

Description

[0001] This invention relates to a turbine with an outer casing having an outer surface facing the atmosphere, wherein the outer casing encloses at least one component and is in thermal communication with the at least one component.

[0002] Such a turbine is very well known to a skilled person. These commonly known turbines operate at very high temperatures of about 650 Celsius and needs to be turned down during routine maintenance. When the turbine is shut down, the turbine usually takes 10-12 days to cool down. This results in a down time which is not desirable. The down time causes significant loss to the operators.

[0003] Traditional techniques for cooling down the turbine include dismantling the components of the turbine while they are still hot. This results in damage to the component of the turbine and also poses a risk to the lives of the operators.

[0004] It is therefore, an object of the invention to provide a turbine as mentioned above which cools down faster during shutdown and maintenance.

[0005] The invention solves this object in that, the outer casing is in thermal contact with one or more fins facing the atmosphere.

[0006] According to the invention the fins provide additional surface area for dissipating the heat contained in the outer casing, thereby decreasing the heat transfer resistance of the outer casing. In general, the outer casing of the turbine has a complex contour and is difficult to provide with additional surface area for heat dissipation. The invention disclosed herein comprises one or more fins which are in thermal contact with the outer casing of the turbine.

The fins may be arranged close to each other to form a channel-like structure. The fins provide additional surface area for heat dissipation, thereby reducing a thermal resistance of the outer casing of the turbine. The thickness and the composition of the fins can be determined based on the rate of heat dissipation required by a user.

[0007] In accordance with an embodiment of the invention, each fin is coupled to a coversheet, wherein the cover sheet is in thermal contact with the outer casing. The coversheet is a metallic structure fabricated to be retrofitted to at least a portion of the casing of the turbine. The coversheet can be fabricated to be mounted very close to the outer surface of the outer casing of the turbine to enable rapid heat dissipation. The fins are coupled to surface of the coversheet. The advantage of coversheet is that it can be manufactured and mounted to an existing turbine. The coversheet can be manufactured in accordance with the structure of the existing turbine irrespective of the manufacturer of the turbine. The coversheet can be retrofitted on the outer casing of the turbine even if the turbine was not designed to accommodate the coversheet.

[0008] In accordance with further embodiment of the

invention, the coversheet is detachable. The coversheet can be attached whenever there is a need to cool the turbine rapidly. The detachability provides flexibility to retrofit the coversheet along with the fins to the outer casing of the turbines. Further, the coversheet can be advantageously mounted on specific parts of the outer casing. Furthermore, the coversheet can be mounted and dismounted based on cooling needs.

[0009] In accordance with a variant of the invention, the coversheet is provided with one or more vents corresponding to one or more vents on the outer casing. The coversheet is designed to provide appropriate vents at certain locations in accordance with a contour of the outer casing. The vents on the coversheet enable circulation of air within the outer casing thereby facilitating uniform cooling of the turbine.

[0010] According to a further embodiment of the invention, the coversheet encloses at least a portion of the outer casing. In some cases, the coversheet may cover 50% -80% of the outer casing of the turbine. Here, the coversheet is radially outwardly mounted on the casing of the turbine which needs cooling. The coversheet along with the fins provides additional area which decreases the heat resistance of the turbine casing.

[0011] In accordance with a further embodiment of the invention, the coversheet is provided with a mounting means. The mounting means enables the coversheet to be retrofitted on the outer casing of the turbine. The mounting means also enables the coversheet to be mounted on the outer casing which had no provisions for accommodating a coversheet. In an embodiment, necessary provisions to accommodate the mounting means may be provided on the outer casing of the turbine. The mounting means enable the coversheet to be mounted at any desired location on the outer casing.

[0012] The mounting means may include one or more of, a clamping means, a bolting means and a magnetic means. The bolting means includes a plurality of bolts arranged at a plurality of points in the coversheet. The outer casing is also modified to receive the bolts resulting in the mounting of the coversheet. The composition and the thickness of the mounting means are determined based on the desired rate of heat dissipation.

[0013] In yet another exemplary embodiment of the invention, at least one of a thickness and a composition of at least one of the coversheet and the fins is determined based on a rate of heat dissipation. In other words, the composition and the thickness of the coversheet, the fins and the mounting means are determined based on a required rate of cooling. As a result, the coversheet and the fins can be fabricated for different rates of cooling. This feature enables the coversheet to be fabricated differently for different parts of the turbine with different cooling needs.

