HEAT SINK PLATE, CURRENT-RECTIFYING ARRANGEMENT, AND ASSOCIATED MULTIPHASE ROTARY MACHINE

Abstract: The invention relates to a heat sink plate of a current-rectifying arrangement for a rotary electric machine intended to be arranged to be traversed by a cooling fluid, said heat sink plate (7) comprising two opposite edges (19, 21) and being able to carry current-rectifying elements (3) to be connected to one phase of a stator of said rotary electric machine, characterized in that one edge (19) of the heat sink plate (7) has a flange (23) with an inclined surface (25) relating the plane (P) defined by the heat sink plate (7) and arranged in order to guide the cooling fluid towards the current-rectifying elements (3). The invention also relates to corresponding current-rectifying arrangement and multiphase rotary electric machine.

Fig. 4
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Heat sink plate, current-rectifying arrangement, and associated multiphase rotary machine

The invention relates to a heat sink plate part of a current-rectifying arrangement for a multiphase rotary electrical machine such as an alternator for a motor. The heat sink plate is able to carry current-rectifying element such as diodes.

The invention also concerns a current-rectifying arrangement for a multiphase rotary electrical machine provided with a bearing housing, in particular an alternator for a motor vehicle, of the type comprising a heat sink plate carrying first current rectifying elements, a support element carrying second current rectifying elements, and a connector interposed between the heat sink and the support element.

The invention also concerns a rotary electrical machine comprising such an arrangement. The present invention relates more particularly to a multiphase rotary electric machine, in particular an alternator or an alternator-starter for a motor vehicle, comprising a current-rectifying arrangement.

The current-rectifying arrangement is provided for converting an induced alternating current into direct current, especially for feeding the consumers of the on-board network of the motor vehicle, and to charge an accumulator of energy of the vehicle as the battery of the motor vehicle.

The alternator generally comprises a casing and, inside thereof, a rotor rotatably connected to a shaft, and a multiphase stator surrounding the rotor.

According to a known embodiment the casing of the rotary electric machine may be in two parts, namely a front end-plate and a rear end-plate. The end-plates are conventionally referred to respectively as the front bearing housing and the rear bearing housing. The bearing housings may be annular in shape and hollow. The bearing housings are metal and therefore electrically conductive, being made for example from aluminum. They are intended to be fixed to a fixed part connected to ground of the motor vehicle connected to the negative terminal of the battery. The front or rear bearing may carry a voltage regulator and at least one rectifier bridge of the current-rectifying arrangement.

Each phase of the stator comprises at least one winding. The windings of the
stator phases are for example three-phase windings, whose outputs are connected to entries belonging to the connector of the current-rectifying arrangement. The number of phases of the stator depends on the application and may be greater than three, one or two rectifier bridges may be provided.

The rotor may comprise two pole wheels and a cylindrical core carrying an excitation coil. When the excitation coil is electrically powered, the rotor, in a ferromagnetic material is magnetized and becomes an inductive rotor. This creates an induced alternating current in the windings of the stator when the shaft rotates. The current-rectifying arrangement thus converts the induced alternating current into direct current, especially for feeding the consumers of the on-board network of the motor vehicle, and to charge the battery of the motor vehicle.

The current-rectifying arrangement may comprise current rectifying elements such as diodes or transistors of the MOSFET type belonging to at least one rectifier bridge. The first current-rectifying elements such as diodes are referred to as positive diodes, and the second current-rectifying elements such as diodes are referred to as negative diodes.

The current-rectifying arrangement is for instance fixed to the rear bearing housing and the element supporting the negative diodes includes a plate of the bearing housing forming a heat sink, referred to as the negative heat sink.

The heat sink plate carrying the first current-rectifying elements is currently called the positive heat sink.

The positive heat sink carries the positive terminal of the alternator, named B+, which corresponds to the rectified output of the alternator to be connected via a wire to the positive terminal of the battery.

The positive heat sink is separated from the negative heat sink by the connector made from an electrically insulating material, for instance plastics material, moulded onto a set of flat electrical conductors, locally visible.

