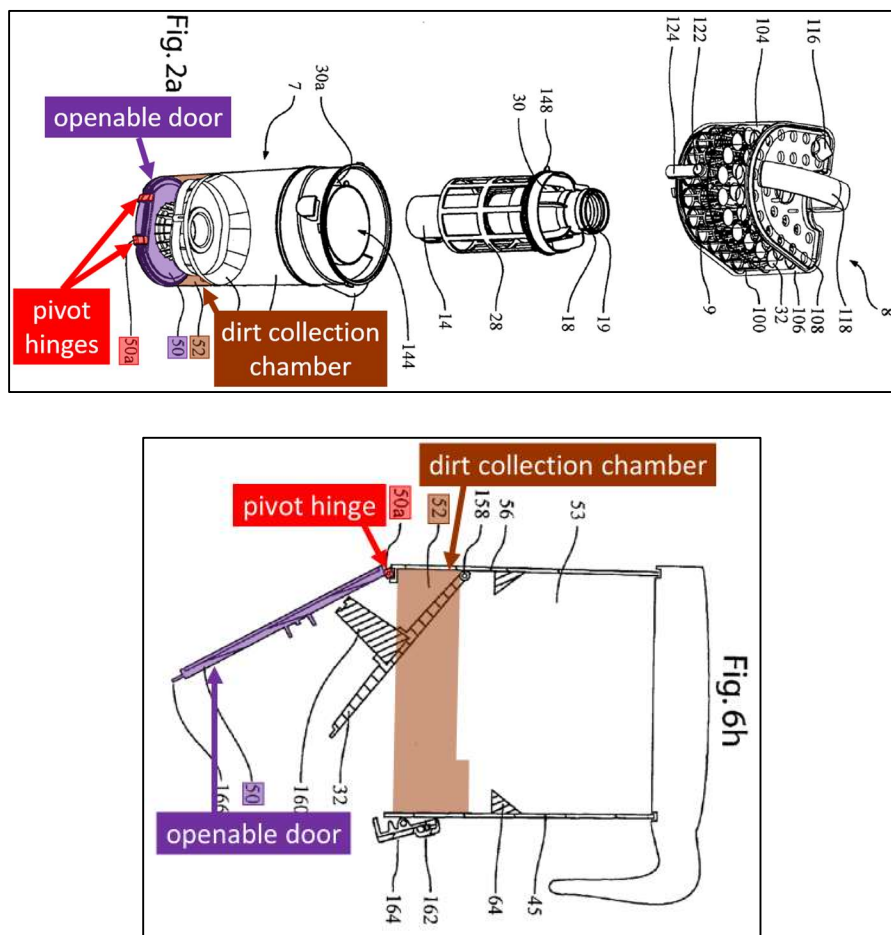
307. Further, in my opinion, IPVG combined with Conrad335 teaches a forward end of the dirt collection chamber is openable. IPVG teaches a “**dust bag or like member [5]**” that is positioned in “**casing 1** closed at the **front end** by a **screwed cover 2**,” as shown in the annotated image below:



Ex1007, 1:51-57, Fig. 1.

308. In my opinion, a POSA would have understood that IPVG’s “screwed cover 2” is an openable forward end of IPVG’s “casing 1,” which, individually or together with IPVG’s dust bag 5,” is a dirt collection chamber.

309. Likewise, Conrad335 teaches an “**openable door [50]**” that can be “pivoted open about, e.g. **pivot hinges 50a**,” and Conrad335 depicts the “**dirt collection chamber 52**” in an opened position when “**openable door [50]**” is pivoted open, as shown in the annotated images below:



Ex1008 ¶¶147, 338-39, Figs. 2a, 6h.

310. Conrad335 teaches that the “dirt collection chamber has a bottom that is openable,” and when “[c]yclonic [cleaning] stage 7” is full, it “may then be emptied, e.g., by opening a bottom pivoting door 50.” Ex1008 ¶¶23, 350.
311. In my opinion, a POSA would have been motivated to modify IPVG’s “dust bag 5” with Conrad335’s cyclone-separator teachings and modify IPVG’s “screwed cover 2” with Conrad335’s openable-door teachings and would have reasonably expected success. Ground 2, §1. Also, in my opinion, the combined teachings meet these limitations because Conrad335’s “opening door 50” would cover a forward end of the dirt collection chamber that is exterior to the cyclone chamber.

f. [1b]/[8b]/[9b]/[14b]/[15b]/[10c]

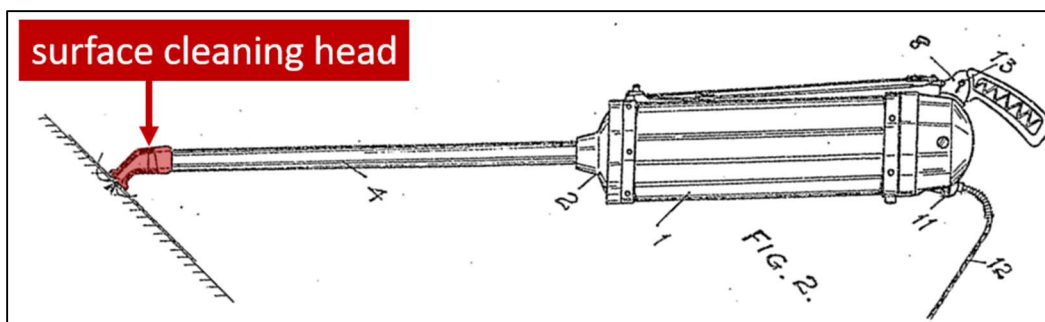
Reference Number	Claim Limitation
[1b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,”
[8b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,”
[9b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,”
[14b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,”
[15b]	“(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,”
[10c]	“(c) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,”

312. In my opinion, IPVG teaches a surface cleaning head having a front end, a

rear end, a dirty air inlet and a surface cleaning head air outlet (Limitations [1b]/[8b]/[9b]).

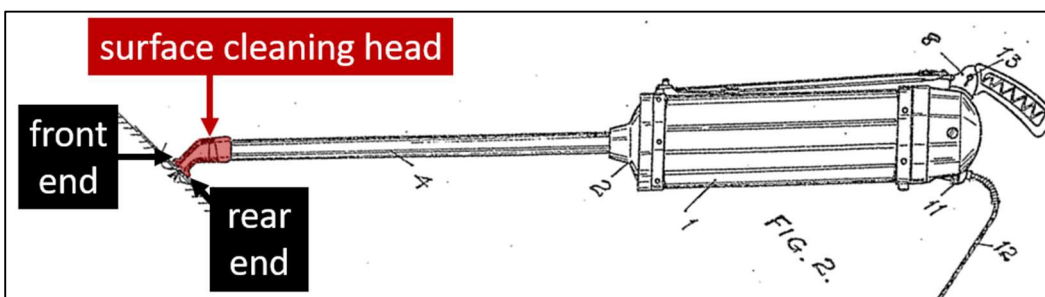
313. In my opinion, IPVG teaches a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet (Limitations [14b]/[15b]/[10c]).

314. A POSA would have understood that IPVG teaches a **surface cleaning head**, as shown in the annotated image below:



Ex1007, Fig. 2.

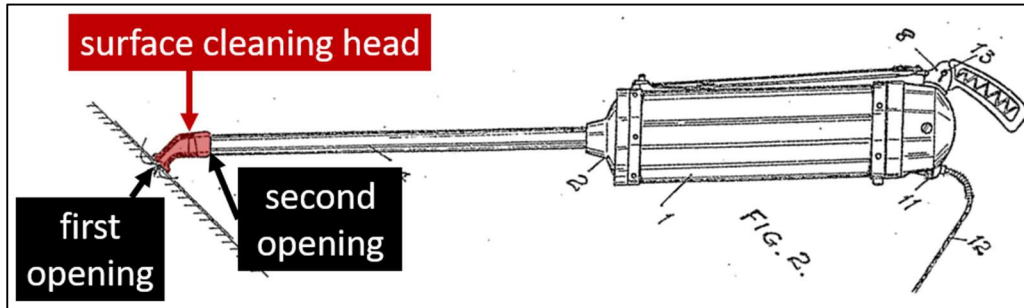
315. A POSA would have understood that IPVG's **surface cleaning head** has a **front end** and a **rear end**, as shown in the annotated image below:



Ex1007, Fig. 2.