[0014] In a preferred embodiment of the invention, at least one of the coversheet, the fins and the mounting means is composed of at least one of a metal, an alloy and a non-insulating material. The material is chosen

such that the rate of heat dissipation is as high as possible. In an exemplary embodiment, the material of the coversheet and the fins is the same. In another embodiment, the material of the coversheet and the fins is different and chosen such that there is maximum heat dissipation to the atmosphere. The material used in the coversheet and the fins may have a high thermal coefficient, which is beneficial in dissipating the heat contained in the outer casing efficiently. In an exemplary embodiment, the coversheet, the fins and the mounting means may be composed of Aluminium, Nickel-Cobalt based alloys and the like.

[0015] In an alternative embodiment, each fin is integrally coupled to the outer casing. The outer casing of the turbine is fabricated along with the fins to expedite the cooling of the turbine. In this case, the coversheet is not required as the fins are integrally coupled to the outer casing.

[0016] In another exemplary embodiment, the fins are fabricated to have at least one of a linear, zigzag and a contoured pattern. The structure of the fins is determined based on the level of heat dissipation required.

[0017] Further, the fins may be coupled to the coversheet at a suitable angle so as to increase the heat dissipation. According to the structure of the outer casing of the turbine, the fins are coupled to the coversheet at a particular angle in order to increase the rate of heat dissipation.

[0018] In yet another exemplary embodiment, the at least one component includes at least one of a combustion unit, a rotor and a stator of the turbine.

[0019] The figures illustrate in a schematic manner further examples of the embodiments of the invention, in which:

- FIG 1 illustrates a coversheet coupled with fins and an outer casing of a turbine, according to an embodiment of the invention;
- FIG 2 illustrates a perspective view of coversheet coupled with fins and the turbine outer casing, according to an embodiment of the invention;
- FIG 3 illustrates the coversheet coupled with fins mounted on the outer casing using mounting means, according to an embodiment of the invention;
- FIGS 4A-4C illustrates variations in the arrangement of fins on the coversheet, according to an embodiment of the invention; and
- FIGS 5A-5C illustrates the variations in integrating the fins with the outer casing of the turbine, according to an embodiment of the invention.

[0020] FIG 1 illustrates an exemplary embodiment of an apparatus for cooling a turbine. FIG 1 illustrates an outer casing 2 of a turbine. The outer casing 2 is a metallic casing of the turbine. The outer casing 2 has an outer surface facing the atmosphere. The outer casing 2 encloses one or more components such as a rotor of the turbine. Further, the outer casing 2 is in thermal communication with the one or more components. In some embodiments, the outer casing 2 is the metallic structure of the turbine after removing an insulating material covering the outer casing 2. FIG 1 illustrates a coversheet 4 and plurality of fins 6 coupled to the coversheet 4. The coversheet 4 is adapted to be retrofitted to the outer casing 2 of the turbine in order to cool the turbine during maintenance or shut-down. The faster cooling is achieved by the introduction of additional surface area, in the form of coversheet along with the fins, for heat dissipation, which decreases the thermal resistance of the outer casing 2 of the turbine. The coversheet 4 may be mounted radially outward to the outer casing 2 for enabling heat exchange, thereby aiding rapid cooling of the turbine. In an exemplary embodiment, the coversheet 4 may enclose at least a portion of, the stator casing, a rotor casing and any other part of the turbine which requires cooling.

[0021] In accordance with a variant of the invention, coversheet 4 is provided with one or more vents 12 corresponding to one or more vents 10 on the outer casing 2. The one or more vents 12 may be provided on the coversheet 4 to enable circulation of air within the turbine casing so as to enable uniform cooling of the turbine. The coversheet 4 is designed to provide vents 12 at locations where there are vents 10 on the outer casing 2. In an additional embodiment, one or more openings may be provided at certain locations on the coversheet to enable air circulation between the outer casing 2 and the coversheet 4. In accordance with an embodiment of the invention, the apparatus for cooling the turbine includes a coversheet 4. The coversheet 4 is composed of a metallic substance and is fabricated to be retrofitted to the outer casing 2 of the turbine. In an embodiment, the coversheet 4 may be a sheet of a metal or an alloy. The material used in the coversheet 4 may have a high thermal coefficient, which is beneficial in dissipating the heat contained in the outer casing 2 at a high rate.