The positive heat sink and the connector may be axially juxtaposed and fixed with electrical insulation for instance by bolts and nuts to the bearing housing. The connector is thus interposed axially between the positive heat sink and the negative heat
sink. "Axially" is used herein with respect to the flowing direction of the cooling fluid such as air flow.

The connector is provided for connecting the current-rectifying elements such as diodes to the output of the stator phases.

The connector, by virtue of its conductors, forms, with the diodes, a current-rectifying bridge belonging to the current-rectifying arrangement.

Further, the current-rectifying arrangement is arranged so that a flow of a cooling fluid, such as an air flow, may flow through the current-rectifying arrangement. The current-rectifying elements located above the heat sink are cooled by the air flow.

According to a known solution, the positive heat sink may be provided with axial openings and fins for cooling the positive diodes. The connector is configured so as to allow free passage of air below the axial openings of the positive heat sink, matching air inlet openings in the rear bearing housing.

For example, an air flow caused by the rotation of one fan on the rotor passes through the axial openings in the positive heat sink and the air inlet openings in the negative heat sink in order to cool the current-rectifying arrangement. The positive heat sink is cooled by means of its fins and its openings mainly by convection.

Furthermore, in solutions of the state of the art, the positive heat sink generally has a complex shape and is made of aluminum die-cast.

It is therefore desirable to improve further, in a simple manner, the cooling of the positive current rectifying elements carried by the positive heat sink.

The purpose of the present invention is to improve further, in a simple manner, the cooling of the current-rectifying arrangement of the type indicated above.

To achieve this aim, the invention proposes a heat sink plate of a current-rectifying arrangement for a rotary electric machine intended to be arranged to be traversed by a cooling fluid, said heat sink plate comprising two opposite edges and being able to carry current-rectifying elements to be connected to one phase of a stator of said rotary electric machine,

characterized in that one edge of the heat sink plate has a flange with an inclined surface relating the plane defined by the heat sink plate and arranged in order to guide
the cooling fluid towards the current-rectifying elements.

This heat sink plate has a simpler form than those of the prior art.

Moreover the inclined flange is arranged to guide the cooling fluid such as the air so that air from outside of the current-rectifying arrangement arriving on the flange follows the shape of the flange and then arrives on the current-rectifying elements carried by the positive heat sink plate.

The flange is thus arranged with its inclined surface extending towards the outside of the current-rectifying arrangement.

Such heat sink plate with its flange can be produced by stamping thus reducing production cost.

According to other features procuring other advantages and taken in isolation or in combination:

- the heat sink plate comprises housings for receiving current-rectifying elements and wherein the flange extends along said housings for receiving said current-rectifying elements, further improving the cooling of the diodes,

- said housings are realized as holes, and said holes are surrounded by a collar for increasing the contact surface between the diodes and the heat sink plate therefore improving the thermal dissipation of the heat from the diode and mechanical support of the diode,

- the collar can be provided with an inlet chamfer inclined towards the associated hole for enabling an easier insertion of the diode during the assembly of the diode in the heat sink,

- the edge of the heat sink plate showing a flange with an inclined surface is intended to face the rotation shaft of the rotor of the rotary electric machine, being arranged at a predefined distance from a protector of the rotor collector,

- the inclined surface of the flange forms an angle around 30° to 60°, preferably 45°, with the plane defined by the heat sink plate,

- the flange has a variable height along the associated edge of the heat sink plate, with a minimal height to the ends of the flange and a maximal height substantially in the middle of the flange,
- the heat sink plate comprises a mounting element for mounting a connection terminal and a wall for preventing the connection terminal from rotating and arranged near the mounting element substantially perpendicular to the plane defined by the heat sink plate. The connection terminal B+ corresponds to the rectified output of the alternator and is intended to be connected to the positive terminal of an accumulator of energy such as the battery of the vehicle,
- the connection terminal B+ may be a screw with a substantially "T" shape, the head of which abuts against the wall of the heat sink plate,
- the heat sink plate has a thickness around 2mm to 5mm, preferably 3mm,
- the heat sink plate has an arcuate shape with two opposite substantially arcuately curved edges.