316. In my opinion, a POSA would have understood that IPVG's surface

cleaning head has a dirty air inlet and a surface cleaning head outlet. A POSA would have understood that, in IPVG, air flows into the **surface cleaning head** via a **first opening**, and exits via a **second opening**, as shown in the annotated image below:



Ex1007, Fig. 2.

317. In my opinion, a POSA would have understood that IPVG's first opening is a dirty air inlet, and IPVG's second opening is a surface cleaning head air outlet.

g. [1c]/[8c]/[9c]/[14c]/[15c]/[10d]

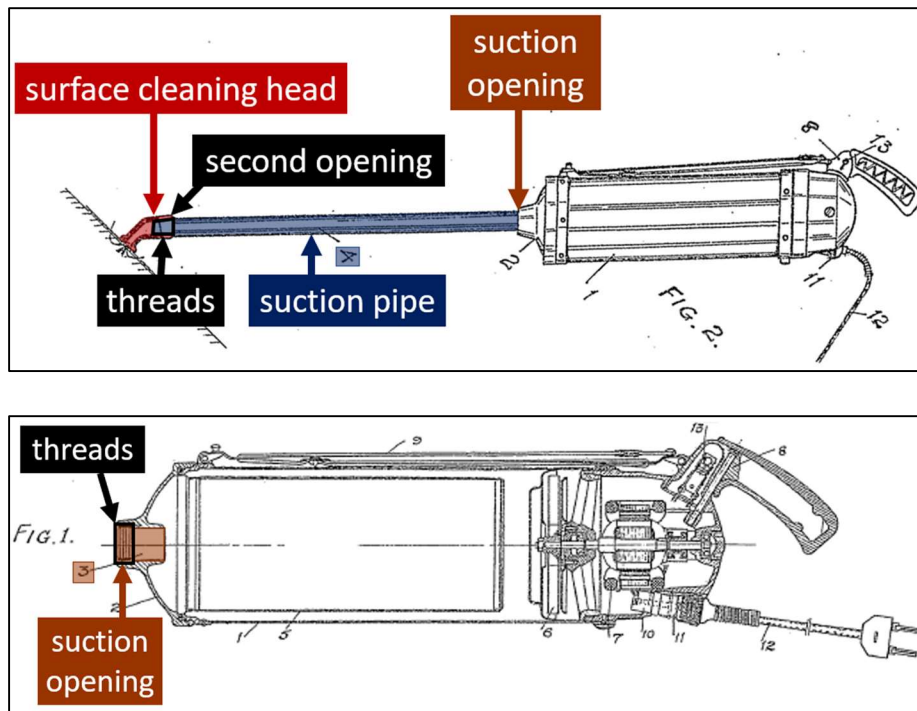
Reference Number	Claim Limitation
[1c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner,”
[8c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner,”
[9c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner,”
[14c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis,”
[15c]	“(c) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis,”
[10d]	“(d) a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis,”

318. In my opinion, IPVG teaches a rigid air flow conduit that is removably

mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner (Limitations [1c]/[8c]/[9c]).

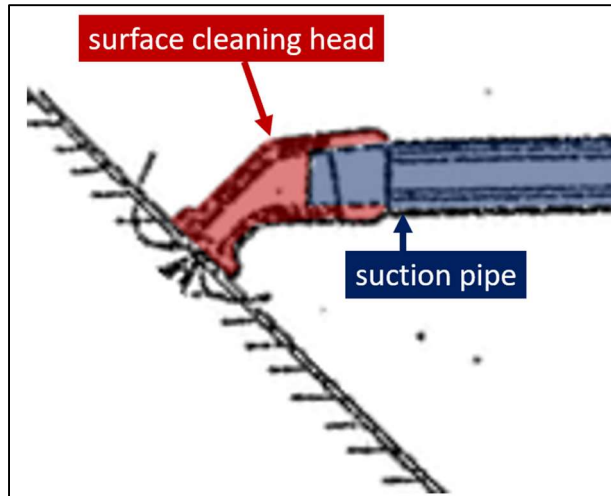
319. In my opinion, IPVG teaches a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis (Limitations [14c]/[15c]/[10d]).

320. In my opinion, IPVG teaches a rigid air flow conduit that is removably mountable to the surface cleaning head and, when attached to the hand vacuum cleaner and the surface cleaning head, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner. IPVG teaches a threaded “**suction pipe 4**” with a downstream end “for attaching” to a “**suction opening 3**,” and an upstream end for attaching to the **second opening** of the **surface cleaning head**, as shown in the annotated images below:



Ex1007, 1:51-57, Figs. 1-2.

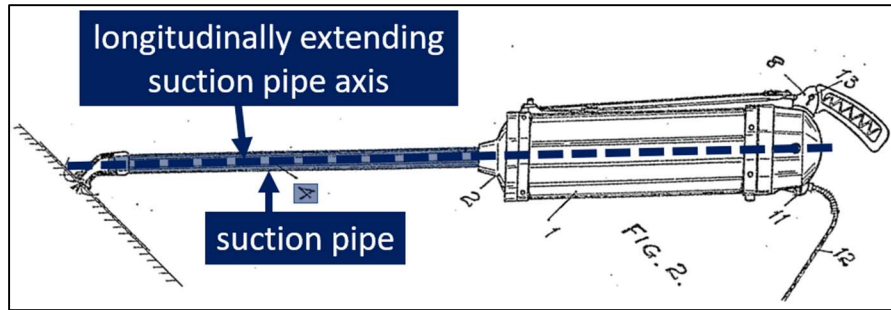
321. In my opinion, a POSA would have understood that IPVG’s “suction opening 3” and second opening each have mating **threads** that correspond to “**suction pipe 4[s]**” threads. As shown above, IPVG’s “**suction pipe 4**” is detached from IPVG’s “**suction opening 3**” in figure 1, and IPVG depicts the **surface cleaning head** and “**suction pipe 4**” as two separate components in figure 2, as shown in the annotated image below:



Ex1007, Fig. 2.

322. Thus, in my opinion, a POSA would have understood that IPVG’s “suction pipe” is a rigid airflow conduit; the second opening of the surface cleaning head is a surface cleaning head air outlet; “suction opening” is a hand vacuum dirty air inlet; and IPVG teaches a rigid airflow conduit that is removably mountable to the surface cleaning head and the hand vacuum cleaner and extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner.

323. Regarding Limitations [14c]/[15c]/[10d], in my opinion, IPVG’s **suction pipe** has a **longitudinally extending suction pipe axis**, which is a longitudinally extending conduit axis, as shown in the annotated image below:



Ex1007, Fig. 2.

