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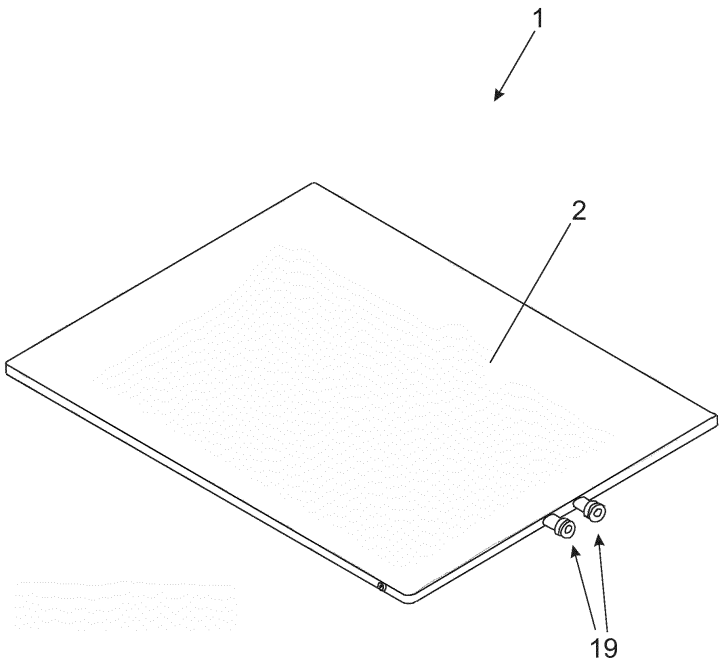
(54) COOLING PLATE AND METHOD FOR MANUFACTURING A COOLING PLATE

(57) Cooling plate comprising a plate body (2) and at least one cooling channel (3) which is disposed inside the plate body (2) and which is at least partly delimited by the plate body (2), wherein the plate body (2)comprises

- a first component part (4) with a at least one first recess (5), and
- a second component part (6) with at least one second recess (7), which second recess (7) geometrically corresponds to the first recess (5),

wherein the first component part (4) and the second component part (6) are attached to each other such that the at least one first recess (5) and the at least one second recess (7) face each other and such that the at least one first recess (5) and the at least one second recess (7) together realise at least part of the at least one cooling channel (3) inside the plate body (2).

Fig. 1



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Description

[0001] The present invention concerns a cooling plate, a cooling device, a use of a cooling plate, and a method for manufacturing a cooling plate.

[0002] Cooling plates are used in cooling devices, for example for cooling and freezing liquids occurring in or resulting from a bio-pharmaceutical production process. The resulting frozen liquid, which represents a sizeable monetary value, can afterwards be transported or stored in such a way that the frozen liquid is protected from damage, stemming for example from mechanical impacts, and potentially resulting loss of sterile integrity.

[0003] In and of themselves, cooling plates for cooling liquids or other goods with a liquid content are also known from other areas, for example from the food industry.

[0004] In the prior art, cooling plates include at least one cooling channel for a cooling medium which is disposed inside a plate body. The liquid to be cooled is placed adjacent to a cooling plate or between cooling plates, and a cooling medium of lower temperature than the liquid is pumped through the at least one cooling channel. Heat from the liquid is then conducted into the cooling medium, thereby cooling the liquid.

[0005] A cooling device making use of cooling plates for use in the bio-pharmaceutical production process is known from unpublished European Patent Application no. 20181117.1 or from WO 2020/047571 A1. Containers for liquids occurring in or resulting from a bio-pharmaceutical production process and which are adapted for freezing in a cooling device are known from WO 2018/129576 A1.

[0006] Cooling plates according to the prior art are for example manufactured by providing two steel sheets which are connected at their periphery by distance panels, e.g. by welding, such that a plate-like shape results. The cooling channel is realised by further panels which are welded into the inside in such a way as to create a meandering channel.

[0007] This has several disadvantages. Because of the many welds there is a large chance that one of the welds is not liquid-tight, such that leakage of the cooling medium is a regular occurrence. Such configurations also often suffer from corrosion.

[0008] A further problem is deformation of the surface of the cooling plate because it is difficult to weld the different panels with high enough accuracy such that the surfaces of the cooling plate are plane enough. However, a surface of the cooling plate which is as plane as possible is of course desired, because the larger the contact area between the cooling plate and the container of the liquid to be cooled is the better the heat transfer between the container and the cooling plate will be. Therefore, a cooling plate with precise geometrical shape directly contributes to an effective cooling.

[0009] The object of the invention is therefore to provide a cooling plate and a method for manufacturing a cooling plate, wherein the properties regarding liquid tightness for the cooling medium, corrosion, and/or precise geometrical shape are improved compared to the prior art.

[0010] Regarding the cooling plate this object is achieved with the features of claim 1, namely by a cooling plate with a plate body and at least one cooling channel which is disposed inside the plate body and which is at least partly delimited by the plate body, wherein the plate body comprises

- a first component part with a at least one first recess, and
- a second component part with at least one second recess, which second recess geometrically corresponds to the first recess,

wherein the first component part and the second component part are attached to each other such that the at least one first recess and the at least one second recess face each other and such that the at least one first recess and the at least one second recess together realise at least part of the at least one cooling channel inside the plate body.

