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(71) Applicant: **Arçelik Anonim Sirketi**
34445 Istanbul (TR)

(72) Inventors:
• **RIAZ, Asawar Bin**
34445 Istanbul (TR)
• **DIN, Maaz Ud**
34445 Istanbul (TR)
• **KILIC, Kaan**
34445 Istanbul (TR)
• **OZCAN, Gokhan**
34445 Istanbul (TR)
• **CEYHAN, Engin**
34445 Istanbul (TR)

(54) **AN EXHAUST HOOD COMPRISING AN ELECTROSTATIC FLUID ACCELERATOR**

(57) The present invention relates to an exhaust hood (1) comprising a body (2); an air suction duct (3) located on the body (2) and allowing an air flow therein in an air flow direction (X); a high-voltage power supply (41) disposed on the body (2); and a plurality of electrostatic fluid accelerators (4) located on the air suction duct (3), each having at least one wire electrode (42)

connected to the high-voltage power supply (41) and charged with an electrical charge and at least one collecting electrode (43) connected to the high-voltage power supply (41) and charged with an electrical charge opposite to that of the wire electrode (42) so as to generate an electrostatic force between the collecting electrode (43) and the wire electrode (42).

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Description

[0001] The present invention relates to an exhaust hood wherein an air flow is generated by producing an ionic wind by means of an electrostatic fluid accelerator.

[0002] In exhaust hoods, an air flow is generally generated in an air suction duct by means of a radial fan. The radial fan provides the pressure drop required for the air flow. However, a high level of noise is generated during the operation of said radial fan. In addition, due to the vibrations occurring during the operation of the radial fan, the user's perception of quality is adversely affected. In order to overcome these disadvantages, in the state of the art, exhaust hoods comprising an electrostatic fluid accelerator are used. The electrostatic fluid accelerator generates an ionic wind, thereby causing the molecules in the air to move. The greatest advantage of using an electrostatic fluid accelerator instead of a radial fan is that, since there are no moving parts in the ionic wind generation mechanism, the exhaust hood operates at low noise levels. However, in the state of the art applications, the air flow generated by the electrostatic fluid accelerator is very small. This leads to a decrease in efficiency. In order to overcome this disadvantage, in the state of the art applications, a plurality of electrostatic fluid accelerators are placed along the air flow path. However, even in these applications, the desired operating efficiency cannot be achieved. Therefore, there is a need for an exhaust hood comprising an electrostatic fluid accelerator and capable of operating efficiently.

[0003] In the state of the art United States Patent Application No. US2010089240A1, an exhaust hood having an electrostatic fluid accelerator is disclosed.

[0004] The aim of the present invention is the realization of an exhaust hood wherein an effective air flow is generated by means of an electrostatic fluid accelerator.

[0005] The exhaust hood realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims, comprises a body; an air suction duct located on the body; a high-voltage power supply; and at least two electrostatic fluid accelerators connected to the high-voltage power supply. The electrostatic fluid accelerator comprises a wire electrode and a collecting electrode connected to different poles of the high-voltage power supply. A diffuser is provided on the air suction duct. The diffuser comprises, in the air flow direction, a first opening having a first diameter, a second opening having a second diameter greater than the first diameter, and at least one first side wall extending in a conical form between the first opening and the second opening. One of the electrostatic fluid accelerators is positioned on the first opening and the other is positioned on the second opening. By means of the diffuser, as the flow proceeds from the first opening toward the second opening, the

static pressure is increased and the air flow velocity is decreased due to the increase in diameter. As a result of this, the air reaching the second opening is enabled to be moved more efficiently in the air flow direction by the electrostatic fluid accelerator by means of the ionic wind effect. Thus, by using the electrostatic fluid accelerator, the air is drawn efficiently in the air flow direction.

[0006] In an embodiment of the present invention, the diffuser comprises, in the air flow direction, a third opening located after the second opening and having a third diameter greater than the second diameter. The diffuser further comprises a second side wall extending in a conical form between the second opening and the third opening. At least one electrostatic fluid accelerator is positioned on the third opening. By means of the second side wall, as the flow proceeds from the second opening toward the third opening, the static pressure is increased and the air flow velocity is decreased due to the increase in diameter. As a result of this, the air reaching the third opening is enabled to be moved more efficiently in the air flow direction by the electrostatic fluid accelerator by means of the ionic wind effect. Thus, by using the electrostatic fluid accelerator, the air is drawn efficiently in the air flow direction. In different versions of the embodiment, more than three openings and electrostatic fluid accelerators positioned on each opening are used. In the air flow direction, each opening has a diameter greater than that of the preceding opening. Thus, the electrostatic fluid accelerator is enabled to be operated more efficiently as the flow progresses in the air flow direction.