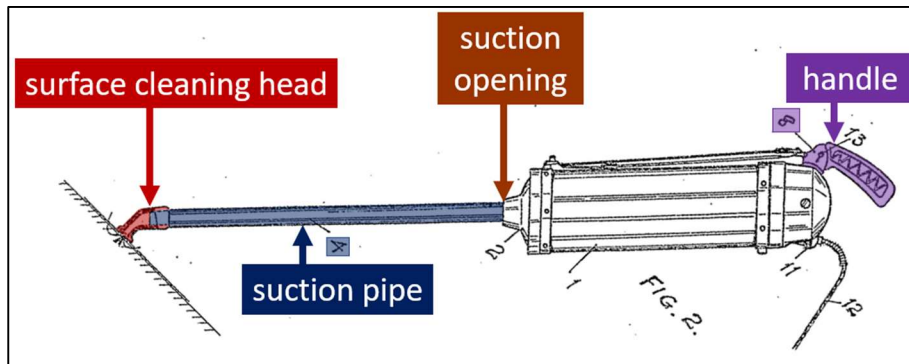
h. [1d]/[8d]/[9d]/[14d]/[15d]/[10e]

Reference Number	Claim Limitation
[1d]	“wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and”
[8d]	“wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and”
[9d]	“wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and”
[14d]	“wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and”
[15d]	“wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and”
[10e]	“wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and”

324. In my opinion, the combined teachings of IPVG and Conrad335 teaches

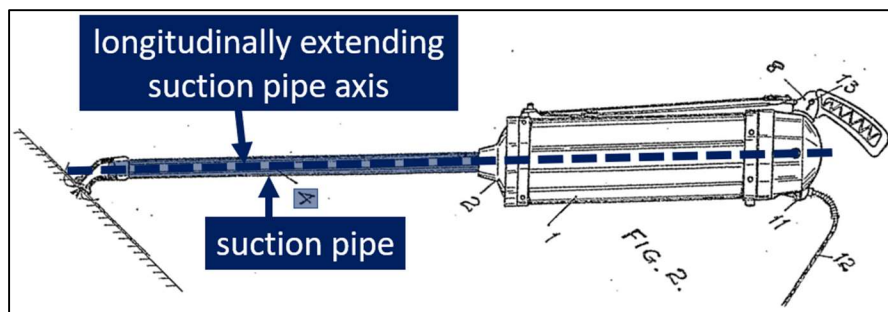
- wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus (Limitations [1d]/[8d]/[9d]).
325. In my opinion, the combined teachings of IPVG and Conrad335 teaches wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation (Limitations [14d]/[15d]/[10e]).
326. As I explained above, in my opinion, IPVG teaches the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit. Ground 2, Limitations [1c]/[8c]/[9c]/[14c]/[15c]/[10d].
327. In my opinion, when IPVG's vacuum is so mounted, a POSA would have understood that the pistol grip handle is a driving handle for the surface cleaning apparatus. IPVG's pistol grip "**handle [8]**" is used to "readily lift[]" the "portable dust suction apparatus" "during operation," and, in my

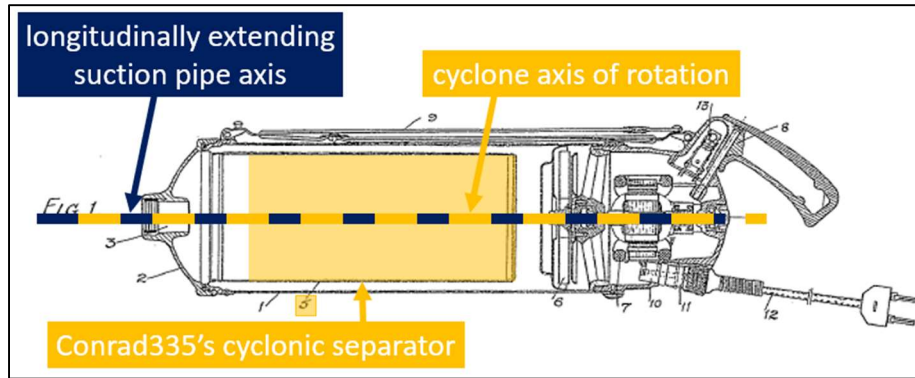
opinion, is a driving handle, as shown in the annotated image below:



Ex1007, 1:10-12, 1:22-33, Fig. 2.

328. Regarding Limitations [14d]/[15d]/[10e], in my opinion, IPVG combined with Conrad335 teaches the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation. In my opinion, when Conrad335's "cyclone separator 20" teachings are incorporated into IPVG's vacuum, IPVG's **longitudinally extending suction pipe axis** is parallel to Conrad335's **cyclone axis of rotation**, as shown in the annotated images below:





Ex1007, Figs. 1(modified)-2.

329. In my opinion, a POSA would have been motivated to modify IPVG's "dust bag 5" with Conrad335's cyclone-separator teachings and would have reasonably expected success. Ground 2, §1.

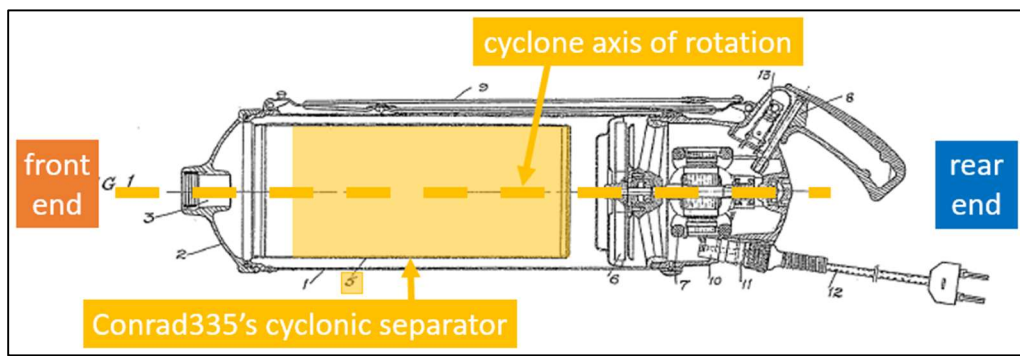
i. [1e]/[8e]/[9e]

Reference Number	Claim Limitation
[1e]	"wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal."
[8e]	"wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal,"
[9e]	"wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal."

330. In my opinion, the combined teachings of IPVG and Conrad335 teaches wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum

cleaner, the cyclone axis of rotation is generally horizontal.

331. In my opinion, when Conrad335’s “cyclone separator 20” teachings are incorporated into IPVG, and IPVG’s hand vacuum is positioned with the “**front end**” of the hand vacuum cleaner in front of the “**rear**” **end** of the hand vacuum cleaner, Conrad335’s **cyclone separator axis of rotation** is generally horizontal, as shown in the annotated image below:



Ex1007, Fig. 1(modified).

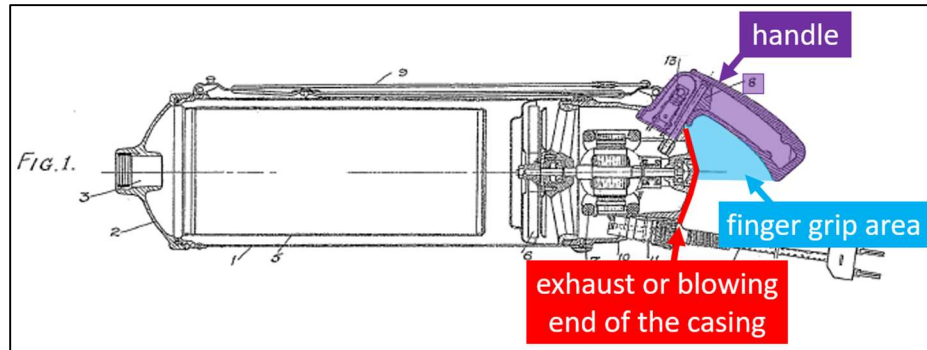
332. In my opinion, a POSA would have been motivated to modify IPVG’s “dust bag 5” with Conrad335’s cyclone-separator teachings and would have reasonably expected success. Ground 2, §1.

j. [14e]/[15e]/[10f]

Reference Number	Claim Limitation
[14e]	“wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone, and”
[15e]	“wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone.”
[10f]	“wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone.”

333. In my opinion, the combined teachings of IPVG and Conrad335 teaches wherein a finger grip area is provided at a location that is forward of the pistol grip handle and rearward of the cyclone.

