

HELMET PROCESSING SYSTEM AND METHOD

TECHNICAL FIELD

This invention relates generally to a method and a system for processing helmets. In particular, this invention relates generally to a method and a system for cleaning, disinfecting and deodorizing helmets.

Background

The helmet becomes a lifeline for head protection when riding a motorcycle. Embedded within the helmet is a cotton layer, soaking up the inevitable elements encountered during rides – sweat and rainwater. While this feature enhances comfort during the journey, it also sets the stage for the gradual accumulation of odors and the thriving of bacteria within the helmet.

The need for regular helmet cleaning becomes apparent as the cotton layer becomes a breeding ground for unpleasant odors and potentially harmful bacteria. A proactive cleaning routine is imperative to preserve the overall hygiene and longevity of this crucial safety gear. Neglecting this aspect not only compromises the user's comfort but also raises health concerns associated with prolonged exposure to bacterial growth within the helmet.

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In response to this demand for cleanliness, helmet cleaning cabinets have emerged as a technological solution. These cabinets employ a dual-phase approach, incorporating a spray-wash mechanism followed by a drying process. However, the current methodology falls short of providing an ideal cleaning effect. Relying solely on water flow proves insufficient in tackling stubborn stains and leaves room for inconvenience in the overall user experience.

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There is therefore a need for a method and system for addressing the foregoing problems.

Summary

In accordance with a first aspect of the invention, there is disclosed a helmet processing system comprising a support structure defining a workspace for receiving a helmet to be processed, a plasma generator for generating plasma for delivery to the workspace for
5 further processing the helmet, a vaporizer module for vaporizing cleaning liquid into vaporized liquid for delivery to the workspace for processing the helmet, and a controller in signal communication with the plasma generator and the vaporizer module. The plasma generator comprises a plasma outlet wherefrom the plasma is discharged and the vaporizer module comprising a vaporizer outlet wherefrom the vaporized liquid is discharged, the
10 helmet having an inside surface defined by the concavity thereof.

In accordance with a second aspect of the invention, there is disclosed a helmet processing method comprising generating plasma by a plasma generator and delivering the generated plasma to a workspace for processing a helmet received in the workspace, the workspace
15 being defined by a support structure, and vaporizing cleaning liquid into vaporized liquid by a vaporizer module and delivering the vaporized liquid to the workspace for further processing the helmet. The plasma generator comprises a plasma outlet wherefrom the plasma is discharged and the vaporizer module comprising a vaporizer outlet wherefrom the vaporized liquid is discharged, the helmet having an inside surface defined by the concavity
20 thereof and the plasma generator and the vaporizer module being in signal communication with a controller for control thereby.

Brief Description of the Drawings

FIG. 1 shows an exemplary system diagram of a helmet processing system according to an aspect of the invention;

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FIG. 2 shows an exemplary process flow diagram of a helmet processing method implemented by the helmet processing system of FIG. 1;

FIG. 3 shows a partial front view of the helmet processing system of FIG. 1 with a sectional
10 view of a base plate;

FIG. 4 shows a partial perspective view of a first actuator assembly configured with the base plate of the helmet processing system of FIG. 3; and

15 FIG. 5 shows a partial front view of the helmet processing system of FIG. 3 with a second actuator module and a brush module; and

FIG. 6 shows a partial front view of the helmet processing system of FIG. 3 with a sectional view of a base plate with at least one of a plasma generator and a plasma outlet being
20 fixably coupled to a support structure and disposed below the base plate.

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Detailed Description

An exemplary embodiment of the present invention, a helmet processing system 20 for implementing a helmet processing method 100 is described hereinafter with reference to
5 FIGS. 1 to 6. The helmet processing system 20 and the helmet processing method 100 are also referable to and known, respectively, as a processing system 20 and a processing method 100.