The invention also relates to a current-rectifying arrangement for a rotary electric machine including a rotor and a multiphase stator surrounding the rotor, said current-rectifying arrangement comprising:

- a positive heat sink carrying first positive current-rectifying elements,
- a negative heat sink carrying second negative current-rectifying elements, and
- and a connector arranged between the positive heat sink and the negative heat sink for connecting the current-rectifying elements to the output of the stator phases,

characterized in that at least one heat sink is realized as a heat sink plate as defined above.

According to other features procuring other advantages and taken in isolation or in combination:

- the positive heat sink is realized as a heat sink plate as defined above and the negative heat sink is part of a bearing housing of a casing of the rotary electric machine inside of which are arranged said rotor and stator,
- the positive heat sink aJd the connector are intended to be fixed to the bearing housing comprising the negative heat sink.

According to a preferred embodiment, the connector comprises a network of electrical conductors for connecting the current-rectifying elements to the output of the stator phases overmoulded by an electrical insulating material, and the electrical
The round wires are simpler than the flat wires used in such application. The round wires also simplify the overmoulding of the metal tracks by an electrical insulating material, such as plastics material. The round wires may have a diameter around 1.2mm to 2mm.

Furthermore, the loops of the round wires at the level of the stator phases allow a simpler and robust connection with the stator phases. The electrical conductors may comprise flattened parts for connecting the current-rectifying elements, for example by welding. The metal tracks may be shaped at the level of the tails of the diodes forming the current-rectifying elements avoiding any gap between the tails of the diodes and the metal tracks. Moreover, being flattened the wires allow good welding of the diodes.

The current-rectifying arrangement may be for a motor vehicle, and the first positive current-rectifying elements are intended to be connected to the positive terminal of an accumulator of energy of the vehicle and the second negative current-rectifying elements are intended to be grounded.

For example, the current-rectifying elements comprise diodes.

The invention further relates to a multiphase rotary electric machine comprising such a current-rectifying arrangement.

The multiphase rotary electric machine may be a motor vehicle alternator.

Other features and advantages of the invention will become more clearly apparent on reading the following description, given by way of illustrative and non-limiting example, and from the appended drawings, in which:

- figure 1 is a view in perspective of a current-rectifying arrangement for a rotary electric machine according to the invention,
- figure 2 is a face view of the current-rectifying arrangement of figure 1,
The invention relates to a rotary machine comprising a current-rectifying arrangement 1 as shown on figures 1 to 3.

The rotary machine is more precisely a multiphase rotary electrical machine such as a motor vehicle alternator of the three-phase type.

The alternator (not shown) comprises a casing and, inside thereof, a rotor rotatably connected to a shaft, and a multiphase stator surrounding the rotor.

The casing of the rotary electric machine comprises a front bearing housing and a rear bearing housing, which are metallic, being made for example from aluminum, and therefore electrically conductive, and which are intended to be fixed to a fixed part connected to ground of the motor vehicle connected to the negative terminal of the battery of the motor vehicle.

The rear bearing housing may carry one rectifier bridge of the current-rectifying arrangement 1 as described hereafter.

The current-rectifying arrangement 1 comprises current-rectifying elements such
as diodes 3, 5. Alternatively, the current-rectifying elements may be transistors of the
MOSFET type.

The current rectifying arrangement 1 also comprises:
- a first heat sink plate 7 for carrying first diodes 3, the first heat sink plate being
  referred to as the positive heat sink 7 is intended to be connected to the positive
terminal of the battery of the motor vehicle,
- an element 9 for supporting second diodes 5, the support element 9 being
  referred to as the negative heat sink 9 is intended to be connected to ground, and
  therefore to the negative terminal of the battery of the motor vehicle, and
- a connector 11 for connecting the diodes 3, 5 to the output of the stator phases
  which is arranged between the positive heat sink 7 and the negative heat sink 9.

For example, the current-rectifying arrangement 1 may comprise three pairs of
current-rectifying elements, namely three first diodes 3 and three second diodes 5.

