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Title: Negative Air Filtration System

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Cited Documents

D1 US 4 979 967 A

D2 US 2018/055033 A1

D3 US 5 761 908 A

D4 KR 2019 0018181 A

D5 KR 2016 0134962 A

D6 WO 2016/013469A1

D7 WO 2016/004399A1

Summary of the EPC Communication

Items 3.1 and 3.2 - Inventive Step

With respect to previously presented arguments and amendments, the EPC Communication alleges that the subject matter of claim 1 lacks an inventive step in view of the combination of D5 and the general knowledge and also in view of the combination of D7 and the general knowledge, Article 56 EPC.

We have argued that independent claim 1 in the previously presented form is novel and inventive in view of D5 and D7 as Main request, and we have amended independent claim 1 as an auxiliary request.

Main Request

Brief description of the argument

We respectfully submit that independent claim 1 is novel and inventive over cited references, because D5 and D7, either alone or in combination, do not disclose:

"inlet (210) is disposed on a lower surface (201) of the housing (200), the inlet (210) and the outlet (220) being vertically oriented, and the lower surface (201) comprising a surface area of less than 4 sq. ft (0.4 m2)," as recited in independent claim 1.

We respectfully submit that the Examiner's suggestion in item 3.1 of the EPC communication, that rotating the device of Figure 1 by 90 degrees would position the inlet and outlet on the top part of the device, does not accurately reflect the specific configuration claimed in A1.

Independent claim 1 explicitly defines the inlet as being located on the lower surface of the housing, with the outlet vertically oriented on the upper surface. This configuration is integral to the operational efficiency of the negative air filtration system, ensuring optimal airflow dynamics and filtration performance through sequential stages from intake to discharge. In contrast, D5 primarily addresses dehumidification through a refrigeration cycle, focusing on moisture control to prevent frost formation on the heat exchanger. D5 does not emphasize on the precise orientation or placement of the inlet and outlet relative to the housing as critical to its function. The structural and operational features necessary for effective filtration, as claimed in amended independent claim 1, including negative pressure generation and sequential filtration stages, are not disclosed in D5.

Further, we respectfully submit that the dehumidifier disclosed in D5 and the negative air filtration system described in the present claims fundamentally address different technical challenges. D5 is primarily focused on extracting moisture from the air to prevent frost formation on the heat exchanger during dehumidification, i.e., to ensure efficient dehumidification performance by averting frost, which can obstruct the dehumidification process. Thus, the teachings of D5 revolve around humidity control and frost prevention, without addressing <u>negative pressure or the integrity of filters</u>. (See, e.g., paragraphs [0001]-[0006] of D5).

The technical problem addressed by the present claims concerns the removal of airborne contaminants to prevent the spread of infectious diseases. Additionally, the negative air filtration system described in the present claims underscores ease of installation and mobility, crucial attributes in environments like hospitals where space is limited and rapid deployment is essential. Therefore, the negative air filtration system not only purifies the air but also maintains a clean environment, particularly in isolation rooms, while minimizing its footprint and enhancing mobility (See, e.g., paragraphs [0002]-[0003] and [0024]-[0034] of the specification).

Moreover, rotating the device of FIG. 1 of D5 by 90 degrees to align the inlet and outlet on the top part would not replicate the specialized configuration and functional benefits asserted by independent claim 1. In fact, such a reorientation may disrupt the intended airflow dynamics and compromise the functionality of D5's components, such as compressors and heat exchangers, which are optimized for a specific orientation and operational mode to manage humidity and temperature effectively.

Therefore, we respectfully submit that the Examiner's assertion regarding the reconfiguration of D5's device to match the claimed configuration overlooks critical structural and operational distinctions, and accordingly, we submit that D5 fails to teach or suggest "*inlet (210) is disposed on a lower surface (201) of the housing (200), the inlet (210) and the outlet (220) being vertically oriented, and the lower surface (201) comprising a surface area of less than 4 sq. ft (0.4* m^2*)*," as recited in amended independent claim 1.

TECHNICAL CHARACTER OF THE PRESENT CLAIMED INVENTION

TECHNICAL PROBLEM:

The technical problem addressed by the present claims is the need for a highly efficient air filtration system that can effectively remove airborne contaminants in environments requiring stringent contaminant control. The challenges associated with the problem include maintaining the integrity of filters under negative pressure, preventing leaks, simplifying maintenance and monitoring, and accommodating space constraints.

TECHNICAL SOLUTION:

The technical solution provided by the present claims is a negative air filtration system designed with a housing that has strategically placed inlet and outlet ports, creating a vertically oriented airflow path. Inside the housing, a pre-filter is positioned immediately downstream of the inlet, followed by a HEPA filter, and a fan assembly that generates negative pressure across these filters. The arrangement ensures the efficient removal of airborne contaminants, optimizes space utilization, and simplifies installation, maintenance, and monitoring. The negative pressure generation helps minimize stress on the filters and prevents leakage, while the streamlined maintenance and monitoring processes enhance the system's operational reliability.