[0022] In accordance with the invention, plurality of fins 6 is coupled to the coversheet 4 to facilitate faster heat dissipation. The fins 6 provide additional area for heat dissipation thereby enabling faster cooling of the turbine. The plurality of fins 6 is composed of a similar material as that of the coversheet 4. In a preferred embodiment, the plurality of fins 6 is welded onto the surface of the coversheet 4. The plurality of fins may be welded at least one of, but not limited to, a linear pattern, a zigzag pattern and a contoured pattern. FIG 2 illustrates a perspective view of coversheet coupled with fins and the turbine casing.

[0023] Further, the coversheet 4 and fins 6 are detachable to the outer casing 2. In another embodiment, the

coversheet 4 may include mounting means 8 to retrofit the coversheet 4 to the outer casing 2. FIG 3 illustrates the coversheet 4 coupled with fins 6 mounted on the outer casing 2 using mounting means 8, according to an embodiment of the invention. The coversheet 4 may be mounted to the outer casing 2 using magnetic attachments at various locations on the outer casing 2 and the coversheet 4. In a preferred embodiment, the coversheet 4 may include provisions for accommodating bolts at various locations to enable the coversheet 4 to be mounted onto the outer casing 2. The fitting mechanism of the coversheet 4 is fabricated such that the surface of the coversheet 4 is very close to the surface of the outer casing 2.

[0024] The effect of the coversheet 4 in heat dissipation can be explained using a principle of extended face cooling. In an exemplary case, a component C_1 , such as the outer casing of the turbine, is at a high temperature (T_h). When the component is brought into contact with another body B_1 , such as the coversheet 4, the overall surface area available for heat transfer is increased. The temperature of the component C_1 is conducted through the body B_1 and results in rapid dissipation of the heat. As a result, an overall thermal resistance of the component C_1 is reduced. Further, the thermal resistance depends on the area of the body B_1 which is contact with the component C_1 . The rate of cooling also depends on the thermal coefficients of the component C_1 and the body B_1 . Therefore, the material composition and the thickness of the body B_1 are chosen for maximizing the heat dissipation.

[0025] In order to expedite the cooling of the turbine, the coversheet 4 is coupled with plurality of fins 6. In an embodiment, the fins may be composed of either a similar material as that of the coversheet 4 or a different material. In a preferred embodiment, the coversheet 4 and the fins 6 are composed of one or more of, a metal and an alloy. The material of the fins 6 is chosen so as the increase the rate of heat dissipation thereby cooling the turbine rapidly. For example, the metal may include aluminium and the alloy may include Nickel - Chromium based alloys. The coversheet 4 may have a thickness in the range of 8-10mm. The material of the coversheet 4 is chosen to have a thickness and a thermal coefficient based on a required rate of heat dissipation. Coversheet 4 may be fabricated to have a profile of the outer casing 2 of the turbine. In an embodiment, the coversheet 4 may be fabricated to have joints along the surface to enable the coversheet 4 to be mounted close to the surface of the outer casing 2.

[0026] In another embodiment, one or more mounting means may enable the coversheet 4 to be retrofitted to the outer casing 2. The one or more mounting means 8 enable the coversheet 4 to be detachable from the outer casing 2. The one or more mounting means 8 includes, but is not limited, a bolting means, a clamping means and a magnetic means to mount the coversheet 4 to the outer casing 2. In an embodiment of the invention, mod-

ifications may be made on the outer casing 2 to enable the coversheet 4 to be mounted.

[0027] In an exemplary embodiment, the plurality of fins 6 is coupled to the coversheet 4 using welding techniques, such as, arc welding, electron beam welding and laser welding. In an instance, the coversheet 4 and the fins 6 are fabricated as a single unit. The fins 6 are coupled to the coversheet 4 in various patterns. FIGS 4A-4C illustrates variations in the arrangement of fins on a coversheet of the apparatus for cooling a turbine, according to an embodiment of the invention. However, the pattern of the fins 6 may be changed based on a desired rate of cooling. In another exemplary embodiment of the invention, the fins 6 may be detachable from the coversheet 4. This enables the fins 6 to be replaced according to the desired rate of cooling.

