

TITLE**A VARIABLE SPEED MULTI DIRECTIONAL AIR VENTILATION AND PURIFICATION HELMET**

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FIELD OF THE INVENTION

The subject matter herein relates to the helmets, particularly relates to the smart helmets, which are capable of redirecting impure surrounding air of the helmet for ventilation and cooling purposes inside the helmet and then purifying and
10 supplying directed purified air outside the helmet with high velocity for the user to breathe the same thereby protecting the helmet wearer from harmful effects of air pollution while keeping the user's head ventilated.

BACKGROUND AND PRIOR ART

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Helmets and other protective headgear have evolved over the years. It is not uncommon for individuals to wear helmets and other protective headgear for recreational activities and sports, for example, jockeys in horse racing, football, ice hockey, cricket, baseball, camogie, hurling and rock climbing; dangerous
20 work activities such as construction, mining, riot police, military aviation, and in transportation (e.g., motorcycle helmets and bicycle helmets) as well as for other general safety purposes.

Helmets have the primary function of protecting the head of a person from an
25 injury that may be sustained while engaged in work, sports and other activities. Moreover, as outdoor activities have increased in popularity, the need emerged for multifunctional helmets, which are adapted to specific needs of work environments.

In many industrial working environments, for example, oil & gas, mining, power, construction, and forestry, heat stress is a common occurrence as the temperature and humidity are abnormally high. Sometimes, the high
5 temperature and/or humidity might be present along with protective clothing worn by the workers. This situation makes things worse for the workers to work at site, especially when they have to work at high work rate. Activities like drilling, blasting and welding add to the heat load put on workers, on the surface and underground. Power equipment such as engines, motors,
10 compressors and some lighting also increase the amount of heat found in these working environments.

In such a warm environment, respiratory protectors are less likely to be donned and in fact are more uncomfortable and even distracting to the workers while
15 working at high temperature, thereby posing a great risk. This situation worsens even further, when the workers are exposed to air pollutants, gases, fumes, etc. which are commonly found or are a byproduct in such settings. It is in these hot-weather activities, the workers are also affected with physical strain. Human bodies itself generate a significant amount of heat, especially
20 when strenuous movement is involved. It causes health problems such as heat stroke, fainting, exhaustion, cramps, and dehydration.

Furthermore, the workers are also affected by movement from a very hot workplace to one that is significantly colder, especially when they are exposed
25 to rapid change in temperature. Therefore, adequate protection should be given not only to the flesh of the body of the worker but also to the head of the worker which should also be protected from such rapid change in temperature.

The harder you work the more heat and sweat your body produces. Blood
30 transports this heat from the core to the shell where it reaches the tiny

capillaries in your skin. The capillaries dilate (expand) and cause a rise in skin temperature. If there is nothing between your skin and the air, this heat is thrown off. However, when a body is shielded or prevented from normal circulation of air like when wearing a helmet, perspiration/sweat does not evaporate, thus eliminating the body's main mechanism for cooling. This shielding does not occur in most parts of the human body as the clothes that are worn absorb the sweat and in turn enable evaporation of the sweat thereby resulting in cooling of the human body parts. However, a hard shell of a helmet prevents this normal circulation and evaporation of the air from the head leading to accumulation of sweat as is commonly observed in various industrial environments, sports, etc.

A detailed assessment has revealed that higher temperatures can cause detrimental circumstances for the workers and eventually causing loss to the employers. These hot, humid environments make the workers lose concentration and take dangerous shortcuts. The ability to remain alert during lengthy and monotonous tasks, and the ability to make quick decisions are adversely affected by the heat. It has been assessed that there are lowest accident rates related to workers who are working at temperature less than 21 0C as compared to the workers who are working at the temperature above 27 0C.

To deal with such situation, measures have been taken for creating ventilation systems in enclosed locations or places where work is being done. However, the said ventilation systems have proven to be non-effective for areas within the close proximity of the workers. Furthermore, these systems are expensive and difficult to install and maintain within open areas where, especially mining and construction takes place. These open areas also have very high air pollution as a result of all the industrial activity and wearing of masks lead to even more discomfort for the workers. Even sun blockers and protective clothing is used

when working in the sun. However, the same restricts the air movement on the head and causes discomfort caused by the sweat. It also causes headaches due to temperature rise, hair loss and eventually health of the workers are affected. Sometimes, the workers do not even wear helmets because of discomfort
5 caused to them from wearing these helmets in such working environment.