[0011] Regarding the method the object is achieved by a method according to claim 12, the method comprising the following steps:

- forming at least one first recess into a first blank body yielding a first component part,
- forming at least one second recess into a second blank body yielding a second component part, such that the at least one second recess geometrically corresponds to the at least one first recess,
- attaching the first component part and the second component part to each other such that the at least one first recess and the at least one second recess face each other and such that the at least one first recess and the at least one second recess together realise at least part of the at least one cooling channel inside a plate body of the cooling plate.

[0012] The invention provides a cooling plate and a method for manufacturing the same from significantly fewer component parts than in the prior art. Furthermore, the at least one cooling channel is easily delimited (at least in part) by two parts which are made up of full or mainly full material (i.e. reduced or no hollowness), such that potential leaks and corrosion automatically become much less likely.

[0013] Furthermore, forming the first part and the second part from full material blanks allows for much better geometrical precision of the cooling plate compared to a welded construction made up of sheet metal.

[0014] The first component part can realise a first plane (i.e. flat) surface of the plate body and/or the second component part can realise a second plane (i.e. flat) surface of the plate body. In other embodiments there can of course also be surfaces of the cooling plate with protrusions or other surface geometries as desired for the particular application.

[0015] The first component part and the second component part can preferably interface along a surface which is substantially parallel to the first plane surface and/or the second plane surface.

[0016] The plate body is preferably of a plate-like base shape, preferably with a rectangular base area. Of course, there can be other features present, such as fastenings for fastening the cooling plates in a cooling device and/or ports for connecting conducts for the cooling medium to the at least one cooling channel, such that cooling medium can be supplied to and discharged from the at least one cooling channel. The cooling plate could also have a different base shape, for example as a curved or bent plate-like shape.

[0017] There can be one or more cooling channels delimited at least partly by the first component part and the second component part. In particular, the at least one first recess and the at least one second recess can each be divided into separate recesses, which are themselves contiguous, resulting in more than one cooling channel which are at least in part delimited by the separate first and second recesses. Of course, the at least one first recess and/or the at least one second recess can each be a single contiguous recess.

[0018] The at least one cooling channel can be of circular cross-section. However, in particularly preferred embodiments the at least one cooling channel are somewhat flattened with flat inner surfaces parallel to the first plane surface and/or the second plane surface of the cooling plate.

[0019] The at least one cooling channel can lead through the plate body in a meandering manner of fashion in order to cover as much of the area of the cooling plate and in order to achieve a heat transfer which is as homogeneous over the area of the cooling plate.

[0020] According to the invention the first component part and the second component part are attached to each other such that the at least one first recess and the at least one second recess face each other and such that the at least one first recess and the at least one second recess together realise at least part of the at least one cooling channel inside the plate body.

[0021] Formulated differently, viewed in a cross-section of the at least one cooling channel one side of the cross section is given by the at least one first recess and the other side of the cross section is given by the at least one second recess. In yet other words, the at least one first recess and the at least one second recess are arranged on top of each other such that material around the recesses together delimits the at least one cooling channel.

[0022] As mentioned before, the first blank body and the second blank body which are furnished with the first recess and the second recess can be made of full material blank bodies.

[0023] The first component part, the second component part, the first blank body, and/or the second blank body can preferably be made of stainless steel.

[0024] The at least one first recess and/or the at least one second recess can preferably be formed into the first blank body and/or the second blank body, respectively, by a cutting method in the engineering sense, in particular milling.

[0025] That the first recess and the second recess correspond to each other geometrically does not necessarily mean that they have to be of equal geometrical shape. That the first recess and the second recess correspond to each other geometrically can interpreted in the sense that they are able to together delimit the at least one cooling channel in a state where the first component part and the second component part are attached to each other.

[0026] Protected is also a cooling device comprising at least one cooling plate according to the invention.

[0027] It should be noted that the cooling plate according to the invention or the cooling device according to the invention can both be used for cooling, in particular freezing, and for heating, in particular thawing, liquids or goods containing a liquid component. The cooling or heating is achieved by arranging the liquids or goods to be cooled or heated adjacent to the cooling plate according to the invention or between cooling plates according to the invention, and supplying a cooling or heating medium of higher or lower temperature than the liquids or goods, respectively, to the cooling plate(s).

[0028] Protected is furthermore a use of a cooling plate according to the invention or a cooling device according to the invention in cooling, in particular freezing, and/or heating, in particular thawing, a liquid occurring in and/or resulting from a pharmaceutical production process, in particular a bio-pharmaceutical production process.

[0029] For these applications a cooling plate according to the invention can be particularly advantageous as leaks, corrosion, as well as inhomogeneous or ineffective heat transfer can have a quite detrimental effect due to the valuable nature of the liquids to be frozen or thawed.

[0030] Further advantageous embodiments are defined in the dependent claims.

