

SYSTEM AND METHOD FOR COATING A SURFACE

5 The present invention relates to a system and method for coating a surface. Specifically, an automated coating application system for application of a coating on a surface.

10 An example of a prior art system is disclosed in WO2020239798. In the prior art system, the spray nozzle is mounted within a conditioning hood that defines a chamber. The system has an air extraction arrangement with an annular air inlet slit extending outward of the lower end of the conditioning hood. Concentrically outwards thereof an annular air curtain device is provided which in operation forms an air curtain of air blowing onto the surface. The combination of the air extraction arrangement and the air curtain device is provided to cause the effect that that coating particles which have not adhered to the surface are entrained with the extraction air and passed to one or more filters.

15 The prior art system is not entirely satisfactory, e.g. in view of stability of the spray pattern of the coating material emitted from the nozzle and/or the final coating that is applied, wherein a spray emitted from the nozzle forms the spray pattern on the surface. Also the prior art system is not entirely satisfactory in terms of preventing escape of coating particles and, possibly, fumes, e.g. considering the energy required for air extraction and/or for the air curtain.

The present invention aims to overcome or at least reduce one of more of the above issues.

25 The present invention provides an automated coating system according to claim 1.

The automated coating system is configured for application of a coating on a surface of an object with a spray tool having a nozzle emitting a spray of atomized coating particles in a spray pattern, for example paint, onto the surface.

30 Preferably, the spray tool is an airless spray tool. Airless spray tools are known in the art.

The system comprises a motion device provided with a mount on which the spray tool having a nozzle emitting a spray of atomized coating particles in a spray pattern is mounted. The motion device is configured to position the nozzle at a nozzle height relative to the surface to be coated. The motion device is configured to move the spray tool relative to the surface

during coating of the surface. For example, the motion device is an industrial robot, e.g. having an articulated robot arm, e.g. with at least three degrees of freedom, e.g. with six degrees of freedom. In another embodiment, the motion device is a wheeled robot, e.g. provided with a magnetic retention system configured to support the robot against a metal
5 wall having a surface to be coated, e.g. a vertical metal wall, e.g. a wall of a metallic storage tank, a metallic wall of a ship, etc.

The system comprises a coating material supply including a pump configured to supply a pressurized liquid coating material to the nozzle of the airless spray tool, e.g. at a pressure of
10 at least 50 bars, e.g. at a pressure or more than 100 bars, e.g. between 200 and 500 bars.

The system comprises an extraction member which is supported by the motion device to move in unison with the spray tool relative to the surface during coating of the surface.

15 The extraction member comprises an annular housing having an inner wall portion, an outer wall portion, a bottom side, and a top side.

The inner wall portion of the housing delimits an opening through which the spray of atomized coating particles passes onto the surface to be coated, wherein the inner wall portion is
20 configured to be peripherally spaced about the spray. For example, the spray pattern is elliptical in cross-section with the housing also being elliptical. In another example, the spray pattern is a cone spray pattern with the housing being circular.

The motion device is configured to position the bottom side of the housing in proximity of the
25 surface to be coated so as to maintain a gap between the bottom side and the surface to be coated. The motion device may, in embodiments, comprises wheels or other surface engaging members that travel, e.g. roll or slide, over the surface to be coated, e.g. to maintain the desired magnitude of the gap. The system may alternatively or in combination with surface engaging members, comprises a gap control mechanism with one or more sensors
30 that sense (directly or indirectly) the magnitude of the gap with the mechanism adjusting the gap when needed.

In the housing an internal annular air channel is present. The bottom side of the housing is provided with an annular inlet slit of the internal annular air channel. Via this inlet slit air is
35 sucked into the internal annular air channel, when the system is in operation.

The housing comprises one or more outlet ports of the internal annular air channel.

