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CURLING HAIR

- (57)

A device for curling hair includes a barrel (20) comprising a heat sink (22). The heat sink (22) includes a hair curling surface (24) and a first set of light-emitting diodes, LEDs, (26) is coupled to the heat sink (22). The heat sink (22) is configured to transfer residual thermal energy from the first set of LEDs (26) to heat hair wound around the hair curling surface (24) via conduction. The hair curling device also includes a housing (28) surround-
- ing the barrel (20). The housing (28) and barrel (20) define a hair chamber (14) between them. A second set of LEDs (12) are coupled to the housing (28). The second set of LEDs (12) is configured to emit light energy towards the hair curling surface (24) to heat the hair wound around the hair curling surface (24) via absorption of the emitted light energy.

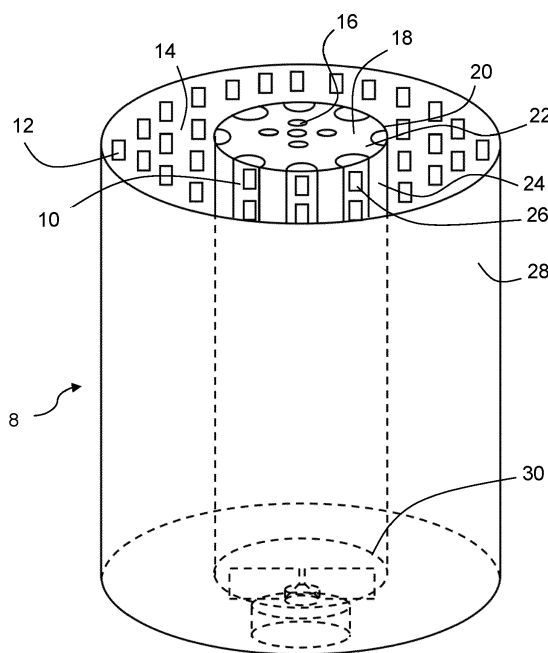


Fig. 1

Description

FIELD OF THE INVENTION

[0001] The subject-matter of the present disclosure relates to the field of curling hair, and more specifically a device and method for curling hair.

BACKGROUND OF THE INVENTION

[0002] Hair curling devices typically include a curling surface for curling the hair and a heating element for heating the hair so that it can be curled more easily. In some prior art devices, the heating element may comprise light-emitting diodes (LEDs) to heat the hair via light radiation absorption.

[0003] WO 2019/048357 A1 discloses a hair styling device comprising a heat source for heating hair by conduction via direct contact between a hair contact surface of the heat source and the hair.

[0004] It is an aim of the subject-matter of the present disclosure to improve on the prior art.

SUMMARY OF THE INVENTION

[0005] According to a first aspect of the present invention, there is provided a device for curling hair that includes a barrel comprising a heat sink. The heat sink includes a hair curling surface and a first set of light-emitting diodes, LEDs, is mounted to the heat sink. The heat sink is configured to transfer residual thermal energy from the first set of LEDs to heat hair wound around the hair curling surface via conduction. The hair curling device also includes a housing surrounding the barrel. The housing and barrel define a hair chamber therebetween. A second set of LEDs is mounted to the housing. The second set of LEDs is configured to emit light energy towards the hair curling surface to heat the hair wound around the hair curling surface via absorption of the emitted light energy.

[0006] In this way, the hair is heated both via conduction using residual thermal energy from the first set of light-emitting diodes, LEDs, and by light energy absorption from the second set of LEDs, thereby providing efficient heating of the hair. Additionally, in this way, the hair is heated using energies from two sets of light-emitting diodes, thereby providing quick heating of the hair.

[0007] In an embodiment, the heat sink is configured to transfer residual thermal energy from the first set of light-emitting diodes to heat hair wound around the hair curling surface via conduction and, the second set of light-emitting diodes is configured to emit light energy towards the hair curling surface to heat the hair wound around the hair curling surface via absorption of the emitted light energy simultaneously.