These diodes 3, 5 are each provided with a substantially cylindrical body
forming a terminal for electrical connection respectively with the positive heat sink 7
and with the negative heat sink 9, and a tail forming another terminal for electrical
connection with a network of electrical conductors 13 belonging to the connector 11.

Only the tails of the second diodes 5 are visible on figures 1 to 3.

The first diodes 3 are said to be positive diodes since the positive positive heat
sink 7 carrying them is intended to be connected to the positive terminal of the battery
of the motor vehicle, while the second diodes 5 are said to be negative diodes since the
negative heat sink 9 carrying them is intended to be grounded, and therefore to be
connected to the negative terminal of the battery.

The current-rectifying arrangement 1 is intended to be arranged to be traversed
by a flow of a cooling fluid, here an air flow. The direction of the air flow is
schematically illustrated by arrow F on figure 3. When the toto of the machine rotates,
there is creation of an air flow generated by the rotation of a fan in the machine, thus
cooling the current-rectifying elements.
Positive heat sink

Figures 4 to 6 show more particularly a heat sink plate, forming the positive heat sink 7 of the current-rectifying arrangement 1 for the rotary electric machine such as a motor vehicle alternator.

The heat sink plate 7 can be produced by stamping.

The heat sink plate 7 is electrically and thermally conductive.

The heat sink plate 7 is intended to be fixed on a bearing housing, for example the rear bearing housing, of the casing of the alternator. For that fixation holes 14 may be provided to each end of the heat sink plate 7.

As said before, the heat sink plate 7 is a support for current rectifying elements of the current-rectifying arrangement 1, here to the first diodes 3, namely the positive diodes 3.

Thereto, housings such as holes are managed on the heat sink plate 7 for receiving the diodes. In the illustrated embodiment, first holes 15, namely three first holes 15, are managed on the heat sink plate 7 for receiving the first positive diodes 3.

The bodies of the positive diodes 3 may be each force-fitted in a first hole 15 of the heat sink plate 7.

Second holes 17 may also be managed on the heat sink plate 7 so that the tails of the negative diodes 5 supported by the negative heat sink 9 may go through these second holes 17 when assembling the current-rectifying arrangement 1.

The heat sink plate 7 may have a thickness $t$ around 2 to 5mm, preferably around 3mm, as it can be seen on figures 4-5. The thickness $t$ is here constant over the entire plate 7.

This heat sink plate 7 has here a globally arcuate shape with two opposite arcuately curved edges 19, 21.

More precisely, the heat sink plate 7 has a first curved edge 19 intended to face the rotation shaft (not shown) of the rotor of the alternator, and a second curved edge 21 opposite to the first curved edge 19.
As already said, the heat sink plate 7 is intended to be arranged to be traversed by a flow of a cooling fluid, here an air flow, schematically illustrated by arrow F on figures 4 and 5. The current-rectifying elements located above the heat sink plate 7 are cooled by the air flow.

The first curved edge 19 of the heat sink plate 7 may further comprise a flange 23. The flange 23 is intended to be arranged to guide the air flow in order to improve the diodes cooling.

Such a flange 23 may be stamped.

The flange 23 is substantially inclined relative to the plane \( P \) defined by the heat sink plate 7. More precisely, the flange 23 is folded up towards the outside of the current-rectifying arrangement 1 as can be seen on figure 3, so on the opposite side from the connector 11, and thus raises out of the planar surface of the heat sink plate 7.

In the described embodiment, the flange 23 has a substantially elbow shape. As it can be seen on figure 5, the flange 23 may be made up of an inclined surface 25 joined to the heat sink plate 7 by a linking edge 27, here a rounded edge 27.

Referring to figures 7 and 8, the inclined surface 25 of the flange 23 forms an angle \( \alpha \) around \( 30^\circ \) to \( 60^\circ \), for example \( 45^\circ \), with the plane \( P \) defined by the heat sink plate 7.