[0031] The first component part and the second component part can be attached to each other with at least one mechanical connection and/or at least one adhesive bond.

[0032] The at least one mechanical connection can be embodied as at least one thread and screw connection and/or

at least one positive lock connection.

[0033] It can be provided that a screw head of the at least one thread and screw connection is welded substantially flat, and a remaining substantially flat surface is polished and/or sanded. The screw head of a thread and screw connection can disturb the surfaces of the cooling plate, which as already mentioned contributes to an efficient heat transfer. By welding the screw head flat, e.g. by removing part of the screw head and/or filling a central recess of the screw head, can therefore be beneficial for a substantially flat or (first or second) plane surface of the cooling plate. This can be further improved by sanding and/or polishing the remaining surface.

[0034] Of course, the first and/or second plane surface can also be polished and/or sanded independently of the presence of a thread and screw connection.

[0035] Positive lock connections are connections which fasten two component parts, here the first component part and the second component part, to each other by way of the shape of the objects or geometrical features realising the connection (in contrast to a frictional connection or a force closure).

[0036] The at least one positive lock connection can comprise a hook component part (preferably more than one hook component part) which is separate from the first component part and/or the second component part, wherein the hook component part includes a first hook element and/or a second hook element, and wherein the first hook element is engaged with a first undercut in the first component part and/or the second hook element is engaged with a second undercut in the second component part.

[0037] The terms "hook component part" and "hook elements" here are not be understood narrowly so as to have to have a shape of a commonly known hook. For the purposes of this document "hooks" should merely be understood as geometrical features which cooperate with an undercut or the like in order to achieve a positive lock.

[0038] As such, the hook component part and/or the first hook element and/or the second hook element can for example be embodied as a T-shaped sliding element cooperating with an undercut (in particular if viewed in a cross section). In particularly preferred embodiments the hook component part can be embodied as double T-shaped sliding elements (T-shapes on opposing sides).

[0039] The hook component part and/or the first hook element and/or the second hook element could also incorporate a conical shape instead of a (double) T-shape (in particular if viewed in a cross section).

[0040] The hook component part can preferably be arranged on an inside of the plate body, i.e. not on the periphery of the plate body.

[0041] In a preferred manufacturing method for a cooling plate the method according to the invention further comprises attaching the first component part and the second component part to each other using a positive lock connection, preferably additionally comprising

- using a hook component part (preferably more than one hook component part) which is separate from the first component part and/or the second component part, wherein the hook component part includes a first hook element and/or a second hook element, and
- engaging the first hook element with a first undercut in the first component part and/or engaging the second hook element with a second undercut in the second component part.

[0042] Such embodiments can preferably additionally comprise engaging the first hook element with the undercut in the first component part, bringing the second component part into contact with the first component part, and moving the second component part relative to the first component part laterally along an interface between the first component part and the second component part until the second hook element of the hook component part engages with the second undercut of the second component part, or vice versa.

[0043] It should be mentioned that a force closure can additionally be present when the second component part is moved laterally along the interface with the first component part (or vice versa). Then the first and second component parts are secured on the one hand against unwanted relative lateral movements by the force closure, and potentially another mechanical connection and/or adhesive bond, and are secured on the other hand against unwanted relative axial movements (i.e. parallel to a normal direction on the surface of the cooling plate) by the positive lock connection, and potentially another mechanical connection and/or adhesive bond.

[0044] The at least one adhesive bond can for example be a metallic continuity bond, in particular a welded bond. Other adhesive bonds, for example with an adhesive substance (glue) are of course in principle conceivable.

[0045] The first component part and the second component part can be bonded to each other through the adhesive bond along at least one peripheral side, preferably all peripheral sides, of the first component part and the second component part.

[0046] In particularly preferred embodiments the first component part and the second component part are attached to each other by at least one positive lock connection, preferably with at least one hook component part as described before, and an adhesive bond, in particular a weld, wherein there is preferably no thread and screw connection.

[0047] In such particularly preferred embodiments the at least one positive lock connection can be arranged in a central

portion of the cooling plate and the adhesive bond is arranged around the peripheral sides of the cooling plate. In test conducted by the Applicant such particularly preferred embodiments have shown themselves to be particularly advantageous as they are particularly resistant to leaks and corrosion while maintaining a particularly precise geometrical shape.

[0048] The cooling plates can have side lengths between 500mm and 1500mm, preferably between 700mm and 1200mm, and particularly preferably between 800mm and 1100mm.

[0049] Further details and advantages of the invention are apparent from the figures and the accompanying description of the figures. The figures show:

Fig. 1	an embodiment of a cooling plate according to the invention,
Fig. 2a, 2b, 3a, 3b, 4a, 4b, 5, 6	steps of an exemplary method of manufacturing a cooling plate according to the invention,
Fig. 7, 8	an embodiment of a hook component part,
Fig. 9, 10, 11	steps of another exemplary method of manufacturing a cooling plate according to the invention,
Fig. 12, 13, 14	steps of another exemplary method of manufacturing a cooling plate according to the invention,
Fig. 15	schematically an embodiment of a cooling plate according to the invention,
Fig. 16	a sectional view of the embodiment of Fig. 15, and
Fig. 17	an embodiment of a cooling device with a cooling plate according to the invention.