The helmet processing system 20 preferably comprises a support structure 22 defining a
10 workspace 24 for receiving a helmet 26 to be processed, and a plasma generator 28 for generating plasma for delivery to the workspace 24 for further processing the helmet 26. The helmet processing system 20 further comprises a vaporizer module 30 for vaporizing cleaning liquid into vaporized liquid for delivery to the workspace 24 for processing the helmet 26, and a controller 32 in signal communication with the plasma generator 28 and
15 the vaporizer module 30. Preferably, the plasma generator 28 comprises a plasma outlet 34 wherefrom the plasma is discharged and the vaporizer module 30 comprises a vaporizer outlet 36 wherefrom the vaporized liquid is discharged. The helmet 26 has an inside surface 38 defined by the concavity thereof. Each of the vaporizer outlet 36 and the plasma outlet 34 can be one of a nozzle, an opening or a cluster of openings defined in a structure or
20 article, a free end opening or an end cap defining an aperture and coupled to the free end opening of a tube extending from and in fluid communication with the respective one of the vaporizer module 30 and the plasma generator 28.

The plasma generator 28 may generate the plasma in-situ or within a chamber before
25 discharging the plasma through the plasma outlet 34. Preferably, a voltage, for example a high frequency voltage, may be applied to low pressure or atmospheric pressure gases such as oxygen and hydrogen for generating the plasma. The generated plasma enables the area around the plasma, or the area whereto the plasma is discharged, to be effectively processed by cleaning without having to subsequently vent and manually clean the area.

In various implementations, the vaporizer module 30 vapourises the cleaning liquid by heating the cleaning liquid provided thereto into fog or aerosol. In this implementation, the vaporizer module 30 will comprise a heating element or heat exchanger for heating the the cleaning liquid. The cleaning liquid used may be just water or a water-surfactant mixture.

5 Additionally, glycol or glycerin may be mixed into the cleaning liquid to facilitate the vapourisation thereof. In some implementations, the vapouriser nozzle 36 is an atomizer nozzle where the cleaning liquid is mixed with compressed air for discharge therethrough. Alternatively, in the absence of compressed air, the vaporizer module 30 may comprise a pump or compressor for pressurizing the cleaning liquid for discharge through the atomizer
10 nozzle for generating the vapourised liquid.

The helmet processing system 20 further comprises at least one first actuator assembly 40 coupled to and for displacing and positioning at least one of the vaporizer module 30, the vaporizer outlet 36, the plasma generator 28 and the plasma outlet 34 for directing discharge
15 of at least one of the plasma and the vaporized liquid into the workspace 24. Preferably the at least one first actuator assembly 40 being at least one of a robotic arm, a linear actuator, a piston actuator, an actuated scissor lift mechanism, an actuated cam mechanism, a servo motor and a motorised translational stage and is in signal communication with the controller 32 for control thereby.

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The helmet processing system 20 further comprises a base plate 42 defining at least one aperture 44. The base plate 42 substantially interposes the helmet 26 and each of the vaporizer outlet 36 and the plasma outlet 34, the at least one aperture 44 being substantially aligned with an opening 46 to the inside surface 38 of the helmet 26 for enabling
25 communication of the vaporized liquid from the vaporizer module 30 and the plasma generated by the plasma generator 28 to the inside surface 38 of the helmet 26 through the at least one aperture 44.

In some implementations, the at least one first actuator assembly 40 comprises an elongated
30 beam 47a and a carriage 47b configured for travel along a first axis defined by and

substantially parallel the length of the beam 47a. The at least one first actuator 40 further comprises a pair of pillars 47c coupled to the support structure 22 and configured to be substantially parallel to one another. The pair of pillars 47c are spatially inter-displaced to enable the beam 47a to extend therebetween with the extremities of the beam 47a being
5 movably coupled to the pair of pillars 47c to enable travel along a second axis. The second axis is defined by one of and substantially parallel the pair of pillars 47c. The second axis is substantially perpendicular the first axis. Through the use of at least one of motorized belts and gears and magnetic transducer between the pair of pillars 47c and the beam 47a and between the carriage 47b and the beam 47a, displacement and positioning of the carriage
10 47b can be controlled via the controller 32. This, in turn, enable displacement and positioning of at least one of the vaporizer module 30, the vaporizer outlet 36, the plasma generator 28 and the plasma outlet 34 when coupled to the carriage 47b.