- The system further comprises an air extraction and filtering device including an air extraction duct, an air extraction fan, and one or more air filters. The air extraction duct is connected to the one or more outlet ports of the internal annular air channel. In embodiments, the extraction duct comprises one or more duct sections mounted to the housing, e.g. rigid duct sections, which then adjoin a flexible air duct section that extends to a remotely arranged air extraction fan and air filter assembly. For example, the latter components are arranged on a trailer. This arrangement is, for example, of benefit in combination with a motion device embodied as a wheeled robot.
- The top side of the housing is lower than the nozzle height and between the top side and the nozzle one or more peripheral air access openings are present. This is in contrast to the mentioned prior art system, wherein the nozzle is arranged with a conditioning hood.
- In operation of the inventive system, the spray of coating material is emitted from the nozzle in the spray pattern to coat the surface, the spray causing a drag flow of air from outside through the one or more peripheral air access openings towards and then along with the spray, whilst the air extraction and filtering device causes a flow of extraction air from the gap between the surface to be coated and the bottom side of the housing via the annular inlet slit into the internal annular air channel, so that coating particles not adhered to the surface are entrained with the extraction air and passed to the one or more filters. The bottom side includes a bottom wall and a bottom area of the inner wall portion and a bottom area of the outer wall portion.
- The inventive system, for example, shows an improved stability of the spray pattern compared to the mentioned prior art system, e.g. in view of stability of the direction of the spray pattern onto the surface. It is believed that the mentioned air flows obtained with the inventive design enhance the stability.
- The inventive system, preferably, is devoid of an air curtain that blows air onto the surface to be coated. This saves energy and also avoids interference of the air curtain with the just coated portion of the surface. So, preferably, the inlet slit is the only inlet for air to be extracted with the system from the gap.
- In an embodiment, the housing comprises an annular air guide that extends from an inner edge of the annular inlet slit in a direction angled upward and outward. This annular air guide serves to cause extracting more air from the inner perimeter of the housing than from the

outer perimeter. By directing the air flowing outwards from the zone where the coating takes place in an upwardly inclined direction, floating atomized coating particles are directed away from the surface and into the slit. Generally, an air guide is a surface which is substantially parallel to the air flowing in close proximity of it. Substantially parallel indicates a small relative angle between the guiding surface and flowing air, for example an angle lower than 45 degrees.

In another embodiment, the housing comprises an annular air guide that extends from an inner edge of the annular inlet slit in a direction angled upward and inward.

In particular embodiments, the annular air guide is positioned at an upward angle such that a larger portion of air is exhausted from inside of the perimeter of the housing and a smaller portion of air is exhausted from outside the perimeter of the housing. This is in line with the extraction function of the annular housing: extraction air flows from the gap between the surface to be coated and the bottom side of the housing via the annular inlet slit and is guided by the annular air guide into the internal annular air channel, so that coating particles not adhered to the surface are entrained with the extraction air and passed to the one or more filters. By exhausting most of the air from the opening, where the spray of atomized coating particles are passed onto the surface, most of the overspray is directed towards the inlet slit. By exhausting smaller portion of air from outside of the housing perimeter a flow of air directed radially inward along the outer wall portion of the housing is created, further preventing atomized coating particles from escaping the housing.

In an embodiment the annular air guide is positioned at an upward angle such that a smaller portion of air is exhausted from inside of the perimeter of the housing and a larger portion of air is exhausted from outside the perimeter of the housing. This allows for a flow of air directed radially inward along the outer wall portion. Combined with an annular inlet slit angled upward and inward this is advantageous to the amount of particles being directed inwards of the housing and further prevents atomized coating particles from escaping the housing.

In an embodiment the internal annular air channel is delimited in part by one or more annular air deflectors configured for deflecting the airflow, which one or more annular air deflectors are positioned between the inlet slit and the one or more outlet ports. The annular air deflectors can e.g. be attached to the inner wall portion or outer wall portion. The annular air deflectors are positioned such that the air is forced to flow around the annular air deflectors, and the heavier paint particles collide with said annular air deflector due to their inertia being

larger than that of the air. By colliding with the deflector a portion of the particles is captured and removed from the flow of air. A deflecting surface is seen as a surface with a substantial relative angle between the deflecting surface and the air flowing forced around it, for example an angle larger than 60 degrees.

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In an embodiment the annular air deflector is positioned relative to the annular air guide such that air flowing along the annular air guide is deflected by the annular air deflector, e.g. the annular air deflector being located at an end portion of the annular air guide remote from the inlet slit. Advantageously, this provides the internal annular air channel with a longer annular
10 air guide improving the exhaustion of air from the opening delimited by the housing.

In an embodiment the annular air deflector is positioned downwardly relative to the annular air guide, e.g. perpendicular to the annular air guide in a downwards direction, e.g. at an end portion of the annular air guide remote from the inlet slit configuration. Advantageously, this
15 provides the internal annular air channel with a long bending turn, within this bend the atomized coating particles are relatively pushed outward towards the walls of the internal annular air channel and captured by the surface of the inner wall portion and outer wall portion. This effect is caused by the inertial forces of the atomized coating particles.