[0050] Fig. 1 shows an exemplary embodiment of a cooling plate 1 according to the invention. A plate body 2 of the cooling plate 1 comprises an internal cooling channel 3 (see Figures 3a, 3b and 6).

[0051] Ports 19 can be used to connect tubing or piping for conveying a cooling medium through the at least one cooling channel 3.

[0052] Silicone oil can be used as cooling (or heating) medium.

[0053] In this example the cooling plate 1 has dimensions of approximately 1074mm by 850mm.

[0054] Fig. 2a, 2b, 3a, 3b, 4a, 4b, 5, and 6 schematically show steps of an embodiment of a manufacturing method for cooling plates 1 according to the invention.

[0055] Initially, a first blank body 17 and a second blank body 18 are provided (Fig. 2a and 2b, shown in top view). The blank bodies can for example be made of stainless steel. Alternatively the blank bodies could be made of Aluminium or (other) materials which offer high heat transfer, resistance to corrosion and impermeability for a cooling or heating medium.

[0056] The first blank body 17 and/or the second blank body 18 can be of substantially cuboidal base shape. In preferred embodiments the blank bodies are of substantially plate-like base shape, i.e. a height of the blank bodies may be much smaller than a width and a length of the blank bodies. Preferably the width and length are different from each other. However, embodiments with equal lengths and widths are in principle conceivable. Since the first blank body 17 and the second plate body 18 eventually make up the plate body 2, analogous statements are true for the plate body 2.

[0057] In a next step at least one first recess 5 is formed in the first blank body 17 and at least one recess 7 is formed in the second blank body 18 (Fig. 3a and 3b), such that the first recess 5 and the second recess 7 correspond to each other geometrically. Herewith, in the terminology of the invention the first blank body 17 becomes the first component part 4 and the second blank body 18 becomes the second component part 6.

[0058] In the depicted embodiment the first recess 5 and the second recess 7 are depicted as geometrically substantially equal in Fig. 3a and 3b. In other embodiments the first recess 5 and the second recess 7 can be of different geometrical shape while still able to together delimit the at least one cooling channel 3 in a state where the first component part 4 and the second component part 6 are attached to each other, as laid out previously.

[0059] Before, during or after the first recess 5 is formed into the first blank body 17 and/or the second recess 7 is formed into the second blank body 18 openings 20, preferably with undercuts or threads, can be formed into the first blank body 17 and/or the second blank body 18, which later allow attachment of the first component part 4 and the second component part 6 to each other.

[0060] The forming of the first recess 5 and/or the second recess 7 and/or the openings 20 can be performed with a machining process, in particular a milling process.

[0061] It will be understood that the particular geometry of the at least one first recess 5, the at least one second recess 7, and consequently of the at least one cooling channel 3 depicted in Fig. 3a and 3b is a mere example and the geometries can be adapted to achieve the desired cooling plate 1, in particular the desired layout of the at least one cooling channel 3.

[0062] Fig. 4a and 4b (as well as Fig. 5 and 6) show the first component part 4 and the second component part 6 in a sectional view through the planes A indicated in Fig. 3a and 3b.

[0063] In a next step the first component part 4 and the second component part 6 are brought together with the sides comprising the first recess 5 and the second recess 7 facing each other at an interface (Fig. 5). The first component part

4 and the second component part 6 are then attached to each other in this configuration.

[0064] Consequently, the first component part 4 and the second component part 6 together become the plate body 2 of the cooling plate 1. The first recess 5 and the second recess 7 together delimit the at least one cooling channel 3, as can be seen from Fig. 6.

[0065] The first component part 4 creates a first plane surface 15 of the plate body 2 and the second component part 6 creates a second plane surface 16 of the plate body 2.

[0066] Attaching the first component part 4 and the second component part 6 to each other can for example be achieved using a positive lock, such as described in connection with Fig. 9 to 11 below, and/or a screw and thread connection, such as described in connection with Fig. 12 to 14 below, realising a mechanical connection.

[0067] Alternatively or additionally, the first component part 4 and the second component part 6 can be attached to each other using an adhesive bond. For example the first component part 4 and the second component part 6 can be welded to each other along the welded bond 14 depicted in Fig. 6. Alternatively or additionally, an adhesive or the like can be used in order to facilitate the adhesive bond.

[0068] In the embodiment depicted in Fig. 6 all four peripheral sides of the first component part 4 and the second component part 6 are attached to each other via the welded bond 14.

[0069] Fig. 7 and 8 schematically depict a hook component part 9 which can be used to attach the first component part 4 and the second component part 6 to each other using one or more positive lock connections.

[0070] Fig. 8 shows the hook component part 9 on its own. It comprises two first hook elements 11 and two second hook elements 12 on opposite sides. It would also be possible to only use one first hook element 11 and/or only one second hook element 12, or more than two of either.