[0028] In an alternate embodiment, the one or more fins are integrally coupled to the outer casing. As illustrated in FIG 5A, the fins 6 are directly attached to the outer casing 2 of the turbine. FIGS 5B-5C illustrates alternative ways of integrating the fins to the outer casing. In some cases, the outer casing 2 may be fabricated to integrally include the fins. In some other embodiments, the fins 6 may be welded on the outer casing 2. The fins 6 provide additional surface area for heat dissipation thereby cooling the turbine quickly.

[0029] In a preferred embodiment, the fins 6 may have a thickness in the range of 2-4 mm. The composition of the fins 6 may be same as that of the coversheet 4. In some cases, the composition of the fins 6 may be different from that of the coversheet 4. However, the thickness and the composition of the coversheet 4 and fins 6 may be determined based on a rate of heat dissipation required.

[0030] In some alternate embodiments of the invention, the coversheet 4 may be mounted on the turbine casing 2 without the fins 6. The coversheet 4 may be mounted on specific parts, where additional cooling is necessary, of the turbine during operation of the turbine. In some cases, the coversheet 4 may be mounted partially on specific regions of the turbine to enable rapid cooling of the specific regions. In an alternate embodiment, the fins 6 may be detachable to the outer casing 2. As a result, a user can attach the fins 6 to the outer casing 2 whenever there is a need to cool the turbine, without having to mount the coversheet 4.

[0031] The embodiments disclosed herein enable faster cooling of turbines during shutdown or maintenance. Rapid cooling of the turbine results in reducing the down time for the customer, thereby increasing the profits for the customer.

[0032] Though the invention has been described herein with reference to specific embodiments, this description is not meant to be construed in a limiting sense. Various examples of the disclosed embodiments, as well as alternate embodiments of the invention, will become apparent to persons skilled in the art upon reference to the description of the invention. It is therefore contemplated

that such modifications can be made without departing from the embodiments of the present invention as defined.

Claims

1. A turbine, comprising:

an outer casing (2) having an outer surface facing the atmosphere,
wherein the outer casing (2) encloses at least one component and is in thermal communication with the at least one component,
characterized in that,
the outer casing (2) is in thermal contact with one or more fins (6) facing the atmosphere.

2. The turbine according to claim 1,
wherein the one or more fins (6) are coupled to a coversheet (4),
wherein the cover sheet (4) is in thermal contact with the outer casing (2).

3. The turbine according to claim 2,
wherein the coversheet (4) is detachable.

4. The turbine according to claims 2 or 3,
wherein the coversheet (4) is provided with one or more vents (12) corresponding to one or more vents (10) on the outer casing (2).

5. The turbine according to claims 3 or 4,
wherein the coversheet (4) encloses at least a portion of the outer casing (2).

6. The turbine according to any one of the claims 2 - 5,
wherein the coversheet (4) is provided with a mounting means.

7. The turbine according to claim 6,
wherein, the mounting means (8) is at least one of, a clamping means, a bolting means and a magnetic means.

8. The turbine according to any one of the claims 1 - 7,
wherein, at least one of a thickness and a composition of at least one of the coversheet (4), the fins (6) and the mounting means (8) is determined based on a rate of heat dissipation.

9. The turbine according to any one of the claims 1 - 8,
wherein, at least one of the coversheet (4), the fins (6) and the mounting means (8) is composed of at least one of a metal, an alloy and a non-insulating material.