Preferably, the first axis is substantially parallel and the second axis is substantially
15 perpendicular the plane of the base plate 42. When in use, at least one of the vaporizer module 30, the vaporizer outlet 36, the plasma generator 28 and the plasma outlet 34 is displaced along the second axis and towards the at least one aperture 44. Once adjacent the at least one aperture 44, at least one of the plasma and the vaporized liquid is discharged from the at least one of the vaporizer module 30, the vaporizer outlet 36, the plasma
20 generator 28 and the plasma outlet 34 which may be displaced or reciprocated along the first axis to facilitate dispersion of the plasma and the vapourised liquid into the workspace 24 and consequently into the helmet 26. Once the helmet 26 has been processed, the at least one of the vaporizer module 30, the vaporizer outlet 36, the plasma generator 28 and the plasma outlet 34 is then displaced along the second axis and away from the base plate 42 to,
25 for example, enable a subsequent process to be carried out on the helmet 26 through the at least one aperture 44. In some implementations, at least one of the plasma generator 28 and the plasma outlet 34 is fixably coupled to the support structure 22 and disposed below the base plate 42 as shown in FIG. 6.

Multiple sets a combination of the pair of pillars 47c, the beam 47a and carriage 47b may be implemented. For example, a first pair of pillars 47c with a first beam 47a forming a carriageway for a first carriage may be configured alongside a second pair of pillars 47c with a second beam 47a forming a carriageway for a second carriage 47b. This configuration allows for the first carriage 47b and the second carriage 47b to be independently displaced and positioned from one another. Further, multiple carriages 47b may be carried on and are positionable along a single beam 47a. The use of multiple carriages 47b enables two or more processes, discharge of the plasma and discharge of the vaporized liquid, to be carried out concurrently.

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The helmet processing system 20 further comprises at least one container for containing cleaning liquids for delivery to the vaporizer module 30, and at least one pump 50 for displacing the cleaning liquid in the at least one container for transport to the vaporizer module 30 for vaporising thereby into the vaporized liquid, the at least one pump 50 being in signal communication with the controller 32 for control thereby.

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The helmet processing system 20 further comprises a vacuum generator 52 comprising a suction head 54 whereat suction force is generated for substantially extracting at least one of fluids and particles from the workspace 24. It is preferred that the vacuum generator 52 comprises a cyclonic filter for enabling cyclonic separation and filtration of dust and particles being drawn into the suction head 54. It is preferred that the cyclonic filter be disposed away from the suction head to enable easier access thereto for cleaning or changing the cyclonic filter or dust container.

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The helmet processing system 20 further comprises a scent diffuser 56 for discharging scented fluids into the workspace 24. The at least one first actuator assembly 40 is further for displacing and positioning the suction head 54 of the vacuum generator 52, the vacuum generator 52 and the scent diffuser 56 being in signal communication with the controller 32 for control thereby. The at least one container may comprise separate containers for

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containing scented liquids, scented aerosols or essential oils for provision to the scent diffuser 56.

5 In some implementations, the suction head 54, at least one of the vaporizer outlet 36 and the plasma outlet 34 may be modularized as end-effectors for removable coupling to the at least one first actuator assembly 40. When not in use, the suction head 54, the vaporizer outlet 36 and the plasma outlet 34 may be docked at a purpose-designed base for receiving and positionally locating thereof. This enables fewer quantity of the at least one first actuator assembly 40, for example one or two thereof, to be used as only the required one or more of
10 the suction head 54, the vaporizer outlet 36 and the plasma outlet 34 needs to be coupled to the at least one first actuator assembly 40 at any one instance. When required, one of the suction head 54, the vaporizer outlet 36 and the plasma outlet 34 may be swapped out for another thereof for sequential use. However, this does not preclude having one dedicated first actuator assembly 40 for each of the suction head 54, the vaporizer outlet 36 and the
15 plasma outlet 34, even when implemented with removable couplable end-effectors.