In mining, which is the extraction of valuable minerals or other geological materials from the Earth. During the process of underground mining, workers have to enter and work in confined spaces. This is hazardous due to the dangers
10 created by pollutants which gets leaked from the fissures or mining rocks. In this kind of working areas, including mines, open fields and construction sites, the workers inhale mostly pollutants and polluted air. Therefore, even the ventilation system fitted in the particular locations cannot protect each and every worker from inhaling pollutants or polluted air. Wearing masks are not
15 an option due to all the reasons discussed above. The WHO estimates that 4.2 million people die prematurely every year as the result of exposure to outdoor (or ambient) air pollution.

Few technologies have been developed that provide ventilation inside the helmet, however, such inventions are mostly developed only for the purpose of
20 passing air from the vents without employing any technical means. These technologies are not at all helpful or usable within the mines/construction sites or any other similar working locations, where the wind pressure is nil and the air is highly polluted.

25 Furthermore, some companies have developed helmets installed with air conditioner like Jarsh Air Conditioner Helmet, however, the same changes the entire dimensions and shape of the shell of helmet, which should not have been changed considering the safety standards established for the safety helmets.
30 These helmets also take external source of power to operate and is significantly

heavier and bulkier than the standard safety helmet. These helmets also affect the health of the person wearing it, as the worker working in the hot and humid climate will only be getting cool air on the head while the entire body remains exposed to heat, which again is unhealthy for workers.

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Therefore, an apparatus or a product or a system was needed, which could overcome the problems associated with earlier developed smart helmets.

AIMS AND OBJECTIVES

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The primary objective of the invention is to develop a smart helmet, which allows the workers to get the air circulation throughout their head while also ensuring that the air gets purified within the helmet and circulated back to the wearer for inhaling, without disturbing the safety standards applicable for manufacturing the safety helmets and without compromising the safety of the workers. This air multi-directional ventilation and purification helmet developed simultaneously and continuously provides ventilation to the head of the wearer and purified directed air to the face of the wearer, thereby reducing the chances of heat strokes and inhalation of pollutants or polluted air.

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SUMMARY OF THE INVENTION

The present invention is for a multi directional air ventilation and purification helmet, that provide ventilation inside the helmet, wherein the air ventilated is first purified with the help of the pre-filter membrane which are attached to the vents, placed at variable angles across the shell of the said helmet. Thereafter, the high velocity air travels through the whole helmet, giving ventilation and cooling effect to the head by enabling evaporation of sweat and then exiting

from the bottom of the peak of the variable speed multi directional air ventilation and purification helmet, after passing through air purification filters.

5 The air sucked with the help of the micro suction pump or a micro fan, gets cleaned of the macro air pollutants with the help of pre-filters placed across the air vents. Thereafter, the semi-purified air travels through the helmet, wherein it regulates the temperature of the head. The circulated air now laden with moisture from the evaporated sweat is then received at the peak of the helmet, wherein it gets purified with a combination of activated carbon filter, charcoal
10 filter and HEPA filter (High Efficiency Particulate Air Filter). The clean air then leaves from the vents, with high velocity, situated at the bottom of the peak of the helmet.

This invention is not only aimed at providing smooth ventilation to the head of
15 the wearer, but it also helps the wearers breathe fresh air all the time, without being affected or exposed to the pollutants or polluted air from their working environment. This invention gives comfort to the wearer and prevents sweat accumulation, headaches and other related health issues. This invention further protects the worker from the health risk which may be caused due to exposure
20 of rapid change or variation in the temperature across various body parts.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1: Top view of the variable speed multi directional air ventilation and
25 purification helmet.

Figure 2: Bottom view of the variable speed multi directional air ventilation and purification helmet.

Figure 3: Perspective view of the variable speed multi directional air ventilation and purification helmet.

Figure 4: Back view of the variable speed multi directional air ventilation and purification helmet.

Figure 5: Side view of the variable speed multi directional air ventilation and purification helmet.

Figure 6: Air Flow Diagram of the variable speed multi directional air ventilation and purification helmet.

Figure 7: Jarsh Air Conditioning Helmet.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to the development of a variable speed multi directional air ventilation and purification helmet, that provide ventilation inside the helmet, wherein the air ventilated is first purified with the help of the pre-filter membrane which are attached to the vents (Figure 1 (2, 3 and 4)), placed at variable angles across the shell of the said helmet. Thereafter, the high velocity air travels through the whole helmet, giving ventilation and cooling effect to the head by enabling evaporation of sweat and then exiting from the bottom of the peak of the variable speed multi directional air ventilation and purification helmet, after passing through air purification filters.