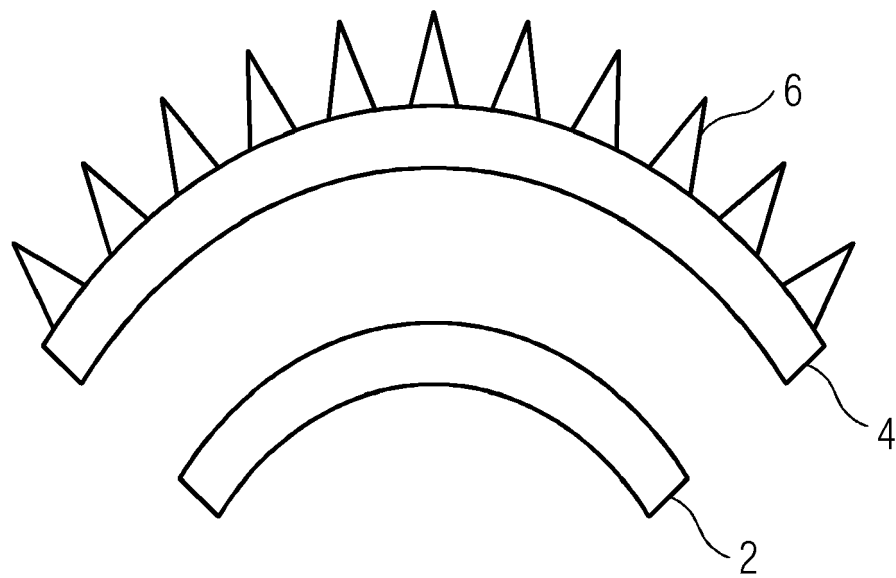
10. The turbine according to claim 1,

wherein the one or more fins (4) are integrally coupled to the outer casing.

11. The turbine according to one of the aforementioned claims,
wherein the fins (6) have at least one of a linear, zigzag and a contoured pattern.

12. The turbine according to claim 1,
wherein the at least one component includes at least one of an internal casing, a rotor and a stator.