334. In my opinion, IPVG teaches a finger grip area. A POSA would have understood, in my opinion, that IPVG teaches a **finger grip area** between IPVG's "**handle 8**" and "the **exhaust or blowing end of the casing**," as shown in the annotated image below:

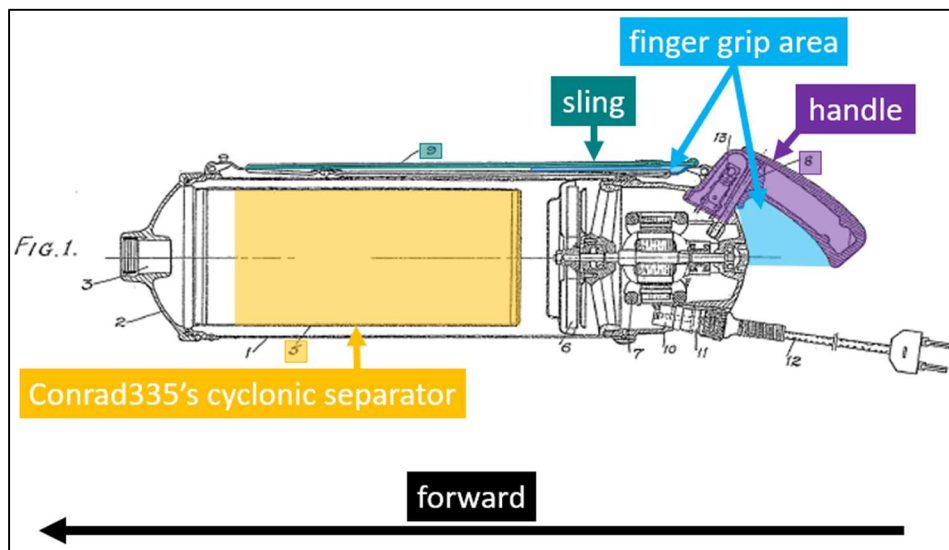


Ex1007, 1:57-62, Fig. 1.

335. In my opinion, a POSA would have understood that when a user grips IPVG's "handle 8," their fingers wrap into the finger grip area identified above.

336. IPVG also teaches "a **sling 9** which may be used to support the body of the apparatus in known matter," as shown in the annotated image below:

areas identified above are provided forward of “handle 8” and rearward of Conrad335’s “cyclone separator” comprising a cyclone, as shown in the annotated image below:



Ex1007, Fig. 1(modified).

339. In my opinion, a POSA would have been motivated to modify IPVG’s “dust bag 5” with Conrad335’s cyclone-separator teachings and would have reasonably expected success. Ground 2, §1.

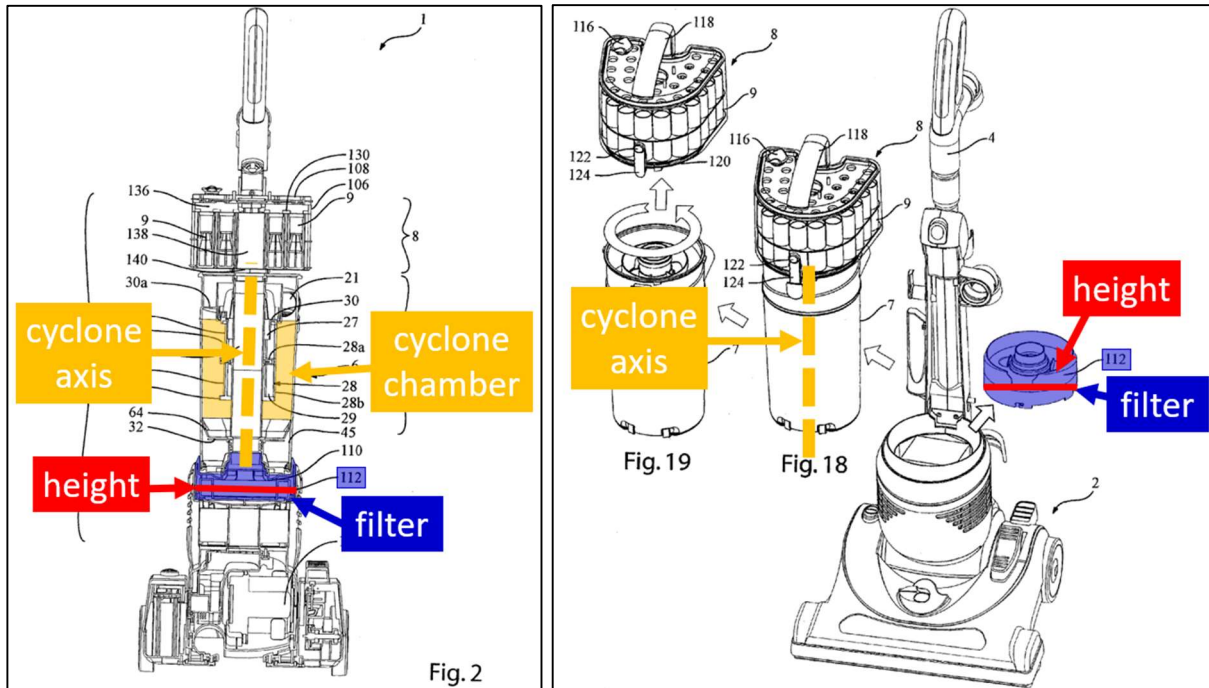
k. [8f]/[14f]

Reference Number	Claim Limitation
[8f]	“wherein a pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.”
[14f]	“wherein a pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.”

340. In my opinion, the combined teachings of IPVG and Conrad335 teaches

wherein a pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

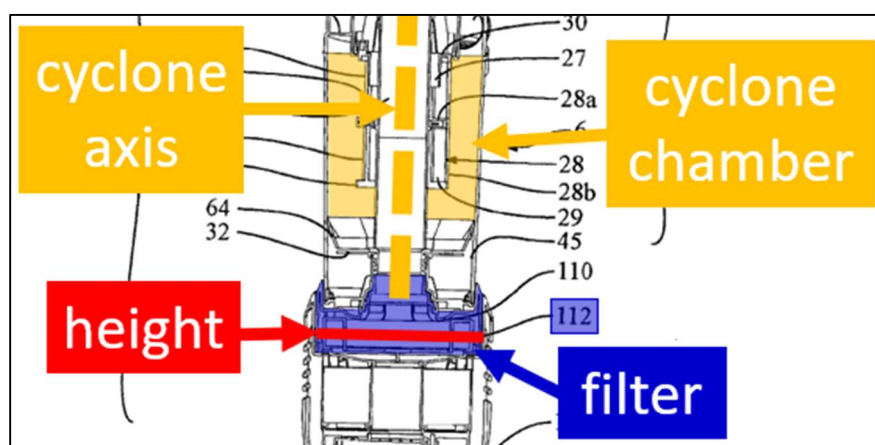
341. In my opinion, Conrad335 teaches that a pre-motor filter has a height in a direction transverse to the cyclone axis. In my opinion, a POSA would have understood that Conrad335's "filter 112" has a height in a direction transverse to "cyclone chamber 53[s]" cyclone axis, as shown in the annotated images below:



Ex1008, Figs. 2, 18-19.