20 In an embodiment the inner wall portion and/or bottom side of the housing comprises undulating surface with one or more annularly extending undulations, e.g. concentric undulations. These undulations aim to capture remaining atomized coating particles which are not exhausted in the internal annular air channel but are moving radially outward. As a result of the air extraction fan pulling air upwards, away from the painting surface, into the
25 internal annular air channel, these remaining atomized coating particles are inclined away from the surface. The undulations are positioned such that they are in the path of the inclined atomized coating particles and capturing them before passing the outer wall portion of the housing.

30 In an embodiment the undulating surface comprises a sawtooth shape in vertical cross-section, e.g. wherein the sawtooth shape comprises two saw teeth. Advantageously, the sawtooth shape provides an inclined surface substantially parallel to the flow path of the atomized coating particles not exhausted into the internal annular air channel, the sharp drop in the sawtooth shape provides a surface with which the atomized coating particles collide
35 and are captured by.

In an embodiment, the inner wall portion of the housing portion comprises an undulating surface, more specifically the inner wall portion near the inner edge 64a' comprises an undulating surface.

5 In an embodiment the internal annular air channel comprises one or more sharp turns, preferably greater than 90 degrees. Due to the difference in inertia between the air and atomized coating particles, the air can follow sharp turns inside of the internal annular air channel, while the heavier, more inert, atomized coating particles cannot follow these sharp turns and will collide with the inner and outer wall portion of the housing.

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In an embodiment the annular air deflector internally aligns with the sawtooth shape of the bottom side to form a sharp turn of the internal annular air channel. Advantageously, this provides the duct with an additional long bending turn further maximizing the collisions of atomized coating particles with the outer wall portion.

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In an embodiment the internal annular air channel is configured such that extracted air flows from the inlet slit in a direction radially outward and upward, which flow direction of the internal annular air channel then is deflected by one or more annular air deflectors to a direction radially inward, e.g. by providing one or more annular air deflectors and/ or sharp turns. By abruptly changing the flow direction the atomized coating particles are pushed outward into the inner and or outer wall portion of the housing and removed from the flow of air inside of the internal annular air channel.

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In an embodiment the annular air deflector has a height of at least 2mm, preferably at least 5mm. With the one or more annular air deflectors a substantial deflection of the airflow is introduced, which further improves the colliding of atomized coating particles with the inner and outer wall portion of the housing.

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In an embodiment an air permeable wind screen is positioned over the one or more peripheral air access openings, e.g. the wind screen comprising an air permeable mesh or an arrangement of slats. Advantageously, this reduces incoming wind speeds during outdoor operations, without substantially reducing the air access to the area in proximity of the spray cone. Using in a windscreen with a fine grating has the additional added benefit of preventing other objects such as leaves from entering and obstructing the coating process.

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In an embodiment an air permeable wind screen is positioned over some of the one or more peripheral air access openings. For example, the air permeable wind screen is positioned

over the largest peripheral air access opening, while allowing the air to more freely flow through smaller peripheral air access openings.

5 In an embodiment the housing is lower than the nozzle height, when measured from the spraying surface, by at least 10 cm, e.g. by between 10 and 25 centimeters, e.g. wherein the nozzle height is between 20 and 40 centimeters, e.g. about 30 centimeters. Keeping a distance between the spray nozzle and housing allows for clear air entering the opening through which the spray of atomized coating particles is passed.

10 In an embodiment multiple outlet ports of the internal annular air channel are spaced around the perimeter of the housing, e.g. wherein two or four outlet ports are present, e.g. two ports at diametrically opposite locations, e.g. the ports being formed in the top side and/or in the outer wall portion of the housing. Having the outlet ports spaced evenly around the perimeter has the advantage of distribution the exhaustion of air out of the internal annular air channel
15 evenly over the one or more outlet ports. Hence, an even exhaustion of air is provided.

In an embodiment the housing consists of a material with properties beneficial for the adhering of floating paint particles. Advantageously, a material is used with properties beneficial for the adhering of atomized coating particles upon impact, and from which the
20 layer of atomized coating particles is easily removed once the coating has dried out improves the reusability of the housing.

In embodiments, the housing has a substantially similar shape to the nozzle spray pattern. Preferably, this is a circular or oval shape.