[0008] In an embodiment, the housing also comprises the heat sink to which the second set of light-emitting diodes are mounted, wherein the heat sink is configured

to transfer residual thermal energy from the second set of light-emitting diodes to the hair wound around the hair curling surface of the heat sink via conduction.

[0009] In this way, the heating by the second set of LEDs using light energy and residual thermal energy provides more efficient heating of the hair than heating using solely the first set of LEDs. A lower intensity of the first set of LEDs is needed than the LEDs of the prior art hair curling devices. A lower intensity of the second set of LEDs is needed than the LEDs of the prior art hair curling devices. In this way, the heating of the hair is quicker than if the heating does not occur simultaneously.

[0010] In an embodiment, the barrel is an inner barrel and the housing is an outer barrel, wherein the device further comprises a connection bridge between the inner barrel and the outer barrel, and wherein the inner barrel, the outer barrel, and the connection bridge are integrally formed.

[0011] In this way, more efficient heat conduction is provided, in comparison to having connections between the inner barrel, outer barrel, and the connection bridge.

[0012] In an embodiment, the barrel comprises a waveguide within which the first set of light-emitting diodes is embedded.

[0013] In an embodiment, the waveguide is configured to permit light emitted by the first set of light-emitting diodes to heat the hair wound around the hair curling surface via absorption of light energy from the light emitted by the first set of light-emitting diodes.

[0014] In this way, more efficient heating of the hair using light energy from the first set of LEDs is provided.

[0015] In an embodiment, the waveguide is configured to block light emitted by the first set of light-emitting diodes from reaching the hair wound around the hair curling surface.

[0016] In this way, in an embodiment in which the light within the hair receiving chamber is too bright it is blocked it from view.

[0017] In an embodiment, the waveguide is configured to selectively block light emitted by the first set of light-emitting diodes from reaching the hair wound around the hair curling surface.

[0018] In an embodiment, the waveguide comprises a hair curling surface providing a continuation of the hair curling surface of the barrel.

[0019] In this way, there is no disruption of the hair curling surface to provide the first set of LEDs on the barrel. This allows for a smooth hair curling surface, which produces a smooth curl. This also reduces the risk of hair getting caught or trapped in the hair curling device.

[0020] In an embodiment, the first set of light-emitting diodes is divided into a plurality of groups, wherein a group includes a plurality of first light-emitting diodes arranged longitudinally along a length of the barrel, and wherein the group is separated circumferentially from an adjacent group from the plurality of groups. In an embodiment, the second set of light-emitting diodes includes a plurality of second light-emitting diodes spaced substan-

tially evenly around an interior surface of the housing.

[0021] In these ways, uniform distribution of heating the hair and the hair curling surface is provided.

[0022] In an embodiment, the hair curling surface is made from a light absorbent material for absorbing the light energy from the second set of light-emitting diodes. In an embodiment, an interior surface of the housing facing the hair curling surface is made from a light absorbent material configured to absorb the light energy emitted by the first set of light-emitting diodes.

[0023] In these ways, more efficient heating of the hair is provided, as any light energy that is not absorbed by the hair may be absorbed by the surfaces and used to heat the hair via conduction.

[0024] In an embodiment, the barrel is hollow.

[0025] In an embodiment, the barrel comprises an air inlet and an air outlet, wherein the device further comprises a fan configured to move air in through the air inlet and out through the air outlet.

[0026] In this way, a cooling mechanism to cool the device and/or the hair is provided.

[0027] In an embodiment, the device further comprises a hair collector mechanism for winding the hair around the hair curling surface.

[0028] According to a further aspect of the present invention, there is provided a method of curling hair using the device of any preceding claim, the method comprising: winding hair around the hair curling surface; operating the first set of light-emitting diodes to generate residual thermal energy to heat the hair around the hair curling surface by conduction via the heat sink; and operating the second set of light-emitting diodes to generate the light energy to heat the hair around the hair curling surface by absorption of the light energy.