[0007] In another embodiment of the present invention, the second diameter is at least 20% greater than the first diameter. When the second diameter is at least 20% greater than the first diameter, the air delivered from the first opening toward the second opening by the electrostatic fluid accelerator positioned on the first opening is delivered to the electrostatic fluid accelerator positioned on the second opening at a suitable velocity. Thus, by ensuring that the air is delivered to the electrostatic fluid accelerator on the second opening at a suitable initial velocity and at a suitable static pressure, the ionic wind generated by the electrostatic fluid accelerator moves the air efficiently in the air flow direction.

[0008] In another embodiment of the present invention, the third diameter is at least 20% greater than the second diameter. When the third diameter is at least 20% greater than the second diameter, the air delivered from the second opening toward the third opening by the electrostatic fluid accelerator positioned on the second opening is delivered to the electrostatic fluid accelerator positioned on the third opening at a suitable velocity. Thus, by ensuring that the air is delivered to the electrostatic fluid accelerator on the third opening at a suitable initial velocity and at a suitable static pressure, the ionic wind generated by the electrostatic fluid accel-

erator moves the air efficiently in the air flow direction.

[0009] In another embodiment of the present invention, a first additional air inlet opening is provided between the first opening and the second opening. Additional ambient air is enabled to enter the diffuser through the first additional air inlet opening. Thus, by increasing the amount of air flowing between the first opening and the second opening within the diffuser, the air flow velocity is reduced.

[0010] In another embodiment of the present invention, a second additional air inlet opening is provided between the second opening and the third opening. Additional ambient air is enabled to enter the diffuser through the second additional air inlet opening. Thus, by increasing the amount of air flowing between the second opening and the third opening within the diffuser, the air flow velocity is reduced.

[0011] In another embodiment of the present invention, the diffuser is connected to an exhaust flue of the air suction duct by means of a nozzle. An air outlet opening arranged at the end of the nozzle connected to the exhaust flue has a diameter smaller than the diameter of the third opening arranged at the end of the nozzle connected to the diffuser. Thus, the air is enabled to be accelerated in the air flow direction. Furthermore, the air is enabled to be directed smoothly in the air flow direction.

[0012] In another embodiment of the present invention, the collecting electrode comprises a plurality of rods in cylindrical form. The rods are preferably manufactured from aluminum. The rods preferably have a diameter of 6 mm. The rods are preferably positioned at intervals of 10 millimeters from each other. Thus, it is ensured that the electrostatic fluid accelerator is operated efficiently and the air flow within the diffuser is obstructed as little as possible.

[0013] In another embodiment of the present invention, the wire electrode and the collecting electrode of the electrostatic fluid accelerator positioned on the first opening are spaced apart by a first distance. The wire electrode and the collecting electrode of the electrostatic fluid accelerator positioned on the second opening are spaced apart by a second distance. The second distance is at least 10% greater than the first distance. As the distance between the collecting electrode and the wire electrode increases, the ion movement between the electrodes accelerates. Thus, an air flow that is faster between the second opening and the third opening than between the first opening and the second opening is obtained.

[0014] In another embodiment of the present invention, the wire electrode and the collecting electrode of the electrostatic fluid accelerator positioned on the third opening are spaced apart by a third distance. The third distance is at least 10% greater than the second distance. Thus, an air flow that is faster between the third opening and the air outlet opening than between the second opening and the third opening is obtained. Con-

sequently, the air flow velocity is enabled to be increased in a controlled manner at each stage of the diffuser.

[0015] By means of the present invention, an exhaust hood is realized, wherein the air flow in the air suction duct is generated effectively and efficiently by means of the electrostatic fluid accelerator and the diffuser.

[0016] The exhaust hood realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the perspective view of the exhaust hood related to an embodiment of the present invention.

Figure 2 - is the bottom perspective view of the exhaust hood related to another embodiment of the present invention.

Figure 3 - is the schematic view of the exhaust hood related to another embodiment of the present invention.

Figure 4 - is the schematic view of the exhaust hood related to another embodiment of the present invention.

Figure 5 - is the schematic view of the detail A in Figure 4.

1. Exhaust hood
2. Body
3. Air suction duct
4. Electrostatic fluid accelerator

41. High-voltage power supply
42. Wire electrode
43. Collecting electrode

5. Diffuser

51. First opening
52. Second opening
53. Third opening
54. First side wall
55. Second side wall
56. First additional air inlet opening
57. Second additional air inlet opening