Consequently, when the air flow goes through the current-rectifying arrangement 1 according to the arrow F shown on figures 3 to 5, the air flow follows the inclined surface 25 of the flange 23 and arrives on the three first diodes 3 for cooling said diodes 3.

The inclined surface 25 may extend over a variable height \( h \) along the first curved edge 19 as illustrated on figures 6 to 8. The inclined surface 25 may have a minimal height \( h \) at its ends (figure 7) which gradually evolves (figure 8) along the first curved edge 19 to achieve a maximal height substantially in the middle of the flange. For instance, the height \( h \) of the inclined surface 25 of the flange 23 varies in the range of 2.9mm to 5.7mm.

The flange 23 may also be substantially arcuately curved following the shape of the associated curved edge 19.
Further, in the embodiment shown, the flange 23 is not provided on the entire length of the first curved edge 19. At least, the flange 23 extends along the housings as first holes 15 for receiving the first diodes 3. Advantageously, the flange 23 is conformed to face all first holes 15 for receiving the first diodes 3 in order to guide the air flow towards all the first diodes 3.

In order to further improve the first diodes cooling, the first holes 15 for receiving first diodes 3 may be provided with a collar 29 surrounding each first hole 15. Such a collar 29 is more visible on figures 4 and 9.

The collar 29 forms an relief on the plane surface of the heat sink plate 7 which is arranged so as to be in the air flow. In a non limitative example, the collar 29 has a thickness around 1.8mm to 2mm for a heat sink plate 7 around 3mm thick.

The collars 29 surrounding first holes 15 for receiving first diodes 3 are needed particularly when the diodes are thicker than the heat sink plate 7, thus preventing part of the diode from not being fitted in the heat sink plate 7.

The collar 29 surrounding a first hole 15 may be formed by locally deforming the heat sink plate 7.

Each collar 29 increases the contact surface between the diode 3 and the heat sink plate 7 therefore improving the thermal dissipation of the heat from the diode 3 and mechanical support of the diode 3.

Moreover, the collar 29 surrounding an associated first hole 15 may be provided with an inlet chamfer 31 (cf figure 4) inclined towards the hole 15. The inlet chamfer 31 inclined towards the associated hole 15 enables an easier insertion of the diode 3 during the assembly of the diode 3 in the heat sink plate 7.

Moreover, the flange 23 may be intended to be arranged at a predefined distance from a protector (not shown) of a collector of the rotor.

Furthermore relating to the thermal diffusion, third holes 33 in which the cooling fluid, here air, is able to pass through, may be arranged near to the flange 23 and between the first holes 15 for receiving the positive diodes 3.

These holes 33 are advantageously provided on the warmest zone of the heat
sink plate 7 to improve the cooling.

The heat sink plate 7 is also electrically conductive. The positive diodes 3 carried by the heat sink plate 7 are intended to be electrically connected to a connection terminal, here the positive terminal of the alternator, named terminal B+, which corresponds to the rectified output of the alternator (not shown). The positive terminal B+ is intended to be connected via a wire to the positive terminal of the battery of the motor vehicle.

To this aim, the body of the heat sink plate 7 has a protrusion 35 having a mounting element, here a hole 37 (cf figures 5-6), for mounting the connection terminal B+, as illustrated on figure 4.

According to the described embodiment, a cylinder 39 surrounds the terminal B+. The terminal B+ is thus fitted in a reported cylinder 39 around the terminal B+.

The terminal B+ is here oriented substantially perpendicular to the plane P defined by the positive heat sink plate 7.

This terminal B+ is here a screw schematically shown on figures 4 and 10. The terminal B+ may be fitted on the heat sink plate 7 through the mounting hole 37.

As more visible on figure 10, the terminal B+ may have a substantially "T" shape the head of which coming in contact with the heat sink plate 7 when the terminal B+ is fitted in the mounting hole 37.

Advantageously, an anti-rotation device may be provided to prevent the terminal B+ from rotating.

The heat sink plate 7 may comprise such an antirotation-device. According to the embodiment shown on figures 5 and 6, the heat sink plate 7 comprises a wall 41 near the mounting hole 37 for receiving the terminal B+. The wall 41 is arranged so that the head of the "T" shape of the terminal B+ abuts against the wall 41, the wall 41 thus providing the anti-rotation function.