[0029] In this way, the hair is heated both via conduction using residual thermal energy from the first set of light-emitting diodes, LEDs, and by light energy absorption from the second set of LEDs, thereby providing efficient heating of the hair. Additionally, in this way, the hair is heated using energies from two sets of light-emitting diodes, thereby providing quick heating of the hair.

[0030] In an embodiment, the method further comprises operating the first set of light-emitting diodes and operating the second set of light-emitting diodes simultaneously.

[0031] These and other aspects of the present invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The embodiments of the present inventions may be best understood with reference to the accompanying figures, in which:

Fig. 1 shows a perspective schematic view of a hair curling device, according to one or more embodiment of the present invention;

Fig. 2 shows a cross-sectional view of the hair curling device of Fig. 1;

Fig. 3 shows a flow chart of a method of operating the hair curling device of Fig. 1.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0033] At least some of the example embodiments described herein may be constructed, partially or wholly, using dedicated special-purpose hardware. At least some of the example embodiments described herein may be constructed, partially or wholly, using dedicated special-purpose hardware. Terms such as 'component', 'module' or 'unit' used herein may include, but are not limited to, a hardware device, such as circuitry in the form of discrete or integrated components, a Field Programmable Gate Array (FPGA) or Application Specific Integrated Circuit (ASIC), which performs certain tasks or provides the associated functionality. Various combinations of optional features have been described herein, and it will be appreciated that described features may be combined in any suitable combination. In particular, the features of any one example embodiment may be combined with features of any other embodiment, as appropriate, except where such combinations are mutually exclusive. Throughout this specification, the term "comprising" or "comprises" means including the component(s) specified but not to the exclusion of the presence of others.

[0034] With reference to Fig. 1, a device 8 for curling hair includes a barrel 20 and housing 28.

[0035] The barrel 20 is an inner barrel. The barrel 20 is a right circular cylinder. An air inlet 36 is located at a first end of the barrel 20 on a first circular face 30 thereof. An air outlet 16 is located at a second end of the barrel 20 on a second circular face 18 of the cylinder. The barrel 20 includes a heat sink 22. The heat sink 22 is a primary structure of the device 8. The heat sink 22 provides a structure to which components of the device may be mounted, including, for example, components that are located within the barrel 20. The heat sink 22 is made from a thermally conductive material, such as aluminium.

[0036] In some embodiments, the barrel 20 may be hollow. The barrel 20 may be any suitable shape, such as a prism. For example, the barrel 20 may be conical rather than cylindrical. Components of the device 8 may be mounted to the heat sink 22.

[0037] The heat sink 22 includes a hair curling surface 24. The hair curling surface 24 is made from a thermally conductive material, such as aluminium. The hair curling surface 24 is made from the same material as the heat sink 22. The hair curling surface 24 is smooth. In use, the user's hair is wound around the hair curling surface 24 so that at least a portion of the user's hair is in direct physical contact with the hair curling surface 24. The user may wind the hair around the hair curling surface 24 using any number of complete or incomplete turns.

[0038] In some embodiments, the heat sink 22 may

comprise a main portion and a separate hair curling surface 24, this allows different materials to be used for the hair curling surface 24 of the heat sink 22 and the main portion of the heat sink 22. The hair curling surface 24 may be made from a light absorbent material for absorbing light energy 34 from the second set of light-emitting diodes 12. This provides more efficient heating of the hair, as any light energy 34 that is not absorbed by the hair may be absorbed by the hair curling surface 24 and used to heat the hair via conduction.

[0039] The first set of LEDs 26 is mounted to the heat sink 22 of the barrel 20 such that the thermal energy generated by the first set of LEDs 26, when the LEDs are on, is transferable to the heat sink 22 via conduction. The first set of LEDs 26 is mounted such that the light energy generated by the first set of LEDs 26, when the LEDs are on, is transferable to the hair wound around the hair curling surface 24 via light radiation absorption.