The helmet processing system 20 further comprises a brush module 70 comprising cylindrical brush configured for rotational displacement about a brush axis defined by the brush module 70. The brush module 70 being operable for positioning and displacing the
20 rotating cylindrical brush adjacent and across at least a portion of an outside surface 72 of the helmet 26 for processing thereof. The outside surface 72 of the helmet 26 substantially outwardly faces the inside surface 38 of the helmet 26.

The helmet processing system 20 further comprises at least one second actuator assembly 74
25 coupled to the brush module 70 for displacement and positioning thereof along the outside surface of the helmet 26. The at least one second actuator assembly 74 is at least one of a linear actuator, a piston actuator, an actuated scissor lift mechanism, an actuated cam mechanism, a servo motor, a motorised translational stage and a robotic arm and is in signal communication with the controller 32 for control thereby. The at least one second actuator
30 assembly 74 may have multiple degrees of freedom for positioning the brush module 70 at

various positions over the outside surface 72 of the helmet 26. The brush module 70 can comprise one or more proximity sensors to keep the brush module 70 at a pre-determined minimum distance away from the outer surface 72 of the helmet 26 and to substantially avoid collision therewith during displacement of the brush module 70. Alternatively, the
5 brush module 70 comprises an arcuate arm shaped for adapting to the curvature of the outer surface 72 of the helmet 26. The arcuate arm may be motorized to impart a single degree of freedom displacement across the outer surface 72 of the helmet 26. The brush module 70 may further comprise spring loaded structures on the arcuate arm for resiliently biasing the cylindrical brush towards the outer surface 72 of the helmet 26.

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The helmet processing system 20 further comprises at least one ultraviolet (UV) light module 78 for generating UV radiation and being configured for substantially directing the UV radiation to the inside surface 38 of the helmet 26. The at least one UV light module 78 may comprise a plurality of UV light emitting diodes (LEDs) or UV lamps positioned for
15 directing UV radiation to the inside surface 38 and the outside surface 72 of the helmet 26.

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The helmet processing system 20 further comprises a heat lamp 79 disposed and configured for drying at least a portion of the helmet 26. Preferably, the heat lamp 79 is in signal communication with the controller 32 and is configured for directing generating and directing heat towards substantially the inside surface 38 of the helmet 26 for facilitating
20 drying thereof. This, however, does not preclude use of the heat lamp 79 for drying portions of both the inside surface 38 and the outside surface 72 of the helmet 26. The heat lamp 79 can contain an integrated fan or blower or has an externally mounted fan or impellor for displacing air therethrough or thereacross. Further, the UV light module 78 may be replaced with or adapted to generate light of other wavelengths for killing bacteria, for example blue
25 light generated from the UV light module 78 using blue light LEDs or blue light lamps. In this instance, the light generated is electromagnetic radiation of preferably a short or shorter wavelength such as those of blue light, which is also referred to as high energy light.

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The helmet processing system 20 may also further comprise a fan module 82 coupled to the
30 support structure 22 for extracting air from the workspace 24 and may be use in tandem with

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or independent of the vacuum generator 52. The fan module 82 is preferably in signal communication with the controller 32 for control thereby.

5 The helmet processing system 20 further comprises an enclosure structure 86 for defining the workspace 24 and a workspace opening for access to the workspace 24 therethrough, and a lid rotatably coupled to the enclosure structure 86 for displacement between an open position to enable access through the workspace opening of the enclosure structure 86 and a closed position for impeding access through the workspace opening of the enclosure structure 86. The helmet 26 is substantially enclosed by the enclosure structure 86 when
10 disposed in the workspace 24 with the lid in the closed position.

The enclosure structure 86 may be implemented with a limit switch disposed at the workspace opening and in signal communication with the controller 32 to determine whether the lid is in the closed position or not. This will prevent starting of processing of
15 the helmet 26 or to pause processing of the helmet 26 when the lid is not in the closed position or has been moved away from the closed position. Additionally or alternatively, the enclosure structure 86 may be implemented with an electromagnetic (EM) door lock in signal communication with the controller 32 which substantially prevents the lid to be moved away from the closed position during processing of the helmet 26.