342. Also, in my opinion, Conrad335 teaches that the pre-motor filter height is larger than the diameter of the cyclone. Conrad335 teaches that the "cyclone separator 20" has a "cyclone separator wall 45" with an "inner surface 56." Ex1008 ¶¶320, 322. In my opinion, a POSA would have

understood that the diameter of the cyclone in Conrad335's "cyclone chamber 53" is contained within "inner surface 56," because that is where cyclonic airflow occurs. Further, in my opinion, a POSA would have understood that the height of Conrad335's "filter 112" is greater than the diameter of the "cyclone separator wall 45." In my opinion, Conrad335's "cyclone separator" fits within the outer edges (i.e., the height in a direction transverse to the cyclone axis) of "filter 112," which is wider than the "cyclone separator," as shown in the annotated image below:



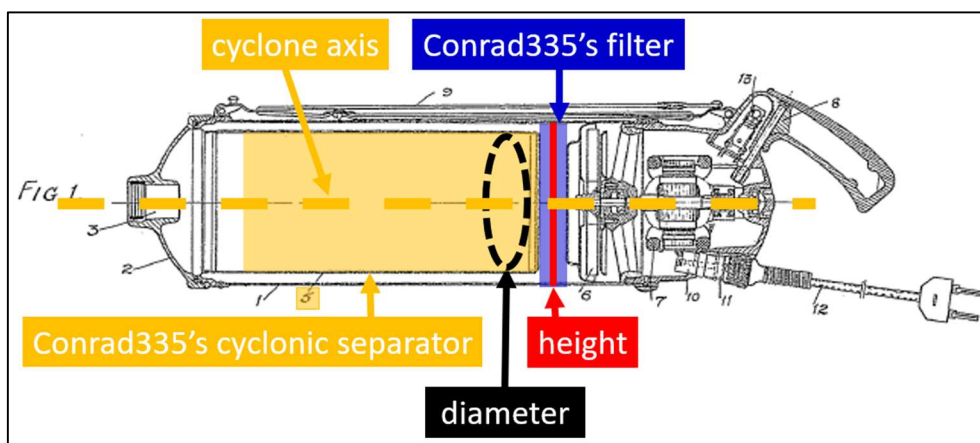
Ex1008, Fig. 2; *see also id.*, Fig. 18.

343. Thus, in my opinion, a POSA would have understood that the height of Conrad335's "filter 112" in a direction transverse to the cyclone axis is larger than the diameter of Conrad335's "cyclone chamber 53" comprising a cyclone.

344. In my opinion, a POSA would have been motivated to modify IPVG's "dust bag 5" with Conrad335's cyclone-separator teachings, including

“filter 112,” and would have reasonably expected success. Ground 2, §1.

Also, in my opinion, when Conrad335’s “cyclone separator 20” teachings are incorporated into IPVG’s vacuum, Conrad335’s “filter 112” has a **height** in a direction transverse to Conrad335’s **cyclone axis** and the **height** is larger than a **diameter** of the cyclone positioned within Conrad335’s **cyclonic separator**, as shown in the annotated image below:



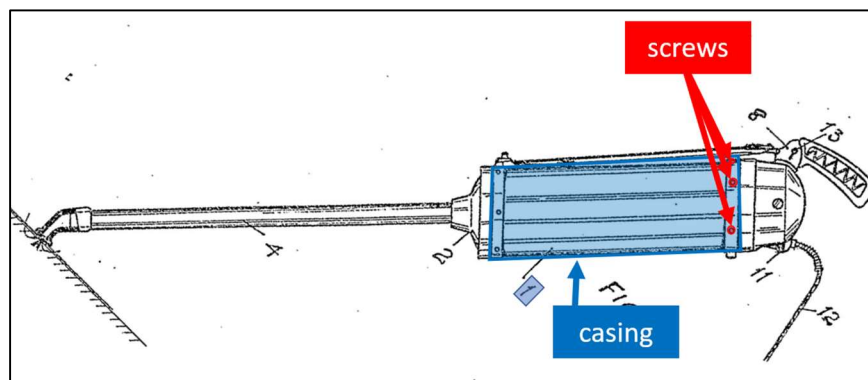
Ex1007, Fig. 1(modified).

2. [2]/[12]

Reference Number	Claim Limitation
[2]	“The surface cleaning apparatus of claim 1 wherein the cyclone unit is removably mounted to the main body.”
[12]	“The surface cleaning apparatus of claim 10 wherein the cyclone unit is removably mounted to the main body.”

345. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 1 wherein the cyclone unit is removably mounted to the main body.

346. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 10 wherein the cyclone unit is removably mounted to the main body.
347. In my opinion, a POSA would have understood that IPVG's "**casing 1**," in which "dust bag 5" is stored, is removable from the hand vacuum cleaner by removing the **screws**, as shown in the annotated image below:



Ex1007, Fig. 2.

348. IPVG describes the use of "screws" in the context of the handle:

As shown more particularly in Fig. 3, the handle 8 is provided with a conical portion 14 which is received in a conical bore 15 of the casing 1. The handle is further formed with a bore adapted to receive a screw 16 which is arranged parallel to the axis of the conical bore 15, but eccentrically thereof. The screw 16 screws into a lug 17 formed on the casing 1. On screwing the screw 16 into the lug 17 the conical surfaces are drawn together and pressed rigidly one within the other so that an entirely secure arrangement is provided in a simple and inexpensive manner.

The handle 8 is covered with an insulating cover 18 which is formed in one piece. This cover 18 is preferably formed of soft or hard rubber or other suitable insulating material. On the inside of the cover are projections or ribs 19 which engage in recesses 20 formed in the handle 8. On drawing the cover over the handle these projections 19 yield but assume their normal form as soon as they lie opposite the recesses 20 so that a secure fastening of the cover 18 on the handle 8 is obtained. These projections together with the corresponding recesses 20 are preferably located at the rear end of the handle so that they need slide over a short portion only of the handle.

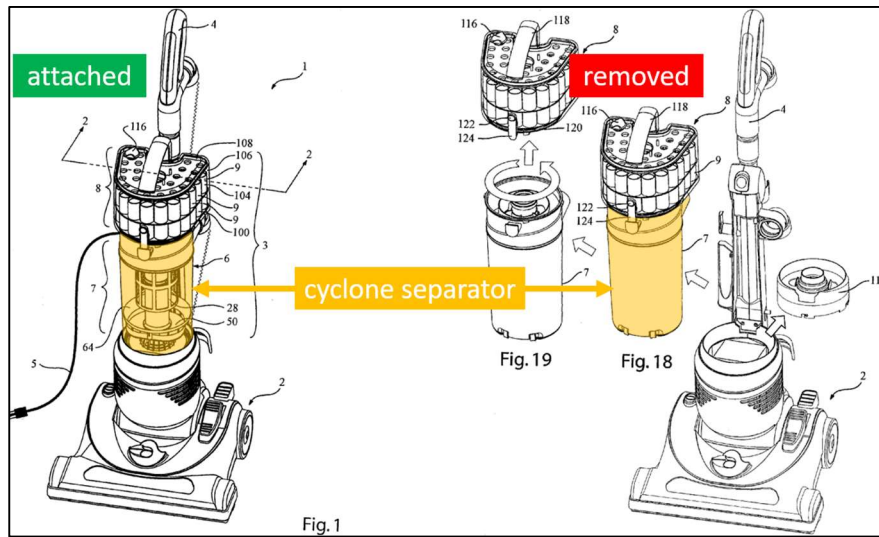
In order to fasten the cover 18 more securely on the handle it may be held by a sunk screw 21 which is arranged in a recess 22 in the cover 18. For this purpose one rear edge 23 of the handle is formed flat and provided with a threaded hole. The screw 21 can, if desired, be protected by a rubber plug 24.

Id., 1:70-2:3

349. In my opinion, a POSA would have understood that IPVG's "casing 1," together with "dust bag 5" are thus a removable air-filtration unit.

350. Likewise, Conrad335 teaches that the "first and second cyclonic stages 7, 8 may be removed at the same time from the vacuum cleaner" "so that they may be transported to a garbage can or the like for emptying." Ex1008 ¶¶177, 350. Conrad335 also depicts the "**first cyclonic stage 7**" comprising "**cyclone separator 20**" being removably mounted to the

vacuum main body, as shown in the annotated image below:



Ex1008, Figs. 1, 18-19.