6. Nozzle
61. Air outlet opening
- X. Air flow direction

[0017] The exhaust hood (1) comprises a body (2); an air suction duct (3) located on the body (2) and allowing an air flow therein in an air flow direction (X); a high-voltage power supply (41) disposed on the body (2); and a plurality of electrostatic fluid accelerators (4) located on the air suction duct (3), each having at least one wire electrode (42) connected to the high-voltage power supply (41) and charged with an electrical charge and at least one collecting electrode (43) con-

nected to the high-voltage power supply (41) and charged with an electrical charge opposite to that of the wire electrode (42) so as to generate an electrostatic force between the collecting electrode (43) and the wire electrode (42). The high-voltage power supply (41) is a direct current power supply. The wire electrode (42) and the collecting electrode (43) are connected to different terminals of the high-voltage power supply (41). For example, the wire electrode (42) is charged with a negative (-) electrical charge, while the collecting electrode (43) is charged with a positive (+) electrical charge. As shown in Figures 4 and 5, the collecting electrode (43) is positioned after the wire electrode (42) in the air flow direction (X). Due to the high potential difference between the collecting electrode (43) and the wire electrode (42), ion movement occurs from the wire electrode (42) toward the collecting electrode (43). While moving from the wire electrode (42) toward the collecting electrode (43), the ions collide with neutrally charged ambient air molecules, thereby generating an air flow, also referred to as ionic wind, and causing the air molecules to move in the air flow direction (X).

[0018] The exhaust hood (1) of the present invention comprises a diffuser (5) arranged on the air suction duct (3), wherein the diffuser (5) has a first opening (51) having a first diameter and configured to receive one of the electrostatic fluid accelerators (4); a second opening (52) arranged after the first opening (51) in the air flow direction (X), having a second diameter greater than the first diameter and configured to receive another electrostatic fluid accelerator (4); and at least one first side wall (54) extending from the first opening (51) toward the second opening (52) so as to guide the air from the first opening (51) toward the second opening (52) and extending in a conical form that expands, at least partially, from the first opening (51) toward the second opening (52). Preferably, the first opening (51) and the second opening (52) are circular. One of the electrostatic fluid accelerators (4) is arranged on the first opening (51) along the first opening (51). Another one of the electrostatic fluid accelerators (4) is arranged on the second opening (52) along the second opening (52). As shown in Figures 3 and 4, the second opening (52) has a diameter greater than that of the first opening (51). The first side wall (54) extending between the first opening (51) and the second opening (52) directs the air flowing in the air flow direction (X) toward the electrostatic fluid accelerator (4) located on the second opening (52). Thus, as the flow proceeds from the first opening (51) toward the second opening (52), the static pressure is increased and the air flow velocity is decreased. Hence, the operating efficiency of the electrostatic fluid accelerator (4) is increased. Furthermore, consequently, oil molecules contained in the air flowing in the air flow direction (X) are enabled to adhere to the collecting electrode (43) by means of the ionic wind effect, enabling the air to be cleaned without the need for an oil filter.

[0019] In an embodiment of the present invention, the exhaust hood (1) of the present invention comprises the diffuser (5) that has a third opening (53) arranged after the second opening (52) in the air flow direction (X), having a third diameter greater than the second diameter and configured to receive another electrostatic fluid accelerator (4); and at least one second side wall (55) extending from the second opening (52) toward the third opening (53) so as to guide the air from the second opening (52) toward the third opening (53) and extending in a conical form that expands, at least partially, from the second opening (52) toward the third opening (53). As shown in Figures 3 and 4, the third opening (53) has a diameter greater than that of the second opening (52). The second side wall (55) extending between the second opening (52) and the third opening (53) directs the air flowing in the air flow direction (X) toward the electrostatic fluid accelerator (4) located on the third opening (53). Thus, as the flow proceeds from the second opening (52) toward the third opening (53), the static pressure is increased and the air flow velocity is decreased. Thus, the air reaches the electrostatic fluid accelerator (4) located on the third opening (53) at a more suitable velocity, thereby increasing the operating efficiency of the electrostatic fluid accelerator (4) on the third opening (53).

[0020] In another embodiment of the present invention, the exhaust hood (1) comprises the second diameter that is at least 1.2 times greater than the first diameter. Thus, the air is enabled to be delivered to the electrostatic fluid accelerator (4) on the second opening (52) at an initial velocity and a static pressure value at which the electrostatic fluid accelerator (4) operates efficiently.

[0021] In another embodiment of the present invention, the exhaust hood (1) comprises the third diameter that is at least 1.2 times greater than the second diameter. Thus, the air is enabled to be delivered to the electrostatic fluid accelerator (4) on the third opening (53) at an initial velocity and a static pressure value at which the electrostatic fluid accelerator (4) operates efficiently.

[0022] In another embodiment of the present invention, the exhaust hood (1) comprises at least one first additional air inlet opening (56) arranged between the first opening (51) and the second opening (52) (Figure 3 and Figure 4). By means of the first additional air inlet opening (56), more ambient air is enabled to be drawn into the air suction duct (3), thereby reducing the air flow velocity within the air suction duct (3). Thus, the velocity of the air delivered to the second opening (52) is reduced.

[0023] In another embodiment of the present invention, the exhaust hood (1) comprises at least one second additional air inlet opening (57) arranged between the second opening (52) and the third opening (53). By means of the second additional air inlet opening (57), more ambient air is enabled to be drawn into the air

suction duct (3), thereby reducing the air flow velocity within the air suction duct (3). Thus, the velocity of the air delivered to the third opening (53) is reduced.