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Preferably, the support structure 22 is formed from a monocoque structure or an inner structural frame with an outer shell or cladding. The support structure 22 may be formed from metals, for example aluminum, non-metals, for example plastics or fiberglass, or any combination thereof, for example an aluminum inner frame structure with an ABS outer
25 shell.

The support structure 22 is shaped and dimensioned for defining a plurality of segments comprising the enclosure structure 86, a mechanism segment 92, a supplies segment and a controller segment. The controller segment is for housing the controller 32.

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The mechanism segment 92 interposes the enclosure structure 86 and the supplies segment. The supplies segment is for housing the at least one container and the at least one pump 50. The mechanism segment 92 is for housing the plasma generator 28, the vaporizer module 30, the at least one first actuator assembly 40, the vacuum generator 52, and the scent diffuser 56. Fluid communication between the at least one container and the respective plasma module and the vaporizer module is achieved by way of pipes or tubes extending therebetween.

The enclosure structure 86 encloses the UV light module 78 and the fan module 82. The base plate 42 interposes the enclosure structure 86 and the mechanism segment 92.

Preferably, the brush module 70 and the at least one second actuator assembly 74 are housed in the enclosure structure 86. Alternatively, the brush module 70 and the at least one second actuator assembly 74 are housed in an elevated segment constituting the support structure 22 with the enclosure structure 86 interposing the elevated segment and the mechanism segment 92. It is preferred that each of the mechanism segment 92, the supplies segment and the controller segment comprises a door that opens to an opening that enables access to the respective one of the plurality of segments. It is preferred that the helmet processing system 20 further comprises a user interface 98 (UI 98) in signal communication with the controller 32 for operating and communicating with the controller 32. It is further preferred that the UI 98 be coupled to the controller segment on an outward facing surface thereof. The UI 98 may comprise one or more of a touch screen display, mechanical switches, a microphone, a speaker and a wireless communication module to enable wireless communication with the controller via Bluetooth, wireless networks such as Wi-Fi network, wireless low-power network, for example the Lora network, and wireless cellular network such as the 5G cellular network.

For clarity, processing of the helmet 26 includes but is not limited to cleaning, deodorizing, drying and scenting of any portions of the helmet 26 by the helmet processing system 20.

Further, it is disclosed that the helmet processing system 20 may be used for processing articles or like articles that contained sponge or sponge padding, for example padded gloves.

5 To process the helmet 26, the helmet 26 is first placed into the enclosure structure 86 the opening 46 to the inside surface 38 of the helmet 26 facing and being substantially aligned with the at least one aperture 44 of the base plate 42. A raised lip structure or protrusions along the periphery of the at least one aperture 44 may be formed on the base plate 42 to facilitate the alignment.

10 Once the helmet 26 is in place within the workspace 24, the helmet processing method 100 is initiated via interaction, for example user interaction, with the UI 98. In an implementation of the helmet processing method 100 by the helmet processing system 20, the helmet processing method comprises a step 110 of substantially directing ultraviolet (UV) radiation generated by the UV light module 78 to the inside surface 38 and the outside
15 surface of the helmet 26. Next, the plasma generator 28, or the plasma outlet 34, is positioned at the at least one aperture 44 of the base plate 42 by the at least one first actuator assembly 40 before a step 112 of generating plasma by the plasma generator 28 and delivering the generated plasma to the workspace 24 for processing the helmet 26. The vaporizer module 30, or the vaporizer outlet 36, is positioned by the at least one first
20 actuator assembly 40 at the at least one aperture 44 of the base plate 42 by the at least one first actuator assembly 40 before a step 114 of vaporizing cleaning liquid into vaporized liquid by the vaporizer module 30 and delivering the vaporized liquid to the workspace 24 for further processing the helmet 26.

25 After a pre-determined duration, the vaporizer module 30, or the vaporizer outlet 36, is displaced away from the at least one first actuator assembly 40 to the at least one aperture 44. The at least one first actuator assembly 40 then positions the suction head 54 of the vacuum generator 52 at the at least one aperture 44 of the base plate 42 before suction force is generated at the suction head 54 in a step 116 for extracting at least one of fluids and

particles from the workspace 24 and particularly from the helmet 26. After a pre-determined duration, the suction head 54 is displaced away from the at least one aperture 44.