[0040] The heat sink 22 includes a plurality of elongate grooves. Each groove extends along a lengthwise direction of the barrel 20. The groove is separated circumferentially from an adjacent groove from the set of grooves. A waveguide 10 is provided in each groove. The waveguides are thus parallel to one another. Each waveguide 10 includes a hair curling surface 24. The hair curling surface 24 of the waveguide is a continuation of the hair curling surface of the heat sink such that the combination of the heat sink of the barrel and the waveguides 22 is cylindrical. This allows the hair to be wound around and curled against a smooth surface. This prevents the hair catching on the hair curling device and prevents kinks in the curl produced by the device, thus enabling a smooth curl to be achieved. The first set of LEDs 26 is embedded within the waveguides 10. The waveguide 22 is made from a transparent material to allow light energy from the first set of LEDs 26 to pass through the hair curling surface 24 to heat the hair.

[0041] In some embodiments, the hair curling surface 24 of the waveguide 10 may be made from a partially or selectively light-transmitting material. The hair curling surface 24 of the waveguide 10 may contain gaps through which the light energy can pass. The hair curling surface 24 of the waveguide 10 may have any other suitable configuration for permitting the light energy emitted by the first set of LEDs 26 to heat the hair wound around the hair curling surface 24.

[0042] In some embodiments, the waveguide 10 may be made from a selectively or completely opaque material. The waveguide 10 may be made from a material that selectively or completely absorbs the light energy generated by the first set of LEDs 26. The hair curling surface 24 of the waveguide 10 may transform the light energy generated by the first set of LEDs 26 into thermal energy, which is transferred to the hair wound around the hair curling surface 24.

[0043] The housing 28 is a right circular hollow cylinder positioned around the barrel 20. The housing 28 may have a substantially cylindrical interior surface. The hous-

ing may be provided around the barrel 20 so as to provide a hair chamber therebetween. The housing 28 is connected to the barrel 20 via a connection bridge 40. The housing 28 may be a heat sink, and may form part of the heat sink 22. The connection bridge 40 may be a heat sink, and may form part of the heat sink 22. The barrel 20, housing 28 and connection bridge 40 are integrally formed, providing more efficient heat conduction, in comparison to having connections between the inner barrel, outer barrel, and the connection bridge 40. The housing 28 and connection bridge 40 may be made from the same material as the barrel 20.

[0044] In some embodiments, the interior surface of the housing 28 and/or the connection bridge 40 facing the hair curling surface 24 may be made from a light absorbent material configured to absorb light energy emitted by the first set of light-emitting diodes 26. The connection bridge and the housing may be made from a metallic material, which may be aluminium.

[0045] A second set of LEDs 12 is mounted to the interior surface of the housing. The second set of LEDs 12 is mounted to the heat sink 22 such that the residual thermal energy generated by the second set of LEDs 12, when the LEDs are on, is transferable to the heat sink 22 via conduction. The second set of LEDs 12 is mounted such that the light energy 34 generated by the second set of LEDs 12, when the LEDs are on, is transferable to the hair wound around the hair curling surface 24. The second set of LEDs 12 includes a plurality of LEDs distributed substantially evenly around the interior surface of the housing.

[0046] In some embodiments, the first set of LEDs 26 and the second set of LEDs 12 may generate light energy and thermal energy simultaneously, and the respective light and thermal energy transfers to the hair may occur simultaneously.

[0047] With reference to Fig. 2, the connection bridge 40 extends between the barrel 20 and the housing 28 at the first end of the barrel 20. The connection bridge 40 is an annular planar structure, with the inner circumference of the connection bridge 40 being defined by the circumference of the first end of the barrel 20 and the outer circumference of the connection bridge 40 being defined by the circumference of a first end of the housing 28. The heat sink 22 is the barrel 20, connection bridge 40 and housing 28.