351. In my opinion, these limitations are met when Conrad335's teachings are incorporated with IPVG's, either by using IPVG's screws or Conrad335's cyclonic-separator connection-and-release mechanism, which, in my opinion, a POSA would have been motivated to do for convenient emptying and maintenance and would have reasonably expected success doing. Ground 2, §1.

3. [3]

Reference Number	Claim Limitation
[3]	"The surface cleaning apparatus of claim 1 wherein the cyclone axis of rotation is generally parallel to the suction motor axis of rotation."

352. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 1 wherein the cyclone axis

of rotation is generally parallel to the suction motor axis of rotation.

353. In my opinion, IPVG combined with Conrad335 renders the limitations of this claim obvious for the same reasons discussed for Limitations [1a.2]/[8a.2]/[9a.2]/[10a.2]/[14a.2]/[15a.2]. Ground 2, Limitations [1a.2]/[8a.2]/[9a.2]/[10a.2]/[14a.2]/[15a.2].

4. [4]

Reference Number	Claim Limitation
[4]	“The surface cleaning apparatus of claim 1 wherein, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the pistol grip handle extends upwardly and forwardly.”

354. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 1 wherein, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the pistol grip handle extends upwardly and forwardly.

355. In my opinion, IPVG combined with Conrad335 renders the limitations of this claim obvious for the same reasons discussed for Limitations [1a.1]/[8a.1]/[9a.1]/[10a.1]/[14a.1]/[15a.1]. Ground 2, Limitations [1a.1]/[8a.1]/[9a.1]/[10a.1]/[14a.1]/[15a.1]

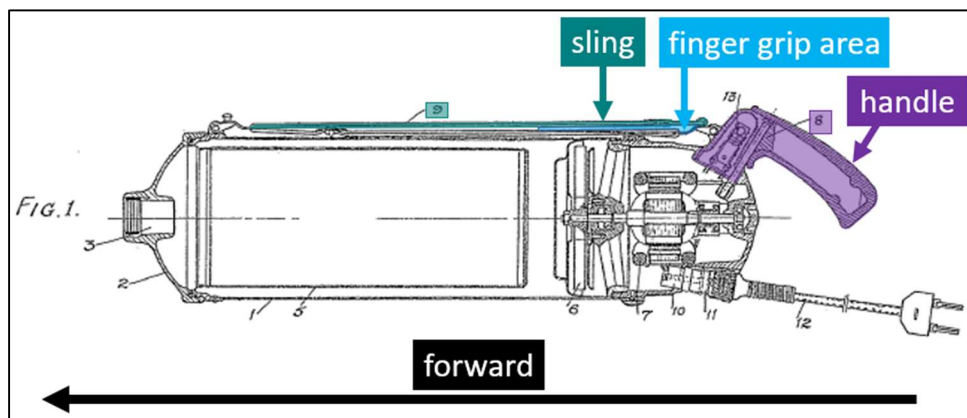
5. [5]

Reference Number	Claim Limitation
[5]	“The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.”

356. In my opinion, the combined teachings of IPVG and Conrad335 renders obvious the surface cleaning apparatus of claim 1 and IPVG teaches and renders obvious an enclosed finger grip area is provided on a forward side of the pistol grip handle.

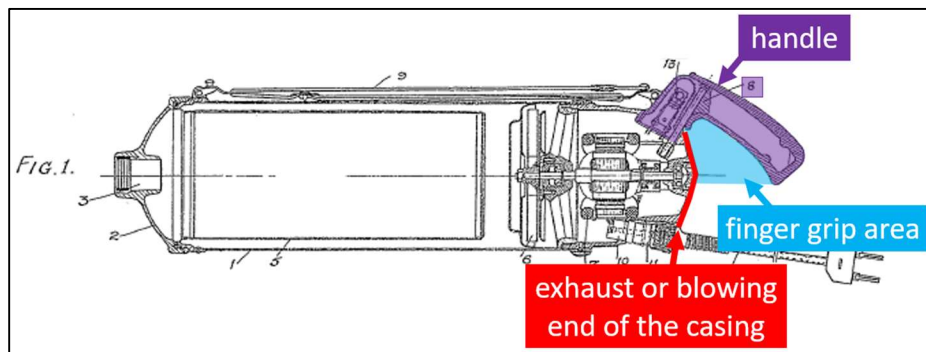
357. As I explained above, in my opinion, IPVG teaches a pistol grip handle and multiple finger grip areas. Ground 2, Limitations [1a]/[8a]/[9a]/[10a]/[14a]/[15a]/[14e]/[15e]/[10f].

358. In my opinion, IPVG teaches an enclosed **finger grip area** between “**sling** 9” and “**casing 1**” that is provided on a **forward** side of “**handle 8**,” as shown in the annotated image below:



Ex1007, Fig. 1.

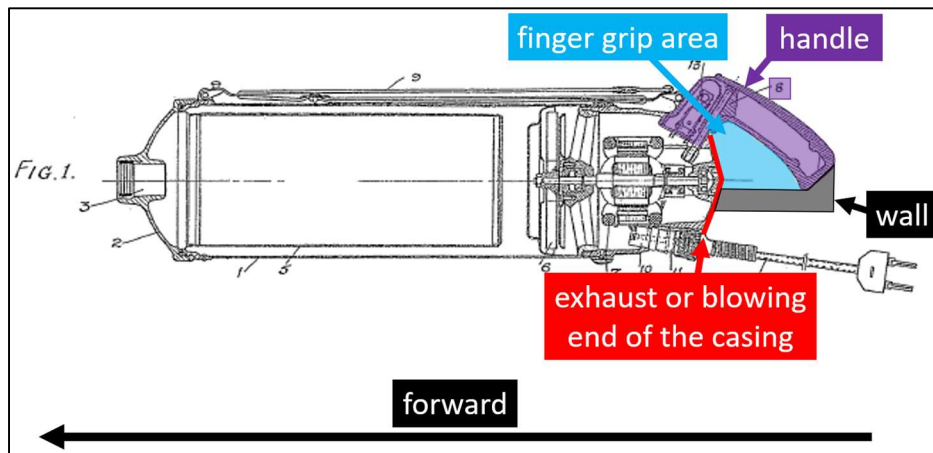
359. In my opinion, a POSA would have understood that the enclosed finger grip area identified above is provided on a forward side of IPVG's "handle 8," i.e., the side closest to IPVG's forward end.
360. To the extent PO argues the enclosed finger grip above is not provided on a forward side of the pistol grip handle, in my opinion, IPVG renders it obvious. In my opinion, IPVG teaches a **finger grip area** between IPVG's "**handle 8**" and "the **exhaust or blowing end of the casing**," as shown in the annotated image below:



Ex1007, 1:57-62, Fig. 1.