TECHNICAL EFFECT:

The technical effect of the claimed invention is the reliable filtration of airborne contaminants in critical environments, such as hospital isolation rooms. By positioning the inlet on the lower surface of the housing and orienting both the inlet and outlet vertically, the system achieves a compact and a space-efficient design. This innovative feature, coupled with the generation of negative pressure across the filters, ensures effective air filtration with a minimized footprint. Consequently, the system enhances air quality, reduces maintenance demands, and simplifies deployment, thereby contributing to a safer and a healthier environment.

The dehumidifier, in D5, is primarily focused on moisture removal through a refrigeration cycle, addressing technical challenges like frost management and humidity control, with no consideration for airborne contaminant filtration. Its horizontal airflow design, lack of filtration components, and absence of negative pressure generation are fundamentally different from the present claims, which involve vertically oriented airflow, integrated pre-filters, and HEPA filters operating under negative pressure. Thus, D5 provides no suggestion or motivation for reconfiguring its system to tackle the air filtration challenges of the present claims, and as such, a transformation would require significant, non-suggested structural and functional changes.

Therefore, D5 fails to teach or suggest the features of independent claim 1.

Further, the Examiner, in item 3.2 of the EPC communication, alleges "claim 1 also lacks an inventive step in view of the combination of D7 and the general knowledge, Art 56 EPC."

We respectfully traverse the above contention of the Examiner for the following reasons:

We respectfully submit that Figure 5 of D7 illustrates the internal components of an air purification system, showing a side-surface inlet directing airflow inward. In this design, the primary filters are vertically aligned with filter fans positioned above, guiding airflow through the filters and out through the outlet vents. The arrangement contrasts with the claimed configuration, which features <u>a lower-surface inlet and vertically oriented inlet and outlet</u>.

Figure 1 of D7, on the other hand, provides an external view of the room air cleaner's structure, depicting the housing, air inlet, and outlet without detailing their specific internal arrangement. Unlike Figure 5, which focuses on internal layout, Figure 1 gives an external overview, lacking the necessary granularity to infer internal configurations accurately.

Furthermore, the Examiner's assertion appears to reflect hindsight bias, disregarding that D7, in its entirety, does not teach or suggest the claimed configuration. Figures 1 and 5 of D7 show distinct configurations, and adapting Figure 5 to match the claimed invention would entail substantial structural changes, such as repositioning the inlet, filters, and fans, which would alter airflow dynamics and require an internal redesign not suggested by D7. Therefore, the claimed invention's configuration is not an obvious modification but a unique and an innovative arrangement distinct from D7.

Thus, D7 fails to teach or suggest "the inlet (210) is disposed on a lower surface (201) of the housing (200), the inlet (210) and the outlet (220) being vertically oriented, and the lower surface (201) comprising a surface area of less than 4 sq. ft (0.4 m2)," as recited in independent claim 1. Hence, D7 also fails to solve the above-mentioned objective technical problem as required by the present claims.

Accordingly, independent claim 1 is novel and inventive over D5 and D7.

Therefore, dependent claims are also novel and inventive, at least by their dependency on amended independent claim 1, which should be allowable for the reason(s) stated above.

<u>Auxiliary request</u>

<u>Brief description of the argument</u>

We respectfully submit that amended independent claim 1 is novel and inventive over D5 and D7, because cited references do not disclose:

"the inlet (210) is disposed on a lower surface (201) of the housing (200), the inlet (210) and the outlet (220) being vertically oriented, and the lower surface (201) comprising a surface area of less than 4 sq. ft (0.4 m^2), and the fan assembly (500) comprises a constant torque motor (510) comprising an operating torque, the constant torque motor (510) being operably connected to a selection device (511), the selection device (511) configured to adjust the operating torque," as recited in amended independent claim 1.

D7 generally relates to systems and methods for producing purified air. D7 describes a room air cleaner system that includes a housing with an air inlet and outlet, and employs at least one filtration fan to draw air into the housing, creating a filtration airflow. Within the housing, a filter box containing at least one primary filter purifies the air by removing ultra-fine particles, which is then expelled into the room by a recirculation fan (see, e.g., Abstract of D7).

We respectfully submit that the system described in D7 differs significantly from the fan and motor configuration of amended independent claim 1.