In the present invention, the vents are strategically provided across the shell of the helmet, from where the air is sucked into the shell with the help of the suction mini/micro pump or fan (Figure 1 (1)), which sucks the polluted air from the vicinity of the worker. The air suction pump or fan is situated inside the peak [Figure 1(11)] of the Helmet. The air sucked with the help of the

suction pump, gets cleaned of the macro air pollutants with the help of pre-filters placed across the air vents. Thereafter, the semi-purified air travels through the helmet, wherein it regulates the temperature of the head.

- 5 The circulated air now laden with moisture from the evaporated sweat is then received at the peak of the helmet, wherein it gets purified with a combination of activated carbon filter, charcoal filter and HEPA filter (High Efficiency Particulate Air Filter) (Figure 3 (5) or Figure 1 (5)). The activated carbon filter absorbs any harmful gases, fumes, chemicals and volatile organic compounds.
- 10 The charcoal filters absorb any moisture resulting from the sweat on wearer's head. HEPA filters out any particles ranging from ultra-microscopic particles to the particles entirely detectable to the human eye. HEPA filter traps the air contaminants, asbestos, dust, dust mites, pollens, etc. which are present in the working environment, in a complex web of fibers. The clean air then leaves
- 15 from the vents (Figure 3 (6)) with high velocity, situated at the bottom of the peak of the helmet. The velocity and direction of the purified air can be manually adjusted for up/down/left/right direction and its speed can be customized using air guidance system vents fixed below the air filters based on the wearers preference and face structure.

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- This invention is not only aimed at providing smooth ventilation to the head of the wearer, but it also helps the wearers breathe fresh air all the time, without being affected or exposed to the pollutants or polluted air from their working environment. This invention gives comfort to the wearer and prevents sweat
- 25 accumulation, headaches and other related health issues. This invention further protects the worker from the health risk which may be caused due to exposure of rapid change or variation in the temperature across various body parts.

- Additionally, the present invention allows the wearer to eject and replace the
- 30 HEPA filter, Charcoal Filter and Activated Carbon Filter as a consolidated

cassette with the help of a single button push, situated at the side of the helmet. The helmet wearer gets an audio filter replacement alert for replacement of the consolidated filter cassette, intelligently programmed on the basis of usage and surrounding air quality in which the worker is working. This system is also
5 termed as helmet filter replacement alert system, which is built inside the helmet, the data of which is saved in the helmet as well as a central cloud.

There is also available at the bottom of the peak of the helmet i.e., below the removable filter cassettes, an adjustable air flow guidance system (Figure 3
10 (6)), which can be used to open or close, either fully or partially a certain portion of the purified air exit vent in order to control the speed and direction in which way the clean air is circulated as per the wearer's facial features and preferences.

15 The ventilation and purification system can be activated and deactivated with a press of a tactile switch or button (Figure 3 (7)) provided at the side of the helmet. On the first press, the system gets activated at minimum air flow speed and on further pressing, the speed of the air flow increases in a step wise manner until at the last press where the system gets deactivated.

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There is also toxic gas sensor (Figure 2 (8) or Figure 3 (8)) provided beneath the peak of the helmet, which detects or sense any toxic gas in the vicinity of the worker. Once the toxic gas detector detects any toxic gas, the signal will be received by the receiver which shuts down the Air Ventilating and Purifying
25 system.

As compared to the recently developed technologies, the current invention does not increase the weight of the helmet and therefore, the worker will not feel reluctant or hesitant to wear the variable speed multi directional air ventilation
30 and purification helmet disclosed in the present invention. This invention helps

in achieving the objectives as discussed in the preceding paragraphs, keeping the structural integrity of the helmet intact for safety purposes.

The high velocity purified air which is coming out from the air flow guidance system (Figure 3 (6)) directly on to the wearers face displaces any static or moving polluted environmental air that earlier surrounded the face of the wearer (Figure 6 (15)) and forms an air curtain in front of the wearers face by releasing a directional high velocity purified air thereby masking the wearer from surrounding air pollution without the need of wearing a physical mask and ensuring that the wearer inhales purified air from the air curtain.