[0024] In another embodiment of the present invention, the exhaust hood (1) comprises a nozzle (6) in the form of a truncated cone, one end of which is connected to the second side wall (55) and the other end of which comprises an air outlet opening (61) having a diameter smaller than the third diameter. The diffuser (5) is connected to an exhaust flue of the air suction duct (3) by means of the nozzle (6). Since the diameter of the air outlet opening (61) is smaller than the third diameter, the nozzle (6) has a truncated conical form that narrows from the third opening (53) toward the air outlet opening (61). Thus, the air flow velocity of the air flowing within the nozzle (6) is increased.

[0025] In another embodiment of the present invention, the exhaust hood (1) comprises the collecting electrode (43) having a plurality of rods with a cylindrical form. Thus, the collecting electrode (43) can be more easily positioned within the diffuser (5) so as not to obstruct the air flow. As shown in Figure 2, the plurality of rods are positioned at intervals on the first opening (51), the second opening (52), and the third opening (53). In another embodiment of the present invention, the exhaust hood (1) comprises a second distance in the air flow direction (X) between the wire electrode (42) and the collecting electrode (43) of the electrostatic fluid accelerator (4) positioned on the second opening (52), said second distance being at least 1.1 times greater than a first distance in the air flow direction (X) between the wire electrode (42) and the collecting electrode (43) of the electrostatic fluid accelerator (4) positioned on the first opening (51). The distance between the wire electrode (42) and the collecting electrode (43) determines the maximum voltage that can be applied without electrical breakdown (air ionization and spark formation). As the distance increases, higher voltages can be applied to the respective electrodes (42, 43). A higher voltage and a greater distance allow the ions to travel a longer acceleration path, thereby enabling them to gain higher velocity and momentum. Since the second distance is greater than the first distance, the air flow from the second opening (52) toward the third opening (53) is conveyed at a higher velocity in the air flow direction (X).

[0026] In another embodiment of the present invention, the exhaust hood (1) comprises a third distance in the air flow direction (X) between the wire electrode (42) and the collecting electrode (43) of the electrostatic fluid accelerator (4) positioned on the third opening (53), said third distance being at least 1.1 times greater than the second distance. Thus, the air flow from the third opening (53) toward the air outlet opening (61) is conveyed at a higher velocity in the air flow direction (X).

[0027] By means of the present invention, an exhaust hood (1) is realized, wherein an air flow is generated

efficiently within the air suction duct (3) by means of electrostatic fluid accelerators (4) positioned at specific stages of the diffuser (5).

Claims

1. An exhaust hood (1) comprising a body (2); an air suction duct (3) located on the body (2) and allowing an air flow therein in an air flow direction (X); a high-voltage power supply (41) disposed on the body (2); and a plurality of electrostatic fluid accelerators (4) located on the air suction duct (3), each having at least one wire electrode (42) connected to the high-voltage power supply (41) and charged with an electrical charge and at least one collecting electrode (43) connected to the high-voltage power supply (41) and charged with an electrical charge opposite to that of the wire electrode (42) so as to generate an electrostatic force between the collecting electrode (43) and the wire electrode (42), **characterized by** a diffuser (5) arranged on the air suction duct (3), wherein the diffuser (5) has a first opening (51) having a first diameter and configured to receive one of the electrostatic fluid accelerators (4); a second opening (52) arranged after the first opening (51) in the air flow direction (X), having a second diameter greater than the first diameter and configured to receive another electrostatic fluid accelerator (4); and at least one first side wall (54) extending from the first opening (51) toward the second opening (52) so as to guide the air from the first opening (51) toward the second opening (52) and extending in a conical form that expands, at least partially, from the first opening (51) toward the second opening (52).
2. An exhaust hood (1) as in Claim 1, **characterized by** the diffuser (5) that has a third opening (53) arranged after the second opening (52) in the air flow direction (X), having a third diameter greater than the second diameter and configured to receive another electrostatic fluid accelerator (4); and at least one second side wall (55) extending from the second opening (52) toward the third opening (53) so as to guide the air from the second opening (52) toward the third opening (53) and extending in a conical form that expands, at least partially, from the second opening (52) toward the third opening (53).
3. An exhaust hood (1) as in Claim 1 or Claim 2, **characterized by** the second diameter that is at least 1.2 times greater than the first diameter.
4. An exhaust hood (1) as in Claim 2 or Claim 3, **characterized by** the third diameter that is at least 1.2 times greater than the second diameter.