5 To improve thoroughness in processing the helmet 26, the steps 114 and 116 and the alternating therebetween may be sequentially repeated for multiple cycles, preferably for three cycles. The UV radiation in step 110 and the plasma in step 112 continues to be generated and delivered to the helmet 26 during the multiple cycles of the steps 114 and 116.

10 Further during the multiple cycles of the steps 114 and 116, the brush module 70 will be initiated by initiating rotation of the cylindrical brush thereof about the brush axis in a step 118. In the step 118, the at least one second actuator 74 displaces the brush module 70, specifically the cylindrical brush thereof, adjacent and across at least a portion of an outside surface 72 of the helmet 26 for cleaning thereof. Alternatively, the step 118 will only be performed during the performance of step 114.

15 Once performance of the multiple cycles of the steps 114 and 116 has been completed, step 118 will be terminated by stopping the rotation of the rotational brush and displacing the brush module 70 away from the helmet 26. Generating of the plasma in the step 112 will also be terminated after the completion of the multiple cycles of the steps 114 and 116.

20 Next, in a step 120, the scent diffuser 56 discharges scented fluids into the workspace 24 and onto the helmet 26, specifically the inside surface 38 and the outside surface 72 thereof. Following the step 120, the step 110 of generating the UV radiation is terminated to conclude the helmet processing method. Additionally, the heat lamp 79 may be activated
25 for drying the helmet 26 during or just before the discharge of the scented fluids into the workspace 24.

In an alternative implementation of the helmet processing system 20 and the helmet processing method 100, the at least one aperture 44 comprises a single aperture 44 and the
30 helmet processing system 20 further comprises a third actuator assembly configured for

displacing a rack structure through the aperture 44 of the base plate 42 between a raised position and a lowered position. The third actuator assembly is in signal communication with the controller 32 for control thereby and is at least one of a linear actuator, a piston actuator, an actuated scissor lift mechanism, an actuated cam mechanism, a servo motor, a
5 motorised translational stage and a robotic arm.

In this implementation, the workspace 24 is defined in an area below the base plate 42 with the base plate 42 being formed from multiple segments which can be raised to enlarge a passageway formed by the aperture 44 and extending between the enclosure structure 86 and
10 the workspace 24. Preferably, the base plate 42 is pivoted at one or more portions of the periphery thereof to enable the raising and lowering of the multiple segments of the base plate 42. One or more motors or actuators are preferably coupled to the multiple segments of the base plate 42 and are in signal communication with the controller 32 to enable the raising and the lowering of the multiple segments of the base plate 42 to be controllable.
15 The rack structure is shaped and dimensioned for supporting the helmet thereon.

In the alternative implementation, the helmet 26 is first placed into the enclosure structure 86 and onto the rack structure when in the raised position. The multiple segments of the base plate 42 are then raised to enable the rack structure, and consequently the helmet 26, to
20 be lowered by the third actuator assembly into the workspace 24 for processing in accordance with the helmet processing method 100. The multiple segments of the base plate 42 may or may not be lowered during processing of the helmet 26. Once processing of the helmet 26 has been completed, the helmet 26 is then displaced to the raised position before the multiple segments of the base plate 42 are lowered to contract the aperture 44. The
25 helmet can then be removed from the enclosure structure 86 and away from the rack structure. In the alternative implementation, it is preferred that the brush module 70 be disposed within the workspace 24 and below the base plate 42.

Aspects of particular embodiments of the present disclosure address at least one aspect,
30 problem, limitation, and/or disadvantage associated with existing computer-implemented

methods and systems. While features, aspects, and/or advantages associated with certain embodiments have been described in the disclosure, other embodiments may also exhibit such features, aspects, and/or advantages, and not all embodiments need necessarily exhibit such features, aspects, and/or advantages to fall within the scope of the disclosure. It will be appreciated by a person of ordinary skill in the art that several of the above-disclosed structures, components, or alternatives thereof, can be desirably combined into alternative structures, components, and/or applications. In addition, various modifications, alterations, and/or improvements may be made to various embodiments that are disclosed by a person of ordinary skill in the art within the scope of the present disclosure, which is limited only by the following claims.