[0071] Fig. 7 shows the hook component part 9 hooked into the first component part 4 (the first component part 4 being depicted in a cutaway view). Several of these hook component parts 9 can be used for attaching the first component part 4 and the second component part 6 to each other (or a single one).

[0072] As can be seen from Fig. 3a and 3b the openings 20 in the first component part 4 and the second component part 6 have a wider area and a narrower area, where the narrower areas each comprise a first undercut 13 or a second undercut. The hook component parts 9 can be inserted into the wider area of the openings 20 and moved laterally into the narrower area such that the first hook elements 11 move under the first undercuts 13. In the view depicted in Fig. 7 a vertical movement of the hook component part 9 away from the first component part 4 is then impeded by the first undercut 13.

[0073] Likewise, the second component part 6 comprises second undercuts (not shown) through which the hook component parts 9 can be hooked into the second component part 6. The second undercuts can be embodied substantially equal to the first undercuts 13.

[0074] The attachment operation for attaching the first component part 4 to the second component part 6 using the hook component part 9 is shown schematically in Fig. 9 to 11.

[0075] Fig. 9 shows the first component part 4 with the hook component parts 9 in the hooked state as shown in Fig. 7.

[0076] The first component part 4 and the second component part 6 are then brought into contact with each other with a lateral offset as depicted in Fig. 10. The hook component parts 9 are thereby inserted into the wider areas of the openings 20 of the second component part 6 (see Fig. 3b).

[0077] By moving the second component part 6 laterally relative to the first component part 4 the second hook elements 12 of the hook component parts 9 move into the narrower areas of the openings 20 such that the second hook elements 12 move over the second undercuts (Fig. 11). In the configuration depicted in Fig. 11 a vertical movement of the second component part 6 away from the first component part 4 is then impeded by the first hook elements 11 being arranged under the first undercuts 13 and the second hook elements being arranged above the second undercuts.

[0078] As mentioned before, an additional adhesive bond (like for example a welded connection) can then be used to inhibit also lateral movement so that the first component part 4 and the second component part 6 are completely fixed to each other.

[0079] Fig. 12 to 14 schematically show an example where the first component part 4 and the second component part 6 are attached to each other using a screw and thread connection. At first, the first component part 4 and the second component part 6 are provided (Fig. 12), brought into contact with each other and screws are used to fix the first component part 4 and the second component part 6 to each other (Fig. 13).

[0080] As can be seen from Fig. 13 screw heads 8 may protrude from the first plane surface 15 or the second plane surface 16.

[0081] The screw heads 8 can then be welded substantially flat by removing the protruding parts of the screw heads 8 and/or filling up recesses in the screw heads 8 (build-up welding) resulting in the configuration depicted schematically in Fig. 14.

[0082] After attaching the first component part 4 and the second component part 6 to each other with one of the methods described above (or combinations thereof) the first plane surface 15 and/or the second plane surface 16 can be polished or sanded in order to achieve a desired surface smoothness or surface structure.

[0083] Fig. 15 shows the embodiment of the cooling plate 1 of Fig. 1 which was manufactured with the methods as described in connection with Fig. 2a, 2b, 3a, 3b, 4a, 4b, 5, 6, 7, 8, 9, 10, and 11. However, instead of using six hook component parts 9 a total of 28 hook component parts 9 have been used in a grid-like arrangement as indicated in Fig. 15.

[0084] Fig. 16 shows the embodiment of Fig. 15 in a sectional view through a plane parallel to the first plane surface 15 and/or the second plane surface 16. The layout of the cooling channel 3 in this embodiment is visible in Fig. 16.

[0085] It will be understood that the number and arrangement of the hook component parts 9 described herein are mere examples. They can be adapted to the particular cooling plate to be manufactured.

[0086] Fig. 17 shows an example of a cooling device 10 with cooling plates 1 according to the invention. In this embodiment there are nine cooling plates 1 according to the invention.

List of reference numerals:

[0087]

1	Cooling plate
2	Plate body
3	At least one cooling channel
4	First component part
5	First recess
6	Second component part
7	Second recess
8	Screw head
9	Hook component part
10	Cooling device
11	First hook element
12	Second hook element
13	First undercut
14	Welded bond
15	First plane surface
16	Second plane surface
17	First blank body
18	Second blank body
19	Ports
20	Openings

Claims

1. Cooling plate comprising a plate body (2) and at least one cooling channel (3) which is disposed inside the plate body (2) and which is at least partly delimited by the plate body (2), wherein the plate body (2)comprises

   - a first component part (4) with a at least one first recess (5), and
   - a second component part (6) with at least one second recess (7), which second recess (7) geometrically corresponds to the first recess (5),

   wherein the first component part (4) and the second component part (6) are attached to each other such that the at least one first recess (5) and the at least one second recess (7) face each other and such that the at least one first recess (5) and the at least one second recess (7) together realise at least part of the at least one cooling channel (3) inside the plate body (2).

2. Cooling plate according to claim 1, wherein the first component part (4) and the second component part (6) are attached to each other with at least one mechanical connection and/or at least one adhesive bond.

3. Cooling plate according to claim 2, wherein the at least one mechanical connection is at least one thread and screw connection and/or at least one positive lock connection.