5. An exhaust hood (1) as in any one of the above claims, **characterized by** at least one first additional air inlet opening (56) arranged between the first opening (51) and the second opening (52). 5
6. An exhaust hood (1) as in any one of Claims 2 to 5, **characterized by** at least one second additional air inlet opening (57) arranged between the second opening (52) and the third opening (53). 10
7. An exhaust hood (1) as in any one of Claims 2 to 6, **characterized by** a nozzle (6) in the form of a truncated cone, one end of which is connected to the second side wall (55) and the other end of which comprises an air outlet opening (61) having a diameter smaller than the third diameter. 15
8. An exhaust hood (1) as in any one of the above claims, **characterized by** the collecting electrode (43) having a plurality of rods with a cylindrical form. 20
9. An exhaust hood (1) as in any one of the above claims, **characterized by** a second distance in the air flow direction (X) between the wire electrode (42) and the collecting electrode (43) of the electrostatic fluid accelerator (4) positioned on the second opening (52), said second distance being at least 1.1 times greater than a first distance in the air flow direction (X) between the wire electrode (42) and the collecting electrode (43) of the electrostatic fluid accelerator (4) positioned on the first opening (51). 25 30
10. An exhaust hood (1) as in Claim 9, **characterized by** a third distance in the air flow direction (X) between the wire electrode (42) and the collecting electrode (43) of the electrostatic fluid accelerator (4) positioned on the third opening (53), said third distance being at least 1.1 times greater than the second distance. 35 40