Claims

1. A helmet processing system comprising:

a support structure defining a workspace for receiving a helmet to be processed;

5 a plasma generator for generating plasma for delivery to the workspace for further processing the helmet;

a vaporizer module for vaporizing cleaning liquid into vaporized liquid for delivery to the workspace for processing the helmet; and

10 a controller in signal communication with the plasma generator and the vaporizer module,

wherein the plasma generator comprising a plasma outlet wherefrom the plasma is discharged and the vaporizer module comprising a vaporizer outlet wherefrom the vaporized liquid is discharged, the helmet having an inside surface defined by the concavity thereof.

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2. The helmet processing system as in claim 1, further comprising:

at least one actuator assembly coupled to and for displacing and positioning at least one of the vaporizer module, the vaporizer outlet, the plasma generator and the plasma outlet for directing discharge of at least one of the plasma and the vaporized liquid into the workspace,

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wherein the at least one actuator assembly being at least one of at least one of a robotic arm, a linear actuator, a piston actuator, an actuated scissor lift mechanism, an actuated cam mechanism, a servo motor and a motorised translational stage and is in signal communication with the controller for control thereby.

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3. The helmet processing system as in claim 2, further comprising:

a base plate defining at least one aperture, the base plate substantially interposing the helmet and each of the vaporizer outlet and the plasma outlet, the at least one aperture being substantially aligned with an opening to the inside surface of the helmet for enabling communication of the vaporized liquid from the vaporizer

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module and the plasma generated by the plasma generator to the inside surface of the helmet through the at least one aperture.

4. The helmet processing system as in claim 2, further comprising;

5 at least one container for containing cleaning liquids for delivery to the vaporizer module; and

 at least one pump for displacing the cleaning liquid in the at least one container for transport to the vaporizer module for vaporising thereby into the vaporized liquid, the at least one pump being in signal communication with the controller for control thereby.

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5. The helmet processing system as in claim 2, further comprising:

 a vacuum generator comprising a suction head whereat suction force is generated for substantially extracting at least one of fluids and particles from the workspace;

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 an heat lamp disposed and configured for drying at least a portion of the helmet; and

 a scent diffuser for discharging scented fluids into the workspace,

 wherein the at least one actuator assembly is further for displacing and positioning the suction head of the vacuum generator, the vacuum generator and the scent diffuser being in signal communication with the controller for control thereby.

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6. The helmet processing system as in claim 5, at least one of the suction head, the vaporizer outlet and the plasma outlet being end effectors for detachable coupling to the at least one actuator assembly.
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7. The helmet processing system as in claim 1, further comprising:

 a brush module comprising cylindrical brush configured for rotational displacement about a brush axis defined by the brush module, the brush module being operable for positioning and displacing the rotating cylindrical brush adjacent

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and across at least a portion of an outside surface of the helmet for processing thereof, the outside surface of the helmet substantially outward faces the inside surface of the helmet.

5 8. The helmet processing system as in claim 7, further comprising:

 at least one actuator assembly where to the brush module is coupled for displacement and positioning thereof along the outside surface of the helmet,

 wherein the at least one actuator assembly is at least one of at least one of a robotic arm, a linear actuator, a piston actuator, an actuated scissor lift mechanism,
10 an actuated cam mechanism, a servo motor and a motorised translational stage and is in signal communication with the controller for control thereby.

 9. The helmet processing system as in claim 1, further comprising:

 a ultraviolet (UV) light module for generating UV radiation and being
15 configured for substantially directing the UV radiation to the inside surface of the helmet.

 10. The helmet processing system as in claim 1, further comprising:

 an enclosure structure for defining the workspace and an opening for access
20 to the workspace therethrough; and

 a lid rotatably coupled to the enclosure structure for displacement between an open position to enable access through the opening of the enclosure structure and a closed position for impeding access through the opening of the enclosure structure, the helmet being substantially enclosed by the enclosure structure when disposed in
25 the workspace with the lid in the closed position.