25 In embodiments, the nozzle is configured to emit a fan spray having a spray pattern with a major axis and a shorter minor axis, e.g. an elliptical flat fan spray nozzle or a elliptical linear fan spray nozzle, and wherein the housing is of a substantially similar shape to the nozzle spray pattern, e.g. elliptical, seen in top view.

30 In an embodiment the housing is composed of housing components that are releasably attached to one another, e.g. in view of cleaning the housing. Advantageously, during maintenance and or cleaning procedures the housing is taken apart easily and cleaned easily. During operation atomized coating particles adhere to the surface of the internal
35 annular air channel, which includes the surfaces of the annular air guide and annular air deflector, and by having these means removably attached cleaning processes are simplified.

In embodiments, the motion device is a wheeled robot, e.g. provided with magnetic retention system configured to support the robot against a vertical metal wall having a surface to be coated, e.g. a vertical metal wall of a storage tank. Advantageously, the robot is suitable to perform X-Y movements. Possibly, the robot is suitable to carry out rotation movements.

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The present invention further relates to a method for coating a surface of an object with a spray tool, wherein use is made of any of the automated coating system as described above.

10 In an embodiment one or more sensors are present inside of the air extraction duct for measuring features of the airflow, e.g. the flow rate or properties of the air mixture flowing through the air extraction duct. An air extraction control system can furthermore be provided that controls the air extraction fan based on information provided by the one or more sensors. For example, in an embodiment a sensor is provided that measures the flow rate to provide a minimum flow rate in order to prevent hazardous mixtures from occurring inside of the
15 housing and/or air extraction duct.

In a method according to the invention, the method comprises the steps of;

- mounting the spray tool on the mount, and
- positioning the nozzle in proximity of the surface of the object to be coated, and
- 20 - operating the automated coating system to spray atomized coating particles emitted from the nozzle through the housing to the surface of the object.

The invention is further elucidated in relation to the drawings, in which:

Fig. 1 schematically depicts a first embodiment of a system for coating according to the
25 invention;

Fig. 2 schematically depicts a top view of the first embodiment of fig. 1;

Fig. 3 schematically depicts an internal annular air channel;

Fig. 4 schematically depicts components of a second embodiment of a system for coating according to the invention;

30 Fig. 5 schematically depicts components of a third embodiment of a system for coating according to the invention.

In fig. 1 a first embodiment of an automated coating system 1 for application of a coating on a surface 5 of an object such as wind turbine parts, e.g. blades, or storage tanks is shown. The
35 coating process is a significant part of required maintenance for ships, freighters and marine vessels to protect them against the corrosion damages caused by the harsh environmental

conditions they operate in. A manual coating application is a time consuming and expensive process that can impose risks for the workers and the environment.

5 The surface 5 is coated with a spray tool 3 having a nozzle 3a emitting a spray 4 of atomized coating particles in a spray pattern 4a, for example paint, onto the surface 5, preferably an airless spray tool. The spray 4 emitted from the nozzle 3a forms a spray pattern 4a on the surface 5.

10 The automated coating system 1 further comprises a motion device, schematically indicated in fig. 1 with reference sign 10. The motion device 10 comprises a mount 2 on which the spray tool 3 having a nozzle 3a is mounted. The motion device 10 is configured to position the nozzle 3a at a nozzle height X1 relative to the surface 5. The motion device 10 is further configured to move the spray tool 3 relative to the surface 5 during coating of the surface.

15 The automated coating system 1 further comprises a coating material supply 6 including a pump 6a configured to supply a pressurized liquid coating material to the nozzle 3a of the spray tool 3. The supply is e.g. connected to a high volume barrel.

20 The automated coating system 1 further comprises an extraction member 7 which is also supported by the motion device 10 to move in unison with the spray tool 3 relative to the surface 5 during coating of the surface. In fig. 1 a cross-sectional view is presented, not showing how the extraction member 7 is supported by the motion device.

25 The extraction member 7 comprises an annular housing 7' having an inner wall portion 8, an outer wall portion 9, a bottom side 10a and a top side 10b.

30 The inner wall portion 8 of the housing 7' delimits an opening 11, visible in fig. 2, through which the spray 4 of atomized coating particles passes onto the surface to be coated. The inner wall portion 8 is configured to be peripherally spaced about the spray.

The motion device 10 is configured to position the bottom side 10a of the housing in proximity of the surface 5 to be coated so as to maintain a gap X2 between the bottom side 10a and the surface 5 to be coated.