[0048] The air inlet 36 allows air 32 into the hollow portion of the barrel 20 and the air outlet 16 allows air 32 out of the hollow portion of the barrel 20. The barrel 20 includes a fan 38 that is configured to move air 32 in through the air inlet 36 and out through the air outlet 16. The fan 38 is located at the first end of the barrel 20, within the air inlet 36.

[0049] When the first set of LEDs 26 is on, the LEDs generate light energy and residual thermal energy. The residual thermal energy is transferred to the heat sink 22, primarily via conduction. The residual heat energy is transferred through the heat sink 22 to the hair curling

surface 24 portion of the heat sink 22 via conduction. The residual heat energy is transferred from the hair curling surface 24 to the hair wound around the hair curling surface 24, primarily via conduction. This heats the hair wound around the hair curling surface 24. Additionally, the light energy emitted by the first set of LEDs 26 travels through the hair chamber 14 and is absorbed by the hair wound around the hair curling surface 24. This heats the hair wound around the hair curling surface 24.

[0050] When the second set of LEDs 12 is on, the LEDs generate light energy 34 and residual thermal energy. The residual thermal energy is transferred to the heat sink 22, primarily via conduction. The residual heat energy is transferred through the heat sink 22 to the hair curling surface 24 portion of the heat sink 22 via conduction. The residual heat energy is transferred from the hair curling surface 24 to the hair wound around the hair curling surface 24. This heats the hair wound around the hair curling surface 24. Additionally, the light energy 34 emitted by the second set of LEDs 12 travels through the hair chamber 14 and is absorbed by the hair wound around the hair curling surface 24. This heats the hair wound around the hair curling surface 24.

[0051] By reusing the light and heat energy of both the first and second set of LEDs 12, the efficiency of the device is improved, as compared to previous hair curling devices. By using two sets of LEDs and the energies from the two sets of LEDs as described hereinbefore, the speed of heating the hair is quicker than previous hair curling devices. Additionally, the heating by the second set of LEDs 12 using light energy 34 and residual thermal energy provides more efficient and quicker heating of the hair than heating using solely the first set of LEDs 26. A lower intensity of the first set of LEDs 26 is needed than the LEDs of previous hair curling devices. A lower intensity of the second set of LEDs 12 is needed than the LEDs of previous hair curling devices.

[0052] In some embodiments, the hair curling device includes an automatic hair collector mechanism for winding the hair around the hair curling surface 24. Automatic hair collector mechanisms are known in the field. The automatic hair collector mechanism may be provided using any suitable arrangement.

[0053] With reference to Fig. 3, a method for using the device is shown, the method comprising the steps winding hair around the hair curling surface 41, operating the first set of light-emitting diodes to generate residual thermal energy to heat the hair around the hair curling surface by conduction via the heat sink 42, and operating the second set of light-emitting diodes to generate the light energy to heat the hair around the hair curling surface by absorption of the light energy 43.

[0054] When the device is in use by a user, in a first step 41, the user winds the hair to be curled around the hair curling surface 24. In a second step 42, the user operates the first set of LEDs 26 to generate residual thermal energy to heat the hair around the hair curling surface 24 by conduction via the heat sink 22. In a third

step 43, the user operates the second set of LEDs 12 to generate the light energy 34 to heat the hair around the hair curling surface 24 by absorption of the light energy 34. The user operates the sets of LEDs using an input, such as a switch. When the LEDs are operated, they are in the on configuration. In some embodiments, the user may cause the first and second set of LEDs 12 to operate simultaneously. The order of the steps described is not critical to the invention.

[0055] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments.

[0056] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfil the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A device for curling hair, the device comprising:

a barrel (20) comprising a heat sink (22) having a hair curling surface (24) and having a first set of light-emitting diodes (26) coupled thereto; a housing (28) surrounding the barrel to define a hair chamber (14) therebetween, the housing having a second set of light-emitting diodes (12) coupled thereto, wherein the heat sink is configured to transfer residual thermal energy from the first set of light-emitting diodes to heat hair wound around the hair curling surface via conduction and, the second set of light-emitting diodes is configured to emit light energy (34) towards the hair curling surface to heat the hair wound around the hair curling surface via absorption of the emitted light energy.