361. In my opinion, a POSA would have been motivated by IPVG's disclosures to modify IPVG to include an enclosed finger grip area. IPVG explains that its handle is designed to protect the user's hand: "handle 8" has a "cover 18 ... formed of soft or hard rubber or other suitable insulating material" "so that the operator ... may be fully protected against accidental contact with current carrying parts of the apparatus." Ex1007, 1:13-21, 1:87-89. In my opinion, a POSA would have understood that, to further

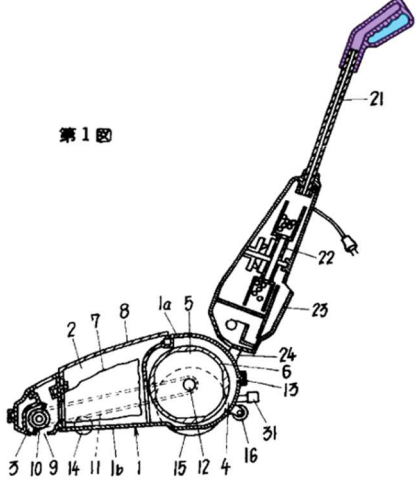
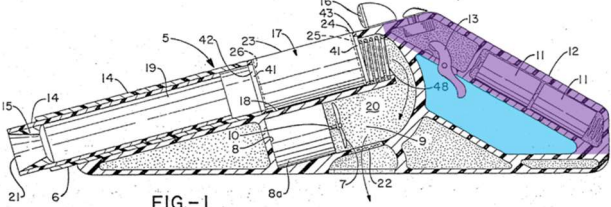
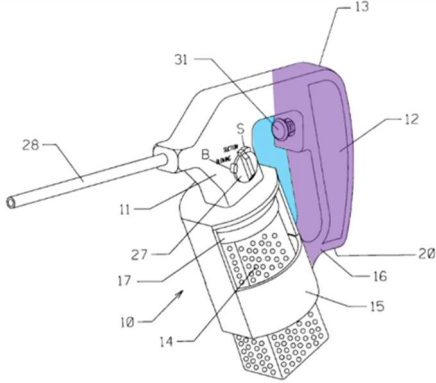
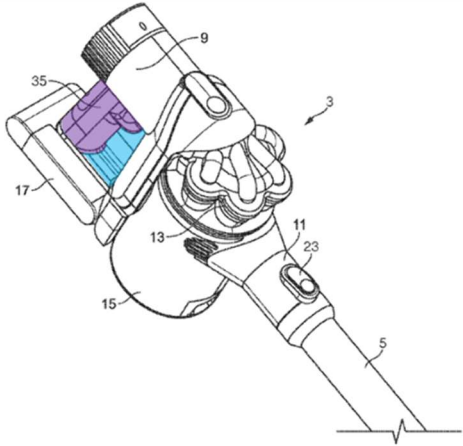
this objective by protecting the user's hand against current and against physical objects during use, it would have been obvious to enclose IPVG's **finger grip area** with a **wall** that extends from "the **exhaust or blowing end of the casing**" to the bottom of "**handle 8**" and is provided on a **forward** side of "**handle 8**," as shown in the annotated image below:



Ex1007, Fig. 1(modified).

362. In my opinion, a POSA would have understood that modifying IPVG as shown above would have certain benefits, including (1) protecting the user's fingers from being hit or pinched by objects during use, (2) providing multiple hand grip positions for different use cases, and (3) providing an additional mounting location for IPVG's handle, thereby reducing stress on the handle mount and increasing component longevity. Further, in my opinion, a POSA would have understood that there were a finite number of handle configurations, including open handles and

enclosed handles. And, in my opinion, **pistol grip handles** with **enclosed finger grip areas** were well-known in the art, as shown in the annotated images below:

JPS5113663U (1974), Fig. 1	Ex1025 (1989), Fig. 1
 第1圖	 FIG. 1
Ex1026 (1999), Fig. 1	Ex1027 (2012), ¶41 (“pistol grip handle 35”), Fig. 2
 FIGURE 1	 FIG. 2

363. Thus, in my opinion, modifying IPVG as described would have been obvious to try, easy to implement, and would have yielded the predictable

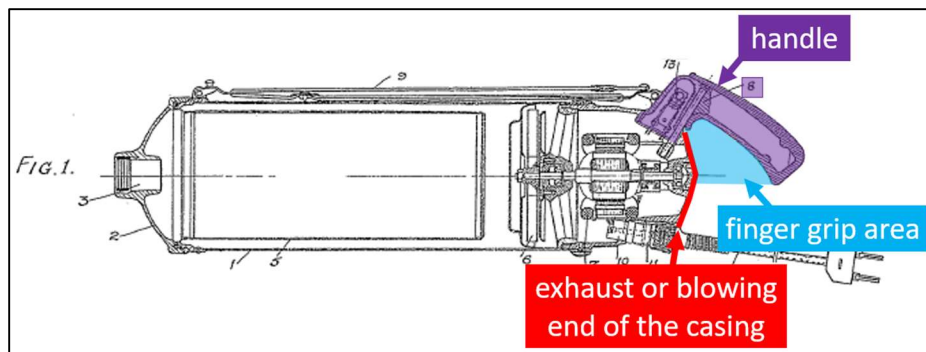
result of “protect[ing]” “the operator[’s]” hand. Ex1007, 1:13-21, 1:87-89. Also, in my opinion, a POSA would have reasonably expected success making this modification because it would have only involved incorporating a straightforward, well-known part—namely, a rigid wall.

6. [6]

Reference Number	Claim Limitation
[6]	“The surface cleaning apparatus of claim 1 wherein the cyclone axis of rotation intersects the finger grip area.”

364. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 1 and teaches the cyclone axis of rotation intersects the finger grip area.

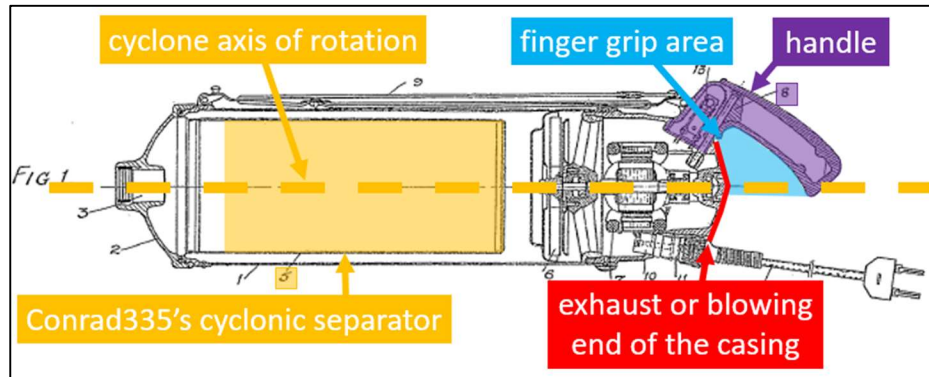
365. In my opinion, IPVG teaches a **finger grip area** between IPVG’s “**handle 8**” and “the **exhaust or blowing end of the casing**,” as shown in the annotated image below:



Ex1007, 1:57-62, Fig. 1.

366. In my opinion, when Conrad335’s “**cyclone separator 20**” teachings are

incorporated into IPVG's vacuum, Conrad335's **cyclone axis of rotation** intersects IPVG's **finger grip area**, as shown in the annotated image below:



Ex1007, Fig. 1(modified).

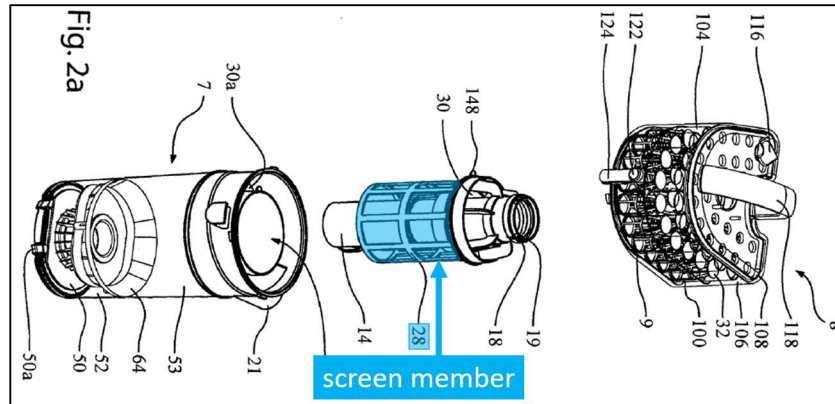
367. In my opinion, a POSA would have been motivated to modify IPVG's "dust bag 5" with Conrad335's cyclone-separator teachings and would have reasonably expected success. Ground 2, §1.

7. [7]/[13]

Reference Number	Claim Limitation
[7]	"The surface cleaning apparatus of claim 2 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body."
[13]	"The surface cleaning apparatus of claim 10 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body."