35 In the housing 7' an internal annular air channel 12 is present. The bottom side 10a of the housing 7' is provided with an annular inlet slit 12a of the internal annular air channel. The

housing 7' further comprises one or more outlet ports 12b of the internal annular air channel 12.

5 The automated coating system 1 further comprises an air extraction and filtering device, not shown, including an air extraction duct, an air extraction fan, and one or more air filters, wherein the air extraction duct is connected to the one or more outlet ports 12b of the internal annular air channel 12.

10 The top side of the housing 10b is lower than the nozzle 3a. In particular, the height of the top side of the housing 10 with respect to the surface to be coated 5, indicated with distance X3, is less than nozzle height X1. Between the top side 10b of the housing 7' and the nozzle 3a one or more peripheral air access openings are present. In fig. 1 an open construction is shown, i.e. one large peripheral air access opening 13.

15 In operation, the spray of coating material is emitted from the nozzle 3 in the spray pattern 4a to coat the surface 5, the spray causing a drag flow of air from outside through the one or more peripheral air access openings 13 towards and then along with the spray, whilst the air extraction and filtering device causes a flow of extraction air from the gap X2 between the surface to be coated and the bottom side of the housing via the annular inlet slit 12a into the internal annular air channel 12, so that coating particles not adhered to the surface 5 are
20 entrained with the extraction air and passed to the one or more filters.

In fig. 3 an embodiment of an internal annular air channel 52 is schematically shown. The internal annular air channel 52 is delimited in part by one or more annular air deflectors 20, 20', 21, 21' configured for deflecting the airflow through the channel. The annular air
25 deflectors are positioned between the inlet slit 52a and the one or more outlet ports (not shown). The annular air deflectors 20, 20' of the shown embodiment are connected to an inner wall portion 18, while the annular air deflectors 21, 21' of the shown embodiment are connected to an outer wall portion 19.

30 In figs. 4 and 5 alternative embodiments of a housing 60, 70 are shown. The housings comprise an inner wall portion 68, 78 and an outer wall portion 69, 79, and a bottom side 66, 76 and a top side 67, 77. In the housing an internal annular air channel 65, 75 is present.

35 The bottom side of the housing 66, 76 is provided with an annular inlet slit 66a, 76a of the internal annular air channel 65, 75.

In these embodiments, the housing 60, 70 comprises an annular air guide 64, 74 that extends from an inner edge 64a', 74a' of the annular inlet slit 66a, 76a in a direction angled upward and outward. The annular air guide 64, 74 is positioned at an upward angle such that a larger portion of air is exhausted from inside of the perimeter of the housing and a smaller portion of
5 air is exhausted from outside the perimeter of the housing.

In these embodiments further an annular air deflector 63, 73 is positioned relative to the annular air guide 64, 74 such that air flowing along the annular air guide is deflected by the annular air deflector, e.g. the annular air deflector being located at an end portion of the
10 annular air guide remote from the inlet slit 66a, 76a. In the shown embodiment, the annular air deflector 63, 73 is positioned downwardly relative to the annular air guide 64, 74, e.g. perpendicular to the annular air guide in a downwards direction, e.g. at an end portion of the annular air guide remote from the inlet slit configuration.

15 In the embodiments of figs. 4 and 5, the bottom side 66, 76 of the housing comprises an undulating surface 62, 72 with one or more annularly extending undulations. Here the undulating surface comprises a sawtooth shape in vertical cross-section, wherein the sawtooth shape comprises two saw teeth 62a, 62b; 72a, 72b.

20 In an embodiment not shown in the figures, the inner wall portion 68 of the housing portion comprises an undulating surface, more specifically the inner wall portion 68 near the inner edge 64a'.

The internal annular air channel 65, 75 thus comprises one or more sharp turns, preferably
25 greater than 90 degrees. In particular, the annular air deflector 63, 73 internally aligns with the sawtooth shape of the bottom side to form a sharp turn of the internal annular air channel.

In the embodiment of fig. 5 an air permeable wind screen 80 is positioned over the one or more peripheral air access openings, e.g. the wind screen comprising an air permeable mesh
30 or an arrangement of slats.

The height of the top side of the housing 10 with respect to the surface to be coated 5, indicated with distance X3, is less than nozzle height X1 by at least 10 cm, e.g. by between 10 and 25 centimeters, e.g. wherein the nozzle height X1 is between 20 and 40 centimeters,
35 e.g. about 30 centimeters.