Unlike D7, which uses separate filtration and recirculation fans for different functions, leading to system complexity and potential inefficiencies, the claimed system employs a single fan assembly with a constant torque motor. D7 does not address the use of a constant torque motor. D7 describes filtration and recirculation fans without highlighting the advantages of a constant torque motor with adjustable torque. Thus, D7's system does not suggest or imply the specific benefits provided by the claimed configuration, demonstrating a significant departure from the design and functionality of the claimed invention.

With respect to D5, the problem addressed relates to the efficiency and performance of a dehumidifier when frost occurs on the heat exchanger during operation. Frost formation on the heat exchanger can hinder the dehumidification process, leading to reduced efficiency and potentially affecting the reliability of the product (See, e.g., paragraphs [0001]-[0006] of D5). D5 provides a dehumidifier including a compressor for controlling the amount of refrigerant gas compressed. When the temperature of the heat exchanger falls within a preset temperature range for a preset time during the dehumidification operation, the driving speed of the compressor is lowered to a preset value, and it operates for a preset time. This controlled operation helps prevent frost formation on the heat exchanger by adjusting the compressor's performance based on temperature conditions.

However, D5 is silent regarding "the fan assembly (500) comprises a constant torque motor (510) comprising an operating torque, the constant torque motor (510) being operably connected to a selection device (511), the selection device (511) configured to adjust the operating torque," as recited in amended independent claim 1.

With respect to previously presented claims 7 and 8, the limitations of which have been partially incorporated into amended independent claim 1, the EPC Communication, dated August 25, 2021 asserts that document D1 discloses the limitations of claims 7 and 8 and refers to motor 206 and Col. 8 lines 22–34 of D1 to support the same.

D1, in column 8, lines 22–34, describes:

> "AHU 22 is comprised of a blower 204 driven by a blower motor 206, which is electrically powered and preferably includes a variable torque frequency inventer (not shown) that allows operation of motor 206 over a range of 0 to 100% full load amps, thus proportionately changing the motor's rotations per minute from 0 to 100% of the motor's design. Preferably, the motor's speed and/or torque may be varied in increments of as little as 0.1% of the maximum. In practice, AHU 22 responds to commands from microprocessor 26 based on readings of outside air pressure versus chamber air pressure made by a differential pressure transducer (208)."

D1 describes an air handling unit (AHU) comprising a blower motor driven by a variable torque frequency inverter, controlled by a microprocessor to maintain a predetermined air pressure differential.

Amended independent claim 1 specifies that the fan assembly comprises a constant torque motor connected to a selection device configured to adjust the operating torque. This design feature ensures consistent negative pressure across the pre-filter and HEPA filter, reducing stress on the filters and minimizing potential leaks. Unlike D1's variable torque motor controlled by a frequency inverter, the constant torque motor in amended independent claim 1 provides a more stable and predictable performance, enhancing the reliability of the filtration system.

Additionally, the use of a selection device to adjust the operating torque of the constant torque motor, as specified in amended independent claim 1, provides a simpler and potentially more reliable means of torque control compared to the complex control system involving a microprocessor in D1. Therefore, D1 does not disclose "*the fan assembly (500) comprises a constant torque motor (510) comprising an operating torque, the constant torque motor (510) being operably connected to a selection device (511), the selection device (511) configured to adjust the operating torque*," as recited in amended independent claim 1.

TECHNICAL PROBLEM

The technical problem addressed by the present claims involves shortcomings in traditional negative air machines used for filtering contaminants such as asbestos, mold, and microbes. These machines typically generate positive pressure across their filters, which can strain the filters and seals, potentially causing leaks and compromising filtration reliability. Moreover, they often rely on complex microprocessor systems to monitor filter clogging, which adds to manufacturing complexity and costs. The use of constant CFM motors in these systems also complicates operations, necessitating additional mechanisms for adjusting to different environmental conditions, thereby limiting operational flexibility.

TECHNICAL SOLUTION

The technical solution offered by the present claims is a negative air filtration system that addresses these challenges through a distinctive design. In this system, the fan assembly is positioned downstream of both the pre-filter and HEPA filter within a vertically oriented housing. This setup generates negative pressure across the filters, minimizing stress and potential leaks. A key feature is the use of a constant torque motor linked to a selection device, enabling straightforward adjustment of torque to maintain consistent negative pressure and airflow. This approach avoids the need for complex electronic systems such as microprocessors.

TECHNICAL EFFECT

The technical effect of the present claims prevents leaks and ensures effective contaminant removal, especially in critical settings like hospital isolation rooms. It simplifies the system, lowering manufacturing and maintenance costs by eliminating microprocessor dependency. Additionally, the adjustable torque feature of the constant torque motor provides operational flexibility, making the system adaptable to various environments with minimal reconfiguration.

Therefore, none of D1, D5, and D7 disclose such a configuration as claimed in amended independent claim 1.