4. Cooling plate according to claim 2 or 3, wherein a screw head (8) of the at least one thread and screw connection is welded substantially flat, and a remaining substantially flat surface is polished and/or sanded.

5. Cooling plate according to claim 3 or 4, wherein the at least one positive lock connection comprises a hook component part (9) which is separate from the first component part (4) and/or the second component part (6), wherein the hook component part (9) includes a first hook element (11) and/or a second hook element (12), and wherein the first hook element (11) is engaged with a first undercut (13) in the first component part (4) and/or the second hook element (12) is engaged with a second undercut in the second component part (6).

6. Cooling plate according to at least one of the claims 2 to 5, wherein the at least one adhesive bond is a metallic continuity bond, in particular a welded bond (14).

7. Cooling plate according to at least one of the claims 2 to 6, wherein the first component part (4) and the second component part (6) are bonded to each other through the adhesive bond along at least one peripheral side, preferably all peripheral sides, of the first component part (4) and the second component part (6).

8. Cooling plate according to one of the preceding claims, wherein the first component part (4) realises a first plane surface (15) of the plate body (2) and/or the second component part (6) realises a second plane surface (16) of the plate body (2).

9. Cooling plate according to claim 8, wherein the first component part (4) and the second component part (6) interface along a surface which is substantially parallel to the first plane surface (15) and/or the second plane surface (16).

10. Cooling device comprising at least one cooling plate (1) according to at least one of the previous claims.

11. Use of a cooling plate (1) according to one of the claims 1 to 9 or of a cooling device (10) according to claim 10 in cooling, in particular freezing, and/or heating, in particular thawing, a liquid occurring in and/or resulting from a pharmaceutical production process, in particular a bio-pharmaceutical production process.

12. Method of manufacturing a cooling plate, in particular according to one of the claims 1 to 9, comprising the following steps:

- forming at least one first recess (5) into a first blank body (17) yielding a first component part (4),
- forming at least one second recess (7) into a second blank body (18) yielding a second component part (6), such that the at least one second recess (7) geometrically corresponds to the at least one first recess (5),
- attaching the first component part (4) and the second component part (6) to each other such that the at least one first recess (5) and the at least one second recess (7) face each other and such that the at least one first recess (5) and the at least one second recess (7) together realise at least part of the at least one cooling channel (3) inside a plate body (2) of the cooling plate (1).

13. Method according to claim 12, wherein the method further comprises attaching the first component part (4) and the second component part (6) to each other using a positive lock connection.

14. Method according to claim 13, wherein the method further comprises

- using a hook component part (9) which is separate from the first component part (4) and/or the second component part (6), wherein the hook component part (9) includes a first hook element (11) and/or a second hook element (12), and
- engaging the first hook element (11) with a first undercut (13) in the first component part (4) and/or engaging the second hook element (12) with a second undercut in the second component part (6).

15. Method according to claim 14, wherein the method further comprises engaging the first hook element (11) with the first undercut (13) in the first component part (4), bringing the second component part (6) into contact with the first component part (4), and moving the second component part (6) relative to the first component part (4) laterally along an interface between the first component part (4) and the second component part (6) until the second hook element (12) of the hook component part (9) engages with the second undercut of the second component part (6), or vice versa.