The multiple outlet ports 12b of the internal annular air channel 12 are spaced around the perimeter of the housing 7', e.g. wherein two or four outlet ports 12b are present, e.g. two ports at diametrically opposite locations, e.g. the ports being formed in the top side 10b and/or in the outer wall portion 9 of the housing 7'.

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The housing 7' has a substantially similar shape to the nozzle spray pattern 4a.

The nozzle 3a is configured to emit a fan spray 4 having a spray pattern 4a with a major axis and a shorter minor axis, e.g. an elliptical flat fan spray nozzle or a elliptical linear fan spray
10 nozzle, and wherein the housing 7' is of a substantially similar shape to the nozzle spray pattern 4a, e.g. elliptical, seen in the top view.

In an embodiment the housing 7' is composed of housing components that are releasably attached to one another, e.g. in view of cleaning the housing. Advantageously, during
15 maintenance and or cleaning procedures the housing 7' is taken apart easily and cleaned easily. During operation atomized coating particles adhere to the surface of the internal annular air channel 12, which includes the surfaces of the annular air guide 64, 74 and annular air deflector 63, 73, and by having these means removably attached cleaning processes are simplified.

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In embodiments, the motion device 10 is a wheeled robot, e.g. provided with magnetic retention system configured to support the robot against a vertical metal wall having a surface
5 to be coated, e.g. a vertical metal wall of a storage tank. Advantageously, the robot is suitable to perform X-Y movements. Possibly, the robot is suitable to carry out rotation
25 movements.

C L A I M S

1. Automated coating system (1) for coating a surface (5) of an object with a spray tool having a nozzle (3a) emitting a spray (4) of atomized coating particles in a spray pattern (4a),
5 for example paint, onto the surface, preferably an airless spray tool,

wherein the system comprises:

- 10 - a motion device (10) provided with a mount (2) on which the spray tool (3) having a nozzle (3a) emitting a spray (4) of atomized coating particles in the spray pattern (4a) is mounted, which motion device is configured to position the nozzle at a nozzle height (X1) relative to the surface (5) to be coated, and which motion device is configured to move the spray tool relative to the surface during coating of the surface,
- 15 - a coating material supply (6) including a pump (6a) configured to supply a pressurized liquid coating material to the nozzle (3a) of the spray tool (3),

- an extraction member (7) which is supported by the motion device to move in unison with the spray tool relative to the surface during coating of the surface,

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wherein the extraction member comprises an annular housing (7') having an inner wall portion (8), an outer wall portion (9), and a bottom side (10a) and a top side (10b),

25 wherein the inner wall portion of the housing delimits an opening (11) through which the spray of atomized coating particles passes onto the surface to be coated, wherein the inner wall portion is configured to be peripherally spaced about the spray,

30 wherein the motion device (10) is configured to position the bottom side of the housing in proximity of the surface to be coated so as to maintain a gap (X2) between the bottom side and the surface to be coated,

wherein in the housing an internal annular air channel (12) is present,

35 wherein the bottom side of the housing (10a) is provided with an annular inlet slit (12a) of the internal annular air channel,

wherein the housing comprises one or more outlet ports (12b) of the internal annular air channel,

- 5 - an air extraction and filtering device including an air extraction duct, an air extraction fan, and one or more air filters, wherein the air extraction duct is connected to the one or more outlet ports of the internal annular air channel,

10 wherein the top side of the housing (10b) is lower than the nozzle height, and wherein between the top side and the nozzle one or more peripheral air access openings (13) are present,

15 wherein, in operation, the spray of coating material is emitted from the nozzle in the spray pattern to coat the surface, the spray causing a drag flow of air from outside through the one or more peripheral air access openings towards and then along with the spray, whilst the air extraction and filtering device causes a flow of extraction air from the gap between the surface to be coated and the bottom side of the housing via the annular inlet slit into the internal annular air channel, so that coating particles not adhered to the surface are entrained with the extraction air and passed to the one or more filters.

20 2. Automated coating system according to claim 1, wherein the housing comprises an annular air guide (64, 74) that extends from an inner edge (64a', 74a') of the annular inlet slit in a direction angled upward and outward.

25 3. Automated coating system according to claim 1, wherein the housing comprises an annular air guide (64, 74) that extends from an inner edge (64a', 74a') of the annular inlet slit in a direction angled upward and inward.