2. The device according to claim 1, wherein the housing also comprises the heat sink to which the second light-emitting diodes are coupled, wherein the heat sink is configured to transfer residual thermal energy from the second set of light-emitting diodes to the hair wound around the hair curling surface of the heat sink via conduction.

3. The device according to claim 1 or claim 2, wherein the barrel is an inner barrel and the housing is an outer barrel, wherein the device further comprises a connection bridge (40) between the inner barrel and the outer barrel, and wherein the inner barrel, the outer barrel, and the connection bridge are integrally formed. 5
4. The device according to any preceding claim, wherein the barrel comprises a waveguide (10) within which the first set of light-emitting diodes is embedded. 10
5. The device according to claim 4, wherein the waveguide is configured to permit light emitted by the first set of light-emitting diodes to heat the hair wound around the hair curling surface via absorption of light energy from the light emitted by the first set of light-emitting diodes. 15
6. The device according to claim 4, wherein the waveguide is configured to block light emitted by the first set of light-emitting diodes from reaching the hair wound around the hair curling surface. 20
7. The device according to any of claims 4 to 6, wherein the waveguide comprises a hair curling surface providing a continuation of the hair curling surface of the barrel. 25
8. The device according to any preceding claim, wherein the first set of light-emitting diodes is divided into a plurality of groups, wherein a group includes a plurality of first light-emitting diodes arranged longitudinally along a length of the barrel, and wherein the group is separated circumferentially from an adjacent group from the plurality of groups. 30
9. The device according to any preceding claim, wherein the second set of light-emitting diodes includes a plurality of second light-emitting diodes spaced substantially evenly around an interior surface of the housing. 35
10. A device according to any preceding claim, wherein the hair curling surface is made from a light absorbent material for absorbing the light energy from the second set of light-emitting diodes. 40
11. A device according to any preceding claim, wherein an interior surface of the housing facing the hair curling surface is made from a light absorbent material configured to absorb the light energy emitted by the first set of light-emitting diodes. 45
12. A device according to any preceding claim, wherein the barrel is hollow. 50
13. A device according to claim 11, wherein the barrel comprises an air inlet (36) and an air outlet (16), wherein the device further comprises a fan (38) configured to move air (32) in through the air inlet and out through the air outlet. 55
14. A device according to any preceding claim, further comprising a hair collector mechanism for winding the hair around the hair curling surface.
15. A method of curling hair using the device of any preceding claim, the method comprising:
 - winding (41) hair around the hair curling surface;
 - operating (42) the first set of light-emitting diodes to generate residual thermal energy to heat the hair around the hair curling surface by conduction via the heat sink; and
 - operating (43) the second set of light-emitting diodes to generate the light energy to heat the hair around the hair curling surface by absorption of the light energy.