FIG 1



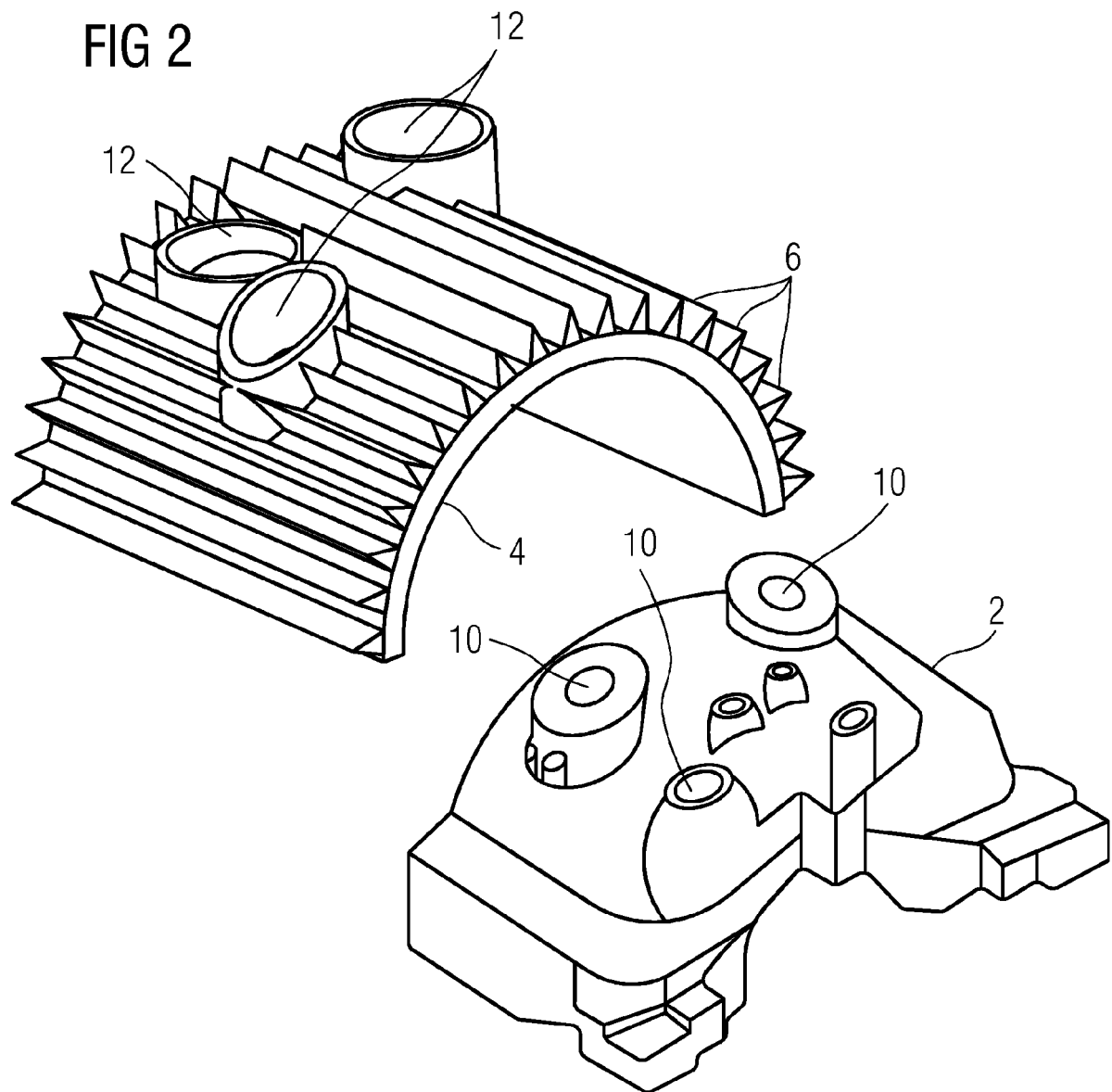


FIG 3

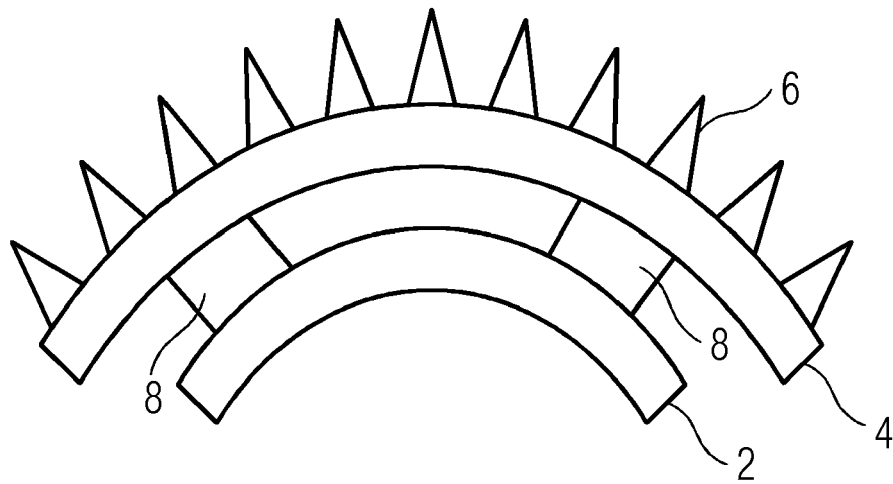


FIG 4A

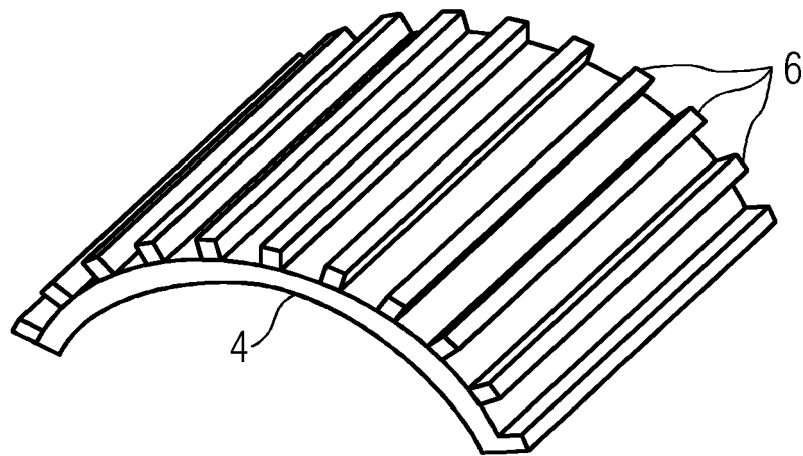


FIG 4B

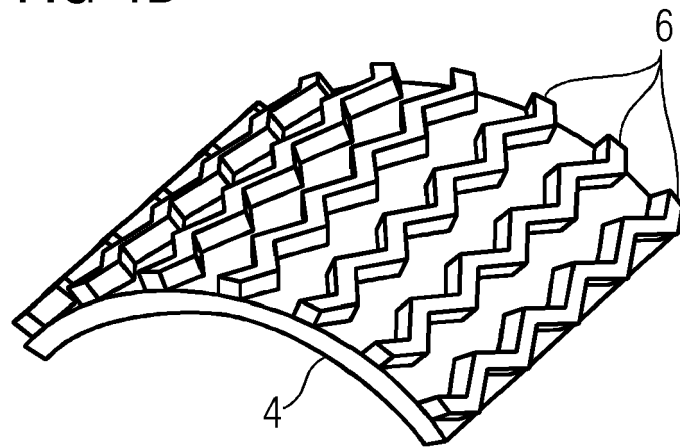


FIG 4C

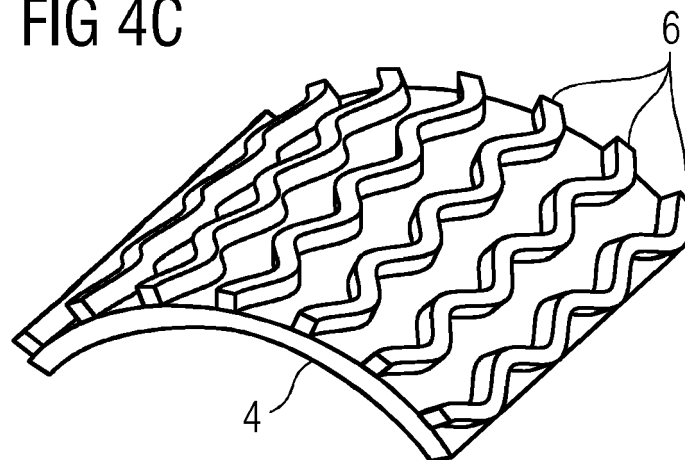


FIG 5A

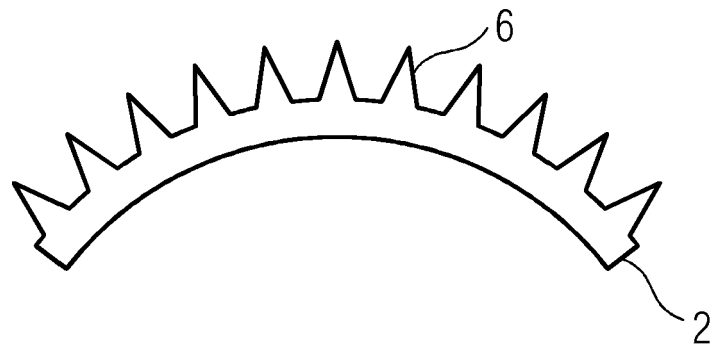


FIG 5B

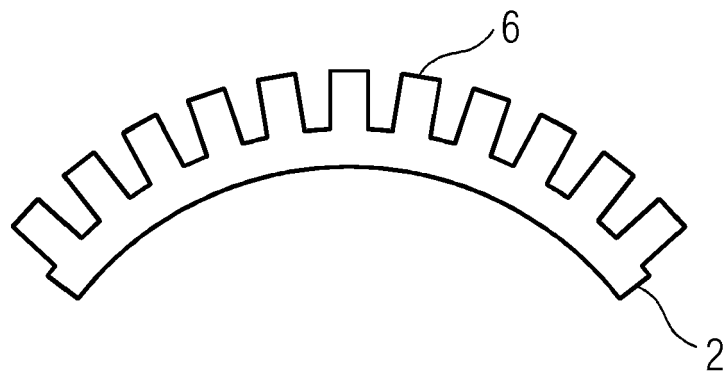
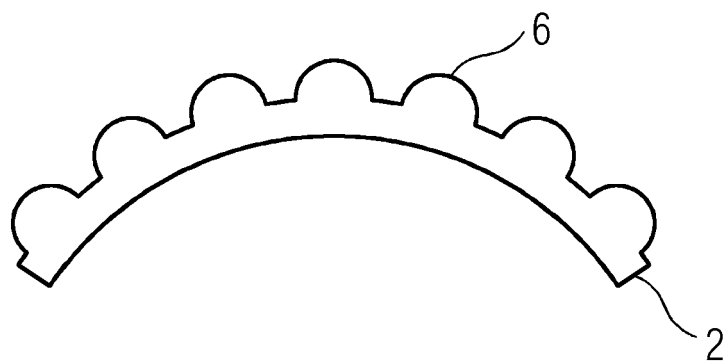


FIG 5C





EUROPEAN SEARCH REPORT

Application Number
EP 14 16 5988

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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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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 October 2014	Examiner Avramidis, Pavlos
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
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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