Referring to figure 5, the wall 41 may be arranged substantially perpendicular to the plane P defined by the heat sink plate 7, thus forming a so called fall-back zone of the heat sink plate 7.
As an example, the wall 41 may be about 4mm high.

**Negative heat sink**

The rear bearing housing comprises a support for the negative current-rectifying elements, here negative diodes 5. The bearing housing therefore comprises the negative heat sink 9 that discharges the heat by conduction and convection.

The negative diodes 5 are for instance force-fitted by their body in an associated hole in the negative heat sink 9 and their tails go through associated holes 17 on the positive heat sink 7.

**Connector**

Referring now to figures 3 and 11, the connector 11 has a body arranged parallel to the positive heat sink 7.

The connector 11 and the positive heat sink 7 are fixed to the negative heat sink 9 by means of a fixing member passing through aligned fixation holes 14, 43 produced respectively in the positive heat sink 7 and in the connector 11. These fixing members may be rivets or bolts, or screws.

The body of the connector 11 (figure 11) is made from electrically insulating material, here from plastics material, in which there is embedded by overmoulding a network of electrical conductors 13.

These conductors 13 are locally visible, that is to say bared or non-overmoulded, to form electrical connections respectively with the outputs of the windings of the stator phases, with the tails of the positive diodes 3 and with the tails of the negative diodes 5.

Thus, the connector 11 has electrical conductors 13, here in the form of metal tracks for connecting together the tails of a pair of diodes 3, 5 with an output of a phase winding of the stator coil (not shown on the figures), to form a bridge between the positive heat sink 7 and the negative heat sink 9.

According to a preferred embodiment, the electrical conductors 13 are round wires 13. The flat wires of the solutions of the state of the art are replaced here by round wires, for example made from copper, which have a certain rigidity. Replacing the usual
flat track by a simple round wire reduces the production cost and allows a simpler molded plastic piece.

The round wires 13 may have a diameter around 1.2mm to 2mm.

The electrical conductors 13 present first bared parts 45 for connecting the output of the stator phases, second bared parts 47 for welding the first diodes 3 tails and third bared parts 49 for welding the second diodes 5 tails.

Each bared part 45, 47, 49 of the metal track 13 may have a substantial wave shape.

The first bared parts 45 for connecting the output of the stator phase are here each provided with a loop 51 inside which the phase output may be pinched and welded.

Optionally, the second and third bared parts 47, 49 for welding the tails of first diodes 3 and second diodes 5, may be flattened. Punching the wire trace at the level for welding the diodes allows better welding.

Further, one or more parts 47, 49 may have perpendicular tracks on either side of the wave shape.

The positive heat sink in the form of a metal plate 7 as described before can be realized simply for example by stamping contrary to the usual die-cast heat sink with complex shape. Such a heat sink plate 7 has a simplified design, a reduced weight and size, and induces production cost reduction.

The flange 23 of the heat sink plate 7 guides the air so that it follows the flange 23 and cools the diodes, what improve heat dissipation.

Finally, a connector 11 as described above with simplified round wires also reduces the production cost and simplify the overmoulding piece. Further, shaping the metal tracks 13 directly at the level of the diodes tails, for example flattening the metal tracks, avoid a gap between the tails and the tracks at the time of welding. That allows better welding.
1. Heat sink plate of a current-rectifying arrangement for a rotary electric machine intended to be arranged to be traversed by a cooling fluid, said heat sink plate (7) comprising two opposite edges (19, 21) and being able to carry current-rectifying elements (3) to be connected to one phase of a stator of said rotary electric machine, characterized in that one edge (19) of the heat sink plate (7) has a flange (23) with an inclined surface (25) relating the plane (P) defined by the heat sink plate (7) and arranged in order to guide the cooling fluid towards the current-rectifying elements (3).

2. Heat sink plate as set forth in claim 1, wherein the heat sink plate (7) with the flange (23) is produced by stamping.