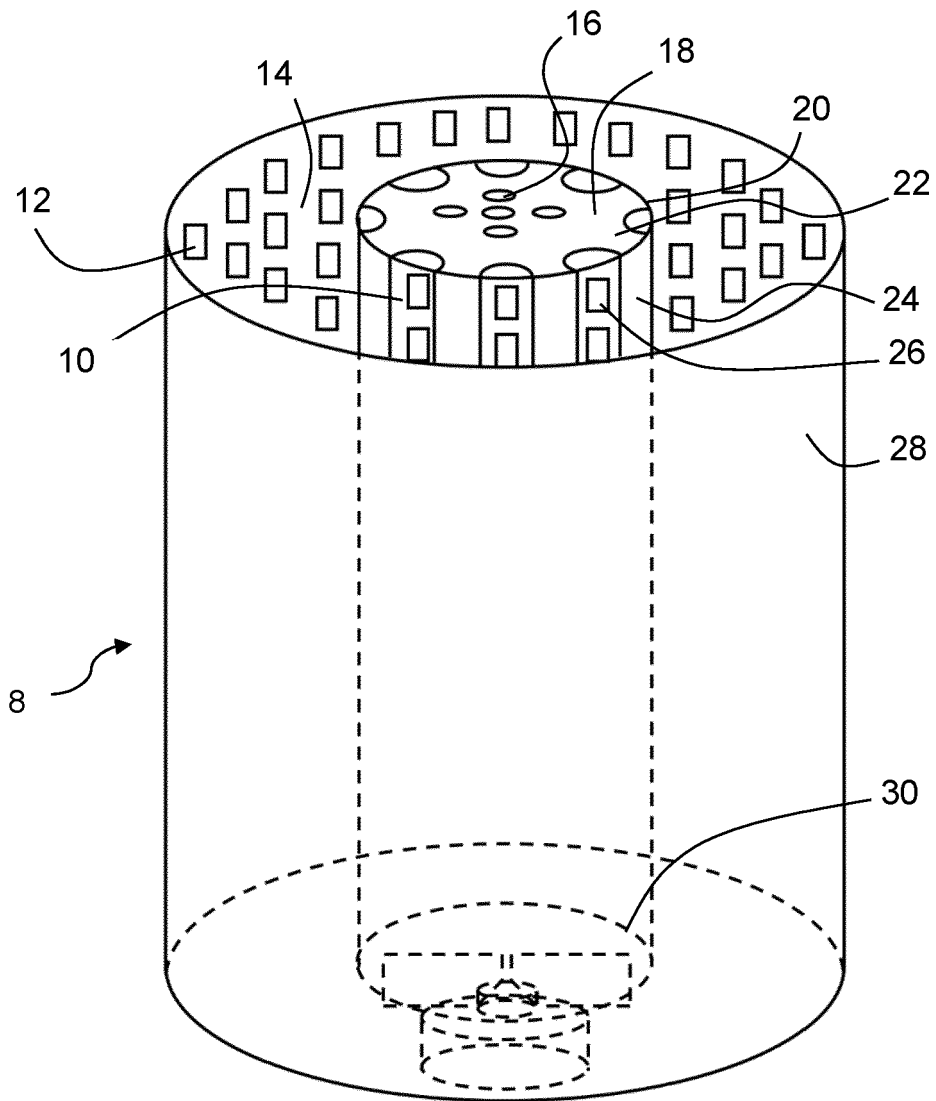


Fig. 1

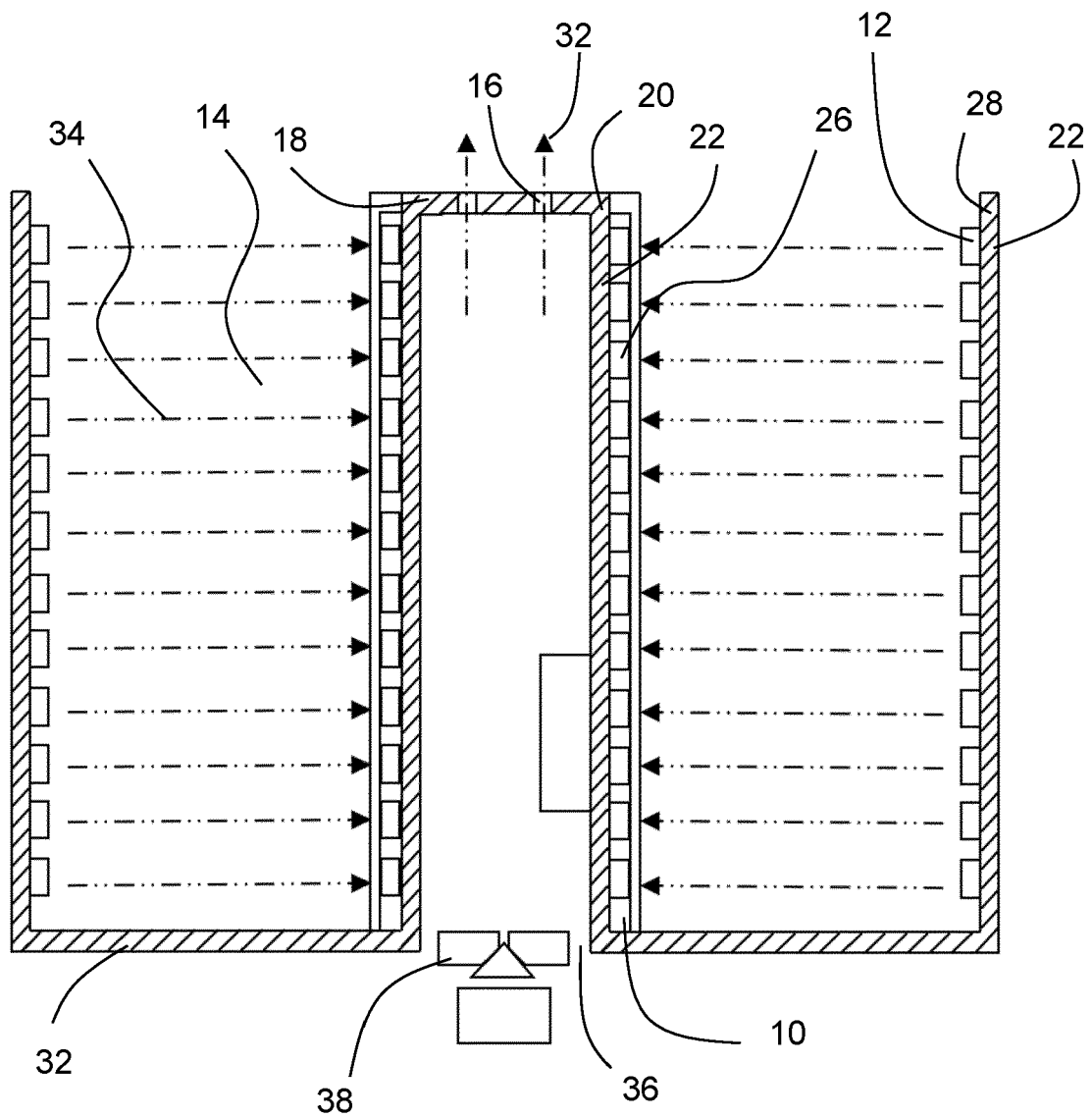


Fig. 2

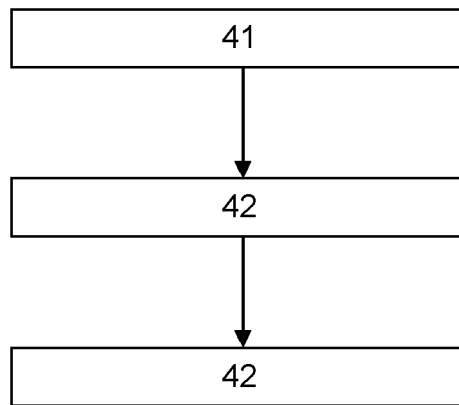


Fig. 3



EUROPEAN SEARCH REPORT

Application Number

EP 22 21 2432

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2019/048357 A1 (KONINKLIJKE PHILIPS NV [NL]) 14 March 2019 (2019-03-14) * page 7, line 26 – page 9, line 3 * * figures 2A, 2B, 3 * -----	1-15	INV. A45D2/36 A45D2/24
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			TECHNICAL FIELDS SEARCHED (IPC)
			A45D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		2 May 2023	Witkowska-Piela, A
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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			
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EPO FORM 1503 03/82 (P04C01)

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

EP 22 21 2432

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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02-05-2023

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REFERENCES CITED IN THE DESCRIPTION

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