11. A helmet processing method comprising:

generating plasma by a plasma generator and delivering the generated plasma to a workspace for processing a helmet received in the workspace, the workspace being defined by a support structure; and

vaporizing cleaning liquid into vaporized liquid by a vaporizer module and delivering the vaporized liquid to the workspace for further processing the helmet,

wherein the plasma generator comprising a plasma outlet wherefrom the plasma is discharged and the vaporizer module comprising a vaporizer outlet wherefrom the vaporized liquid is discharged, the helmet having an inside surface defined by the concavity thereof and the plasma generator and the vaporizer module being in signal communication with a controller for control thereby.

12. The helmet processing method as in claim 11, further comprising:

displacing and positioning at least one of the vaporizer module, the vaporizer outlet, the plasma generator and the plasma outlet by at least one actuator assembly for directing discharge of at least one of the plasma and the vaporized liquid into the workspace,

wherein the at least one actuator assembly being at least one of at least one of a robotic arm, a linear actuator, a piston actuator, an actuated scissor lift mechanism, an actuated cam mechanism, a servo motor and a motorised translational stage and is in signal communication with the controller for control thereby.

13. The helmet processing method as in claim 12, further comprising:

directing the vaporized liquid and the generated plasma through at least one aperture defined in a base plate, the base plate substantially interposing the helmet and each of the vaporizer outlet and the plasma outlet, the at least one aperture being substantially aligned with an opening to the inside surface of the helmet for enabling communication of the vaporized liquid from the vaporizer module and the plasma

generated by the plasma generator to the inside surface of the helmet through the at least one aperture.

14. The helmet processing method as in claim 12, further comprising;

5 providing at least one container for containing cleaning liquids for delivery to the vaporizer module; and

 providing at least one pump for displacing the cleaning liquid in the at least one container for transport to the vaporizer module for vaporising thereby into the vaporized liquid, the at least one pump being in signal communication with the controller for control thereby.

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15. The helmet processing method as in claim 12, further comprising:

 substantially extracting at least one of fluids and particles by a vacuum generator from a workspace, the vacuum generator comprising a suction head whereat suction force is generated;

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 drying at least a portion of the helmet by an heat lamp being disposed and configured therefro; and

 and

 discharging scented fluids by a scent diffuser into the workspace,

20 wherein the at least one actuator assembly is further for displacing and positioning the suction head of the vacuum generator, the vacuum generator and the scent diffuser being in signal communication with the controller for control thereby.

16. The helmet processing method as in claim 15, at least one of the suction head, the vaporizer outlet and the plasma outlet being end effectors for detachable coupling to the at least one actuator assembly.
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17. The helmet processing method as in claim 11, further comprising:

 rotationally displacing cylindrical brush of a brush module about a brush axis defined by the brush module, the brush module being operable for positioning and

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displacing the rotating cylindrical brush adjacent and across at least a portion of an outside surface of the helmet for processing thereof, the outside surface of the helmet substantially outward faces the inside surface of the helmet.

- 5 18. The helmet processing method as in claim 17, further comprising:

displacing and positioning of the brush module by at least one actuator assembly along the outside surface of the helmet,

10 wherein the at least one actuator assembly is at least one of at least one of a robotic arm, a linear actuator, a piston actuator, an actuated scissor lift mechanism, an actuated cam mechanism, a servo motor and a motorised translational stage and is in signal communication with the controller for control thereby.

19. The helmet processing method as in claim 11, further comprising:

15 substantially directing ultraviolet (UV) radiation generated by a UV light module to the inside surface of the helmet.

20. The helmet processing method as in claim 11, further comprising:

providing an enclosure structure for defining the workspace and an opening for access to the workspace therethrough; and

20 providing a lid rotatably coupled to the enclosure structure for displacement between an open position to enable access through the opening of the enclosure structure and a closed position for impeding access through the opening of the enclosure structure, the helmet being substantially enclosed by the enclosure structure when disposed in the workspace with the lid in the closed position.