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Figure 1

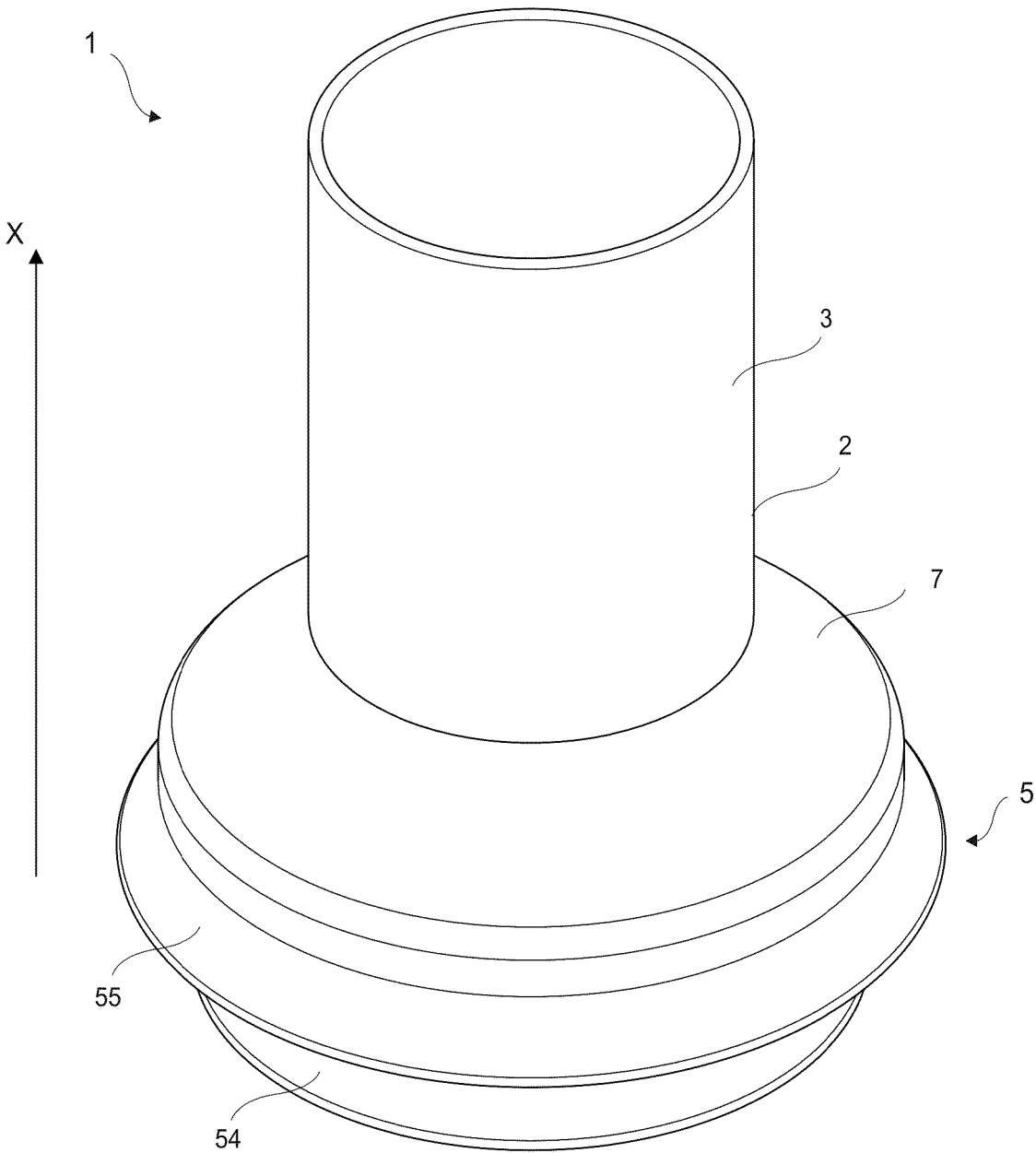


Figure 2

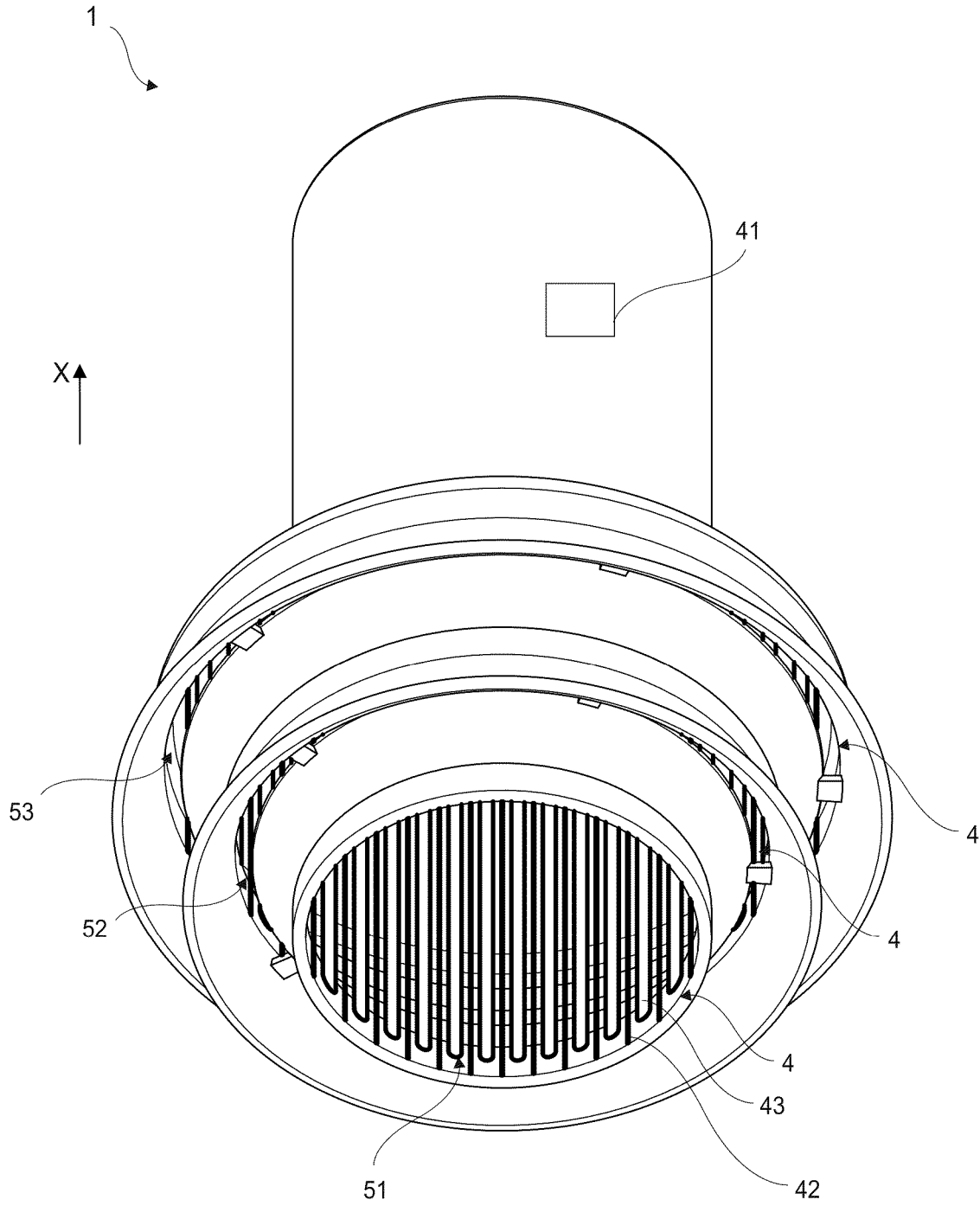


Figure 3

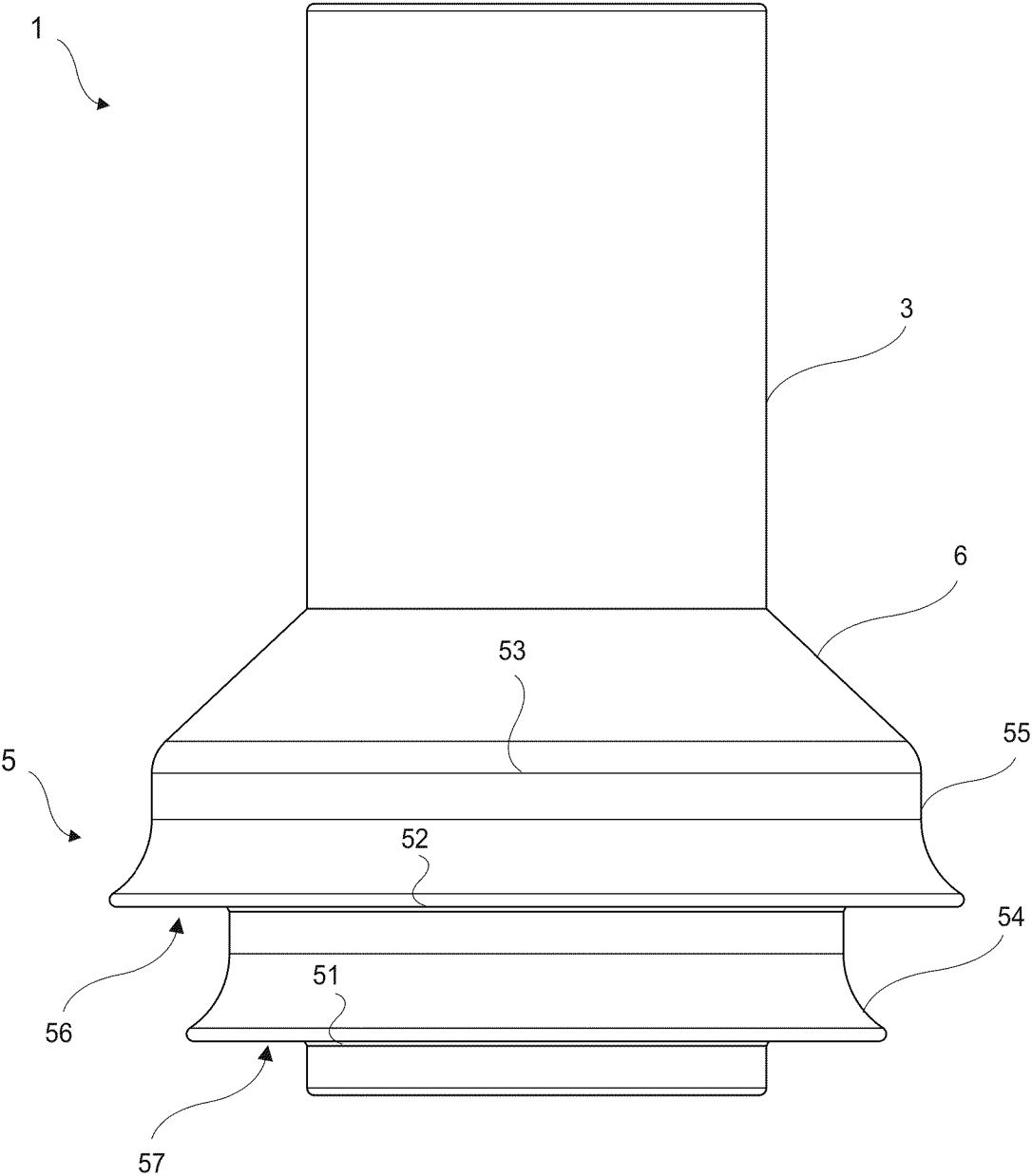


Figure 4

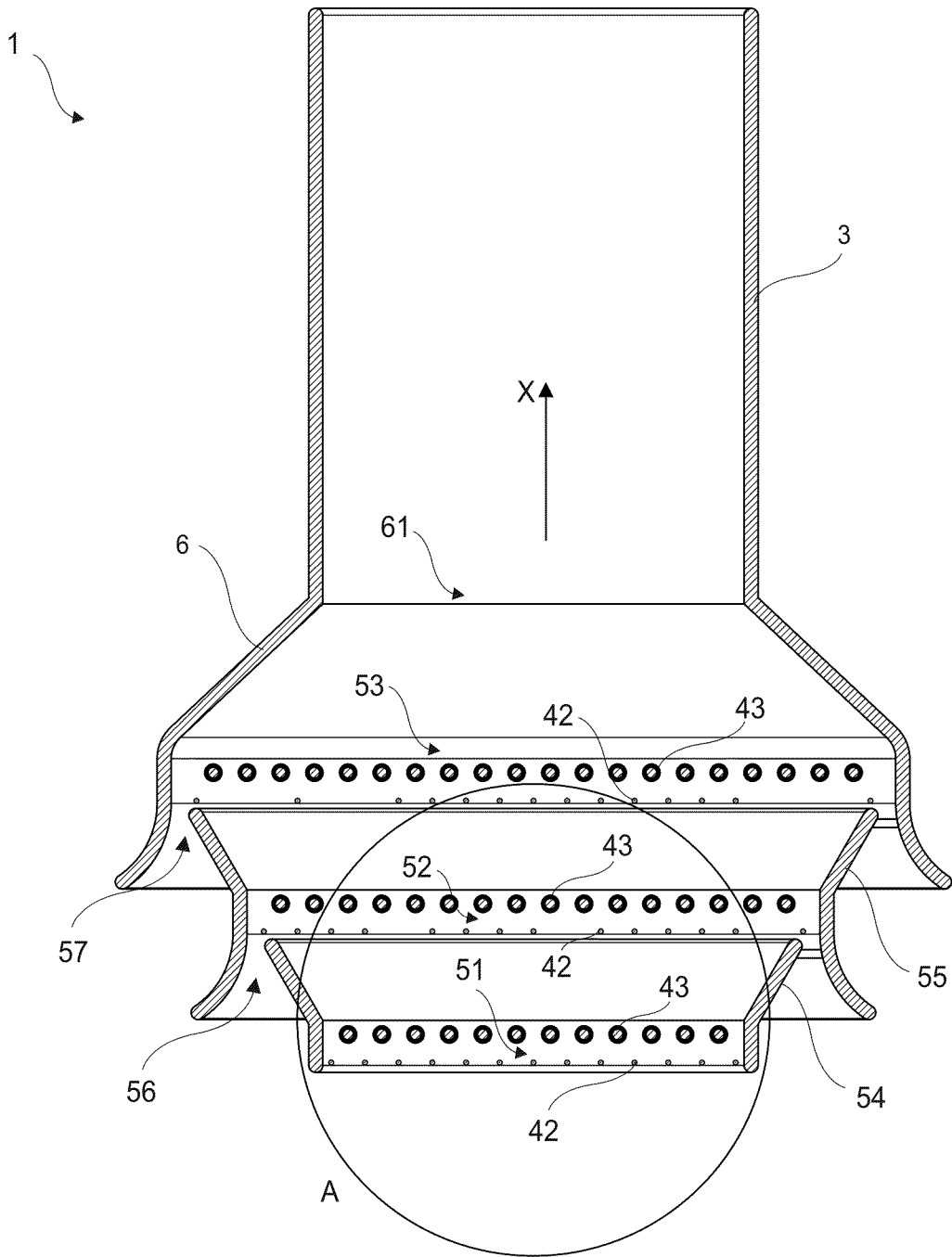