Fig. 1

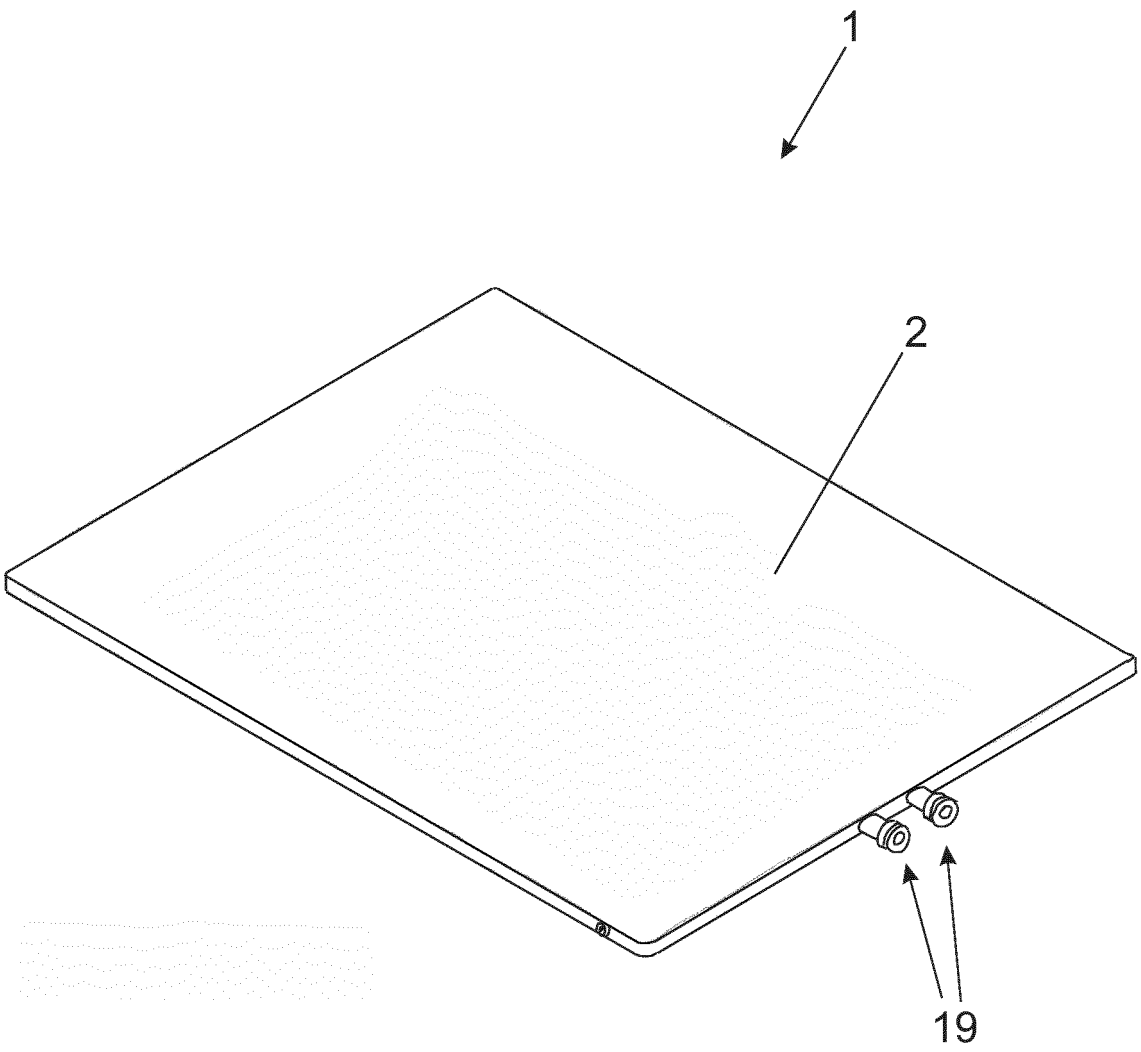


Fig. 2a

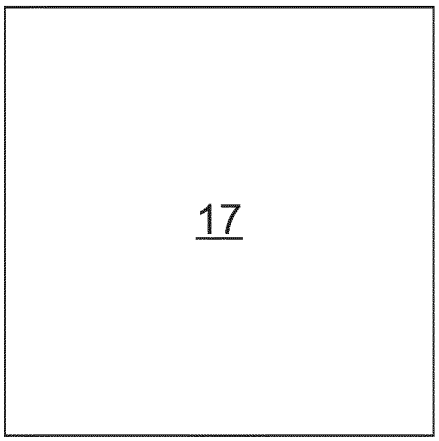


Fig. 2b

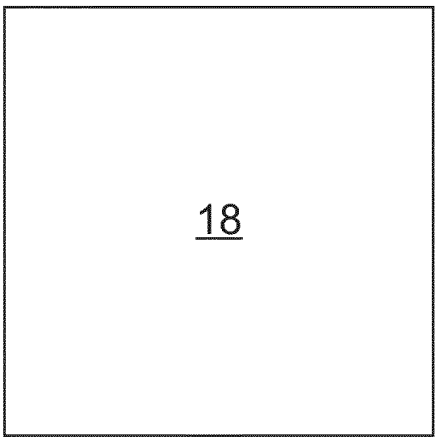


Fig. 3a

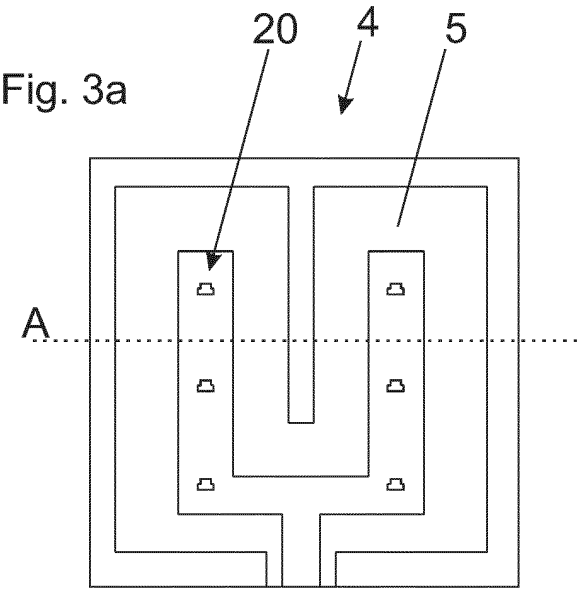


Fig. 3b

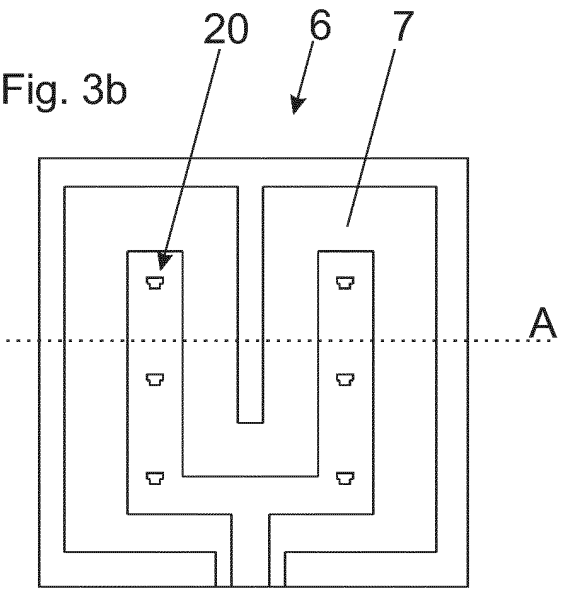