30 4. Automated coating system according to claim 2 or 3, wherein the annular air guide is positioned at an upward angle such that a larger portion of air is exhausted from inside of the perimeter of the housing and a smaller portion of air is exhausted from outside the perimeter of the housing.

35 5. Automated coating application system according to any of claims 2 or 3, wherein the annular air guide is positioned at an upward angle such that a smaller portion of air is exhausted from inside of the perimeter of the housing and a larger portion of air is exhausted from outside the perimeter of the housing.

6. Automated coating system according to any of the preceding claims, wherein the internal annular air channel (12, 52) is delimited in part by one or more annular air deflectors (20, 20', 21, 21') configured for deflecting the airflow, which one or more annular air deflectors are positioned between the inlet slit and the one or more outlet ports.
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7. Automated coating system according to any of claims 2 - 5, wherein an annular air deflector (63, 73) is positioned relative to the annular air guide (64, 74) such that air flowing along the annular air guide is deflected by the annular air deflector, e.g. the annular air deflector being located at an end portion of the annular air guide remote from the inlet slit.
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8. Automated coating system according to claim 7, wherein the annular air deflector is positioned downwardly relative to the annular air guide, e.g. perpendicular to the annular air guide in a downwards direction, e.g. at an end portion of the annular air guide remote from the inlet slit configuration.
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9. Automated coating system according to any of the preceding claims, wherein the inner wall portion and/or bottom side of the housing comprises an undulating surface (62, 72) with one or more annularly extending undulations, e.g. concentric undulations.
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10. Automated coating application system according to claim 9, wherein the undulating surface comprises a sawtooth shape in vertical cross-section, e.g. wherein the sawtooth shape comprises two saw teeth (62a, 62b; 72a, 72b).
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11. Automated coating surface according to any of the preceding claims, wherein the internal annular air channel comprises one or more sharp turns, preferably greater than 90 degrees.
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12. Automated coating system according to claims 8 and 10, wherein the annular air deflector internally aligns with the sawtooth shape of the bottom side to form a sharp turn of the internal annular air channel.
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13. Automated coating system according to any of the preceding claims, wherein the internal annular air channel is configured such that extracted air flows from the inlet slit in a direction radially outward and upward, which flow direction of the internal annular air channel then is deflected by one or more annular air deflectors to a direction radially inward.

14. Automated coating system according to any of the preceding claims, wherein the internal annular air channel is configured such that extracted air flows from the inlet slit in a direction radially inward and upward, which flow direction of the internal annular air channel then is deflected by one or more annular air deflectors to a direction radially outward
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15. Automated coating system according to any of the preceding claims, wherein an air permeable wind screen (80) is positioned over the one or more peripheral air access openings, e.g. the wind screen comprising an air permeable mesh or an arrangement of slats.
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16. Automated coating system according to any of the preceding claims, wherein the housing is lower than the nozzle height, when measured from the spraying surface, by at least 10 cm, e.g. by between 10 and 25 centimeters, e.g. wherein the nozzle height is between 20 and 40 centimeters, e.g. about 30 centimeters.
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17. Automated coating system according to any of the preceding claims, wherein multiple outlet ports of the internal annular air channel are spaced around the perimeter of the housing, e.g. wherein two or four outlet ports are present, e.g. two ports at diametrically opposite locations, e.g. the ports being formed in the top side and/or in the outer wall portion of the housing.
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18. Automated coating system according to any of the preceding claims, wherein the housing has a substantially similar shape to the nozzle spray pattern, for example a circular shape.
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19. Automated coating system according to any of the preceding claims, wherein the nozzle is configured to emit a fan spray having a spray pattern with a major axis and a shorter minor axis, e.g. an elliptical flat fan spray nozzle or a elliptical linear fan spray nozzle, and wherein the housing is of a substantially similar shape to the nozzle spray pattern, e.g. elliptical, seen in top view.
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20. Automated coating system according to any of the preceding claims, wherein the housing is composed of housing components that are releasably attached to one another, e.g. in view of cleaning the housing.
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21. Automated coating system according to any of the preceding claims, wherein the motion device is a wheeled robot, e.g. provided with magnetic retention system configured to

support the robot against a vertical metal wall having a surface to be coated, e.g. a vertical metal wall of a storage tank.

22. Method for coating a surface of an object with a spray tool, wherein use is made of the
5 automated coating system according to any one or more of the preceding claims.