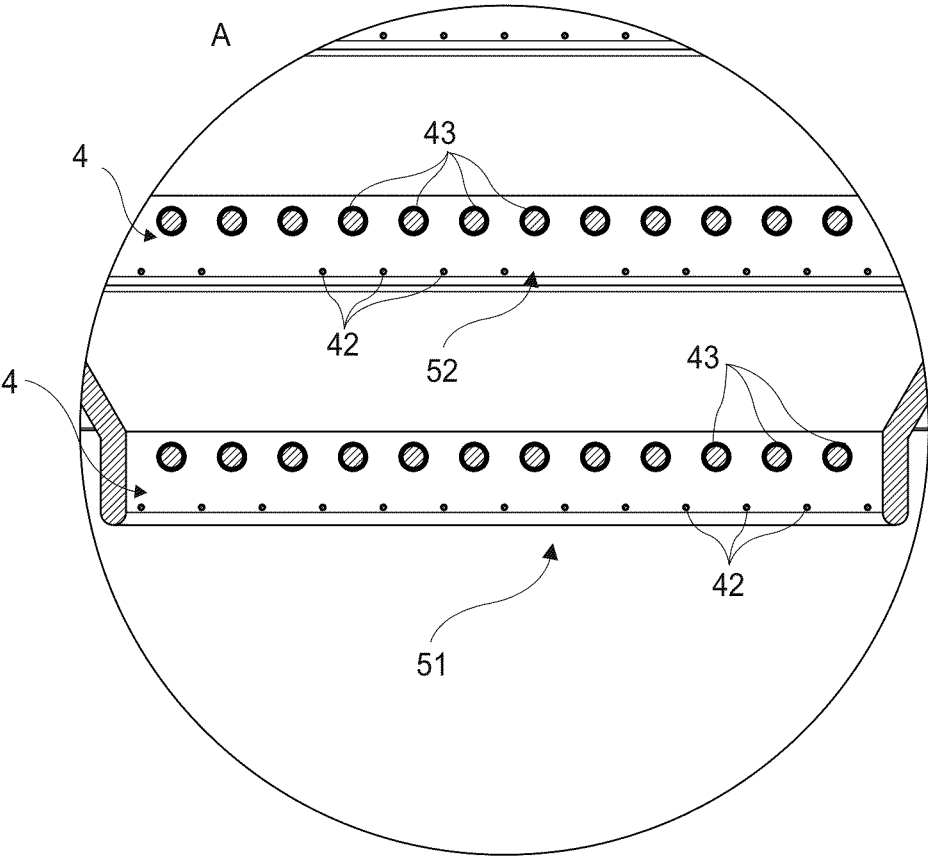


Figure 5



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EUROPEAN SEARCH REPORT

Application Number

EP 26 17 1827

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			B03C A21B F24C F24F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		11 June 2026	Ismail, Youssef
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-06-2026

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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