3. Heat sink plate as set forth in claim 1 or 2, comprising housings (15) for receiving current-rectifying elements (3) and wherein the flange (23) extends along said housings (15) for receiving said current-rectifying elements (3).

4. Heat sink plate as set forth in claim 3, wherein said housings (15) are realized as holes (15), and wherein said holes (15) are surrounded by a collar (29).

5. Heat sink plate as set forth in claim 4, wherein the collar (29) comprises an inlet chamfer (31) inclined towards the associated hole (15).

6. Heat sink plate as set forth in any one of the preceding claims, wherein the edge (19) of the heat sink plate (7) showing a flange (23) with an inclined surface (25) is intended to face the rotation shaft of the rotor of the rotary electric machine.

7. Heat sink plate as set forth in any one of the preceding claims, wherein the inclined surface (25) of the flange (23) forms an angle (a) around 30° to 60°, preferably 45°, with the plane (P) defined by the heat sink plate (7).

8. Heat sink plate as set forth in any one of the preceding claims, wherein the flange (23) has a variable height (h) along the associated edge (19) of the heat sink plate.
(7), with a minimal height to the ends of the flange (23) and a maximal height substantially in the middle of the flange.

9. Heat sink plate as set forth in any one of the preceding claims, comprising:
   - a mounting element (37) for mounting a connection terminal (B+) and
   - a wall (41) for preventing the terminal (B+) from rotating and arranged near the mounting element (37) substantially perpendicular to the plane (P) defined by the heat sink plate (7).

10. Heat sink plate as set forth in any one of the preceding claims, having a thickness (t) around 2mm to 5mm, preferably 3mm.

11. Heat sink plate as set forth in any one of the preceding claims, having an arcuate shape with two opposite substantially arcuately curved edges (19, 21).

12. Current-rectifying arrangement (1) for a rotary electric machine including a rotor and a multiphase stator surrounding the rotor, said current-rectifying arrangement (1) comprising:
   - a positive heat sink (7) carrying first positive current-rectifying elements (3),
   - a negative heat sink (9) carrying second negative current-rectifying elements (5),
   - and a connector (11) arranged between the positive heat sink (7) and the negative heat sink (9) for connecting the current-rectifying elements (3, 5) to the output of the stator phases,

characterized in that at least one heat sink is realized as a heat sink plate (7) as set forth in any one of the preceding claims.

13. Current-rectifying arrangement (1) as set forth in claim 12, wherein it is the positive heat sink (7) which is realized as a heat sink plate (7) and the negative heat sink (9) is part of a bearing housing of a casing of the rotary electric machine inside of which are arranged said rotor and stator.
14. Current-rectifying arrangement (1) as set forth in claim 13, wherein the positive heat
sink (7) and the connector (11) are intended to be fixed to the bearing housing
comprising the negative heat sink (9).

15. Current-rectifying arrangement (1) as set forth in any one of claims 12 to 14,
wherein the connector (11) comprises a network of electrical conductors (13) for
connecting the current-rectifying elements (3, 5) to the output of the stator phases
overmoulded by an electrical insulating material, and wherein the electrical
conductors (13) comprise round wires with first parts (45) associated to the stator
phases and having a loop (51) for connection to a stator phase, for example by
pinching and welding the stator phases.

16. Current-rectifying arrangement (1) as set forth in claims 12 to 15, wherein the
electrical conductors (13) comprise flattened parts (47, 49) for connecting the
current-rectifying elements (3, 5), for example by welding.

17. Current-rectifying arrangement (1) as set forth in claims 12 to 16, for a motor
vehicle, wherein the first positive current-rectifying elements are intended to be
connected to the positive terminal of an accumulator of energy of the vehicle and the
second negative current-rectifying elements are intended to be grounded.

18. Current-rectifying arrangement as set forth in claims 12 to 17, wherein the current-
rectifying elements comprise diodes.

19. Multiphase rotary electric machine, such as a motor vehicle alternator, comprising a
current-rectifying arrangement (1) as set forth in claims 12 to 18.