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CLAIMS

I/We Claim:

- 5 1. A variable speed multi-directional air ventilation and purification helmet, comprising:
 - a) helmet body having outer shell [Figure 1 (9)], inner casing [Figure 2 (10)] and peak [Figure 1 (11)];
 - 10 b) pre-filter membrane attached to the vents [Figure 1 (2, 3 and 4)], placed at variable angles across the outer shell of the helmet [Figure 1];
 - c) air suction mini/macro pump or fan [Figure 1 (1)], situated at the peak of the Helmet;
 - 15 d) combination of activated carbon filter, charcoal filter and HEPA filter (High Efficiency Particulate Air Filter) in a form of a consolidated filter cassette [Figure 3 (5)];
 - e) an adjustable air flow guidance system [Figure 3 (6)];
 - f) a tactile switch or button [Figure 3 (7)], situated at the side of the
 - 20 helmet;
 - g) toxic gas sensor [Figure 1 (8)].
2. A variable speed multi-directional air ventilation and purification helmet system, wherein:
 - 25 a) the air is sucked into the shell of the helmet with the help of the air suction mini/macro pump or fan [Figure 1(1)], fixed inside the peak of the Helmet;

- b) the air sucked travels through the pre-filter membrane attached to the vents [Figure 1 (2, 3 and 4)], placed at variable angles across the shell of the helmet, wherein the air sucked gets cleaned of the macro air pollutants with the help of pre-filters placed across the air vents.
- c) the semi-purified air then travels through the helmet, wherein it regulates the temperature of the head;
- d) the circulated air laden with moisture from the evaporated sweat is then received at the peak of the helmet, wherein it gets purified with a combination of activated carbon filter, charcoal filter and HEPA filter (High Efficiency Particulate Air Filter) in a form of consolidated filter cassette (Figure 3 (5))
- e) the clean air then leaves from the vents attached to an air guidance system, [Figure 3 (6)], situated at the bottom of the peak of the helmet with high velocity;
3. A variable speed multi directional air ventilation and purification helmet as claimed in claim 1 and claim 2, wherein the velocity and direction of the purified air can be manually adjusted and customized using an air guidance system fixed below the air filters.
4. A variable speed multi directional air ventilation and purification helmet as claimed in claim 1 and claim 2, wherein the consolidated filter cassette can be ejected and replaced with the help of a single button push, situated at the side of the helmet.

5. A variable speed multi directional air ventilation and purification helmet as claimed in claim 1 and claim 2, wherein the helmet wearer gets an audio filter replacement alert for replacement of the consolidated filter cassette, intelligently programmed on the basis of usage and surrounding air quality in which the worker is working.
6. A variable speed multi directional air ventilation and purification helmet as claimed in claim 1 and claim 2, wherein the system can be activated and deactivated with a press of a tactile switch or button [Figure 3 (7)]. On the first press, the system gets activated at minimum air flow speed and on further pressing, the speed of the air flow increases in a step wise manner until at the last press where the system gets deactivated.
7. A variable speed multi directional air ventilation and purification helmet as claimed in claim 1 and claim 2, wherein the gas sensor detects or sense any toxic gas in the vicinity of the worker. Once the gas detector detects any toxic gas, the helmet shuts down the air ventilation and purification system.
8. A variable speed multi directional air ventilation and purification helmet as claimed in claim 1 and claim 2, wherein the activated carbon filter absorbs any harmful gases, fumes, chemicals and volatile organic compounds.
9. A variable speed multi directional air ventilation and purification helmet as claimed in claim 1 and claim 2, wherein the charcoal filters absorb any moisture resulting from the sweat on wearer's head.

10. A variable speed multi directional air ventilation and purification
helmet as claimed in claim 1 and claim 2, wherein the HEPA filters
take out any particles ranging from ultra-microscopic particles to the
particles entirely detectable to the human eye. HEPA filter traps the air
5 contaminants, asbestos, dust, dust mites, pollens, etc.

11. A variable speed multi directional air ventilation and purification
helmet as claimed in claim 1 and claim 2, wherein high velocity
purified air which is coming out from the air flow guidance system
10 (Figure 3 (6)) directly on to the wearers face displaces any static or
moving polluted environmental air that earlier surrounded the face of
the wearer (Figure 6 (15)) and forms an air curtain in front of the
wearers face by releasing a directional high velocity purified air
thereby masking the wearer from surrounding air pollution without the
15 need of wearing a physical mask and ensuring that the wearer inhales
purified air from the air curtain