Fig. 4a

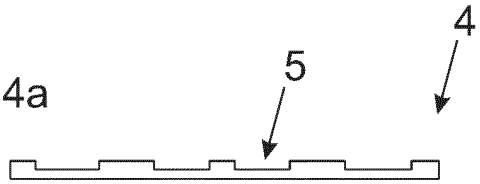


Fig. 4b

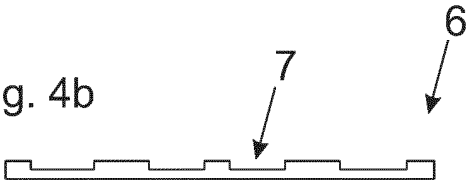


Fig. 5

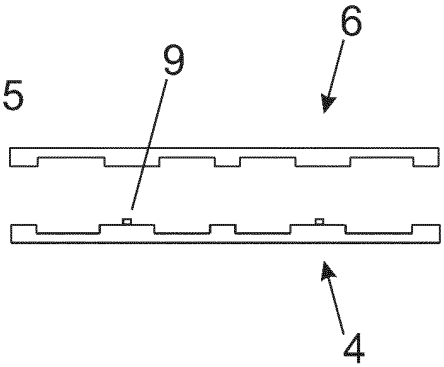


Fig. 6

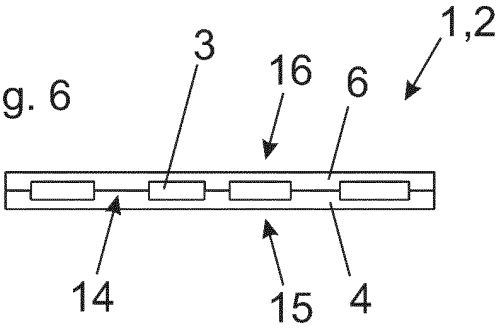


Fig. 7

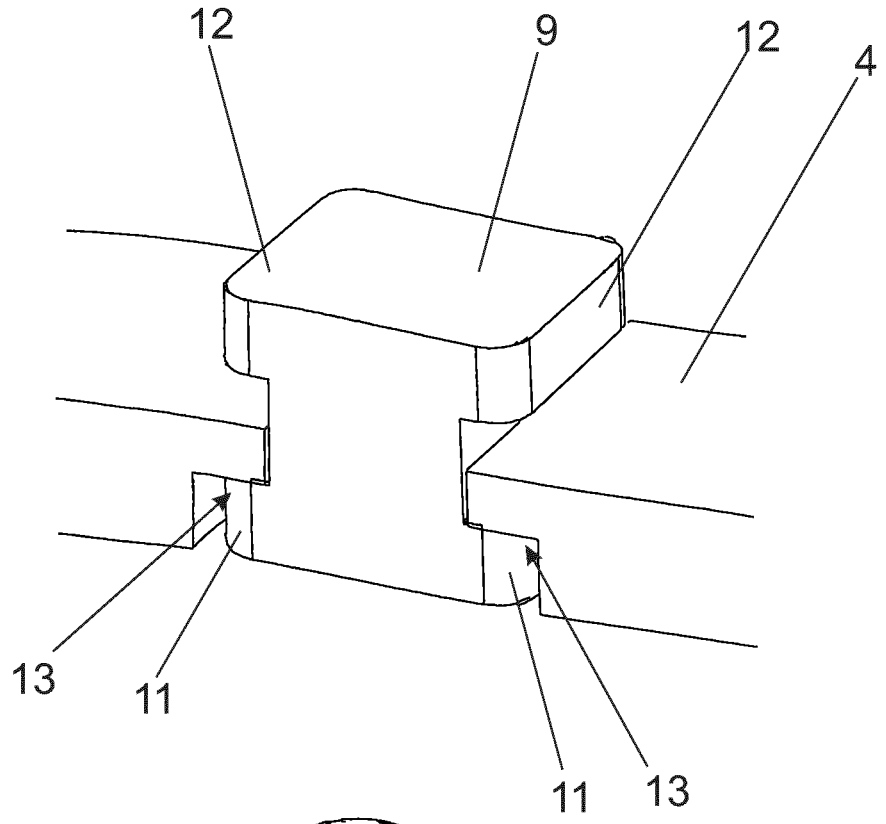


Fig. 8