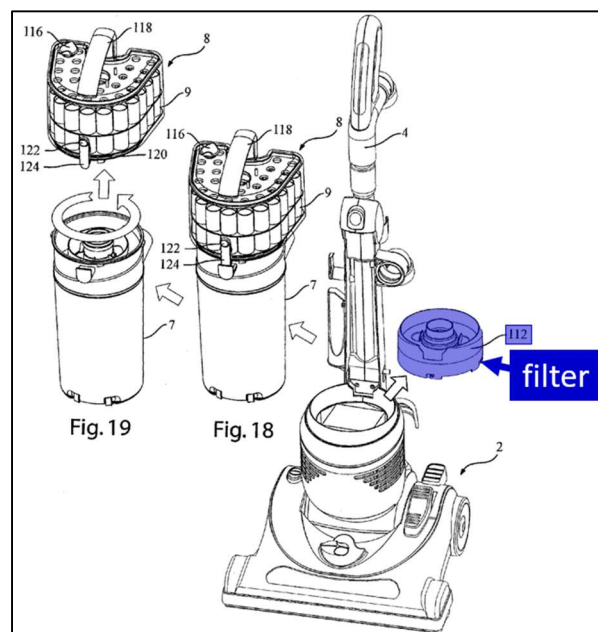
368. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 2 and teaches a pre-motor

- filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body.
369. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 10 and teaches a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body.
370. As I explained above, in my opinion, Conrad335 teaches multiple pre-motor filters, and IPVG combined with Conrad335 teaches a removable cyclone unit. Ground 2, Limitations [1a.2]/[8a.2]/[9a.2]/[10a.2]/[14a.2]/[15a.2], Claims 2/12.
371. Also, in my opinion, Conrad335 further teaches that the pre-motor filter is accessible when the cyclone unit is removed from the main body. Conrad335 teaches that when “cyclone separator 20” is removed from the main body, “screen [member] 28 may be removed” and “placed over a garbage can and banged against the side to loosen the dirt contained therein,” as shown in the annotated image below:



Ex1008 ¶¶287, 292, Fig. 2a.

372. Likewise, Conrad335 teaches that “when **filter 112** is dirty and requires cleaning or replacement,” “the first and second cyclonic stages are removed” and “the consumer ... [may] remov[e] **filter 112** from the vacuum cleaner,” as shown in the annotated image below:



Ex1008 ¶¶271, 373.

373. In my opinion, these limitations are met when Conrad335’s teachings are

incorporated with IPVG's, either by using IPVG's screws or Conrad335's cyclonic-separator connection-and-release mechanism to release the cyclone unit and provide access to the pre-motor filters, which, in my opinion, a POSA would have been motivated to do for convenient emptying and maintenance and would have reasonably expected success doing. Ground 2, §1.

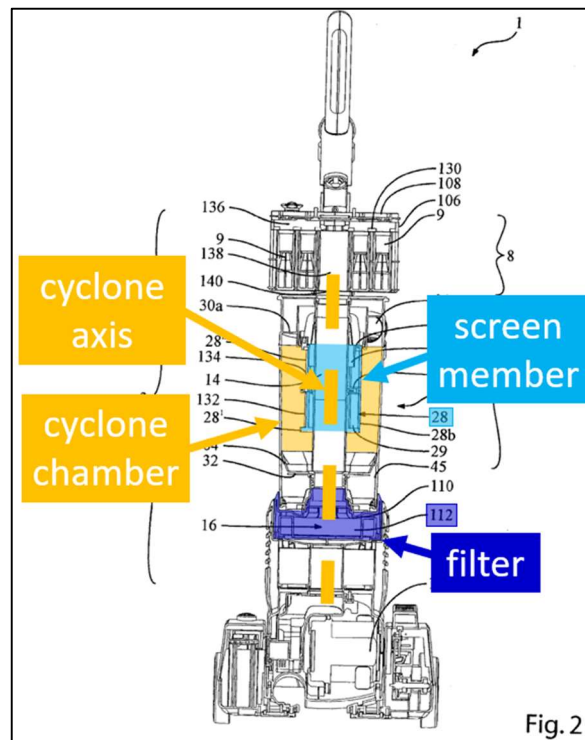
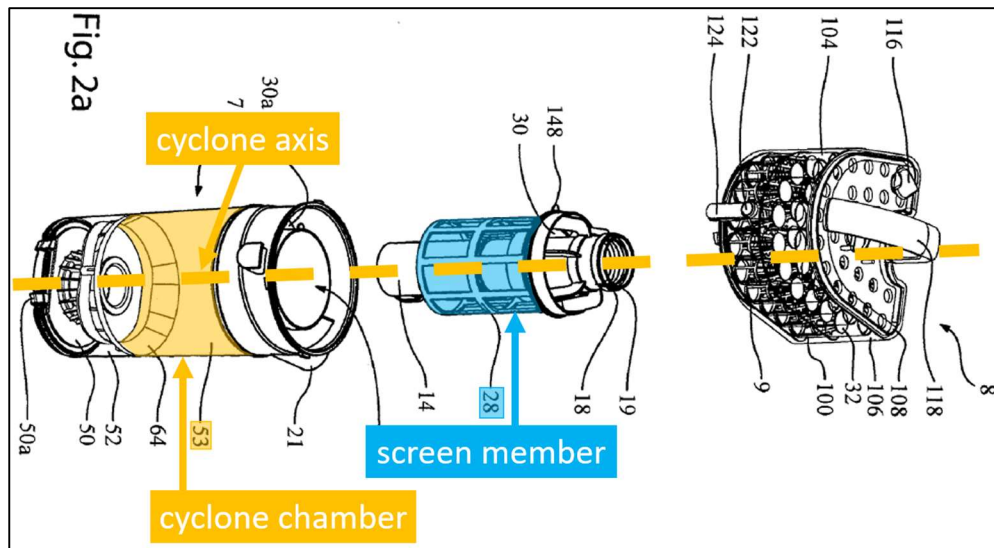
8. [11]

Reference Number	Claim Limitation
[11]	"The surface cleaning apparatus of claim 10 further comprising a pre-motor filter, wherein the cyclone axis of rotation intersects the pre-motor filter."

374. In my opinion, the combined teachings of IPVG and Conrad335 render obvious the surface cleaning apparatus of claim 10 and teaches a pre-motor filter, wherein the cyclone axis of rotation intersects the pre-motor filter.

375. As I explained above, in my opinion, Conrad335 teaches multiple pre-motor filters. Ground 2, Limitations [1a.2]/[8a.2]/[9a.2]/[10a.2]/[14a.2]/[15a.2].

376. In my opinion, Conrad335 further teaches that the cyclone axis of rotation intersects the pre-motor filters. A POSA would have understood that Conrad335's **cyclone axis of rotation** intersects "**screen member 28**" and "**filter 112**," as shown in the annotated images below:



Ex1008, Figs. 2-2a.

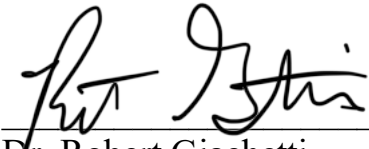
377. In my opinion, a POSA would have been motivated to modify IPVG’s “dust bag 5” with Conrad335’s cyclone-separator teachings and would have reasonably expected success. Ground 2, §1. Also, in my opinion, the

combined teachings likewise meet these limitations.

XI. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

378. I am unaware of any secondary considerations of non-obviousness that provide evidence the claims of the above patents are not obvious. To the contrary, as I explained in detail above, the claims are based on an obvious combination of well-known vacuum cleaner parts and configurations. To the extent Patent Owner attempts to argue there are secondary considerations of non-obviousness, I reserve the right to evaluate Patent Owner's arguments and purported evidence at that time.

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

Signature: 
Dr. Robert Giachetti

Dated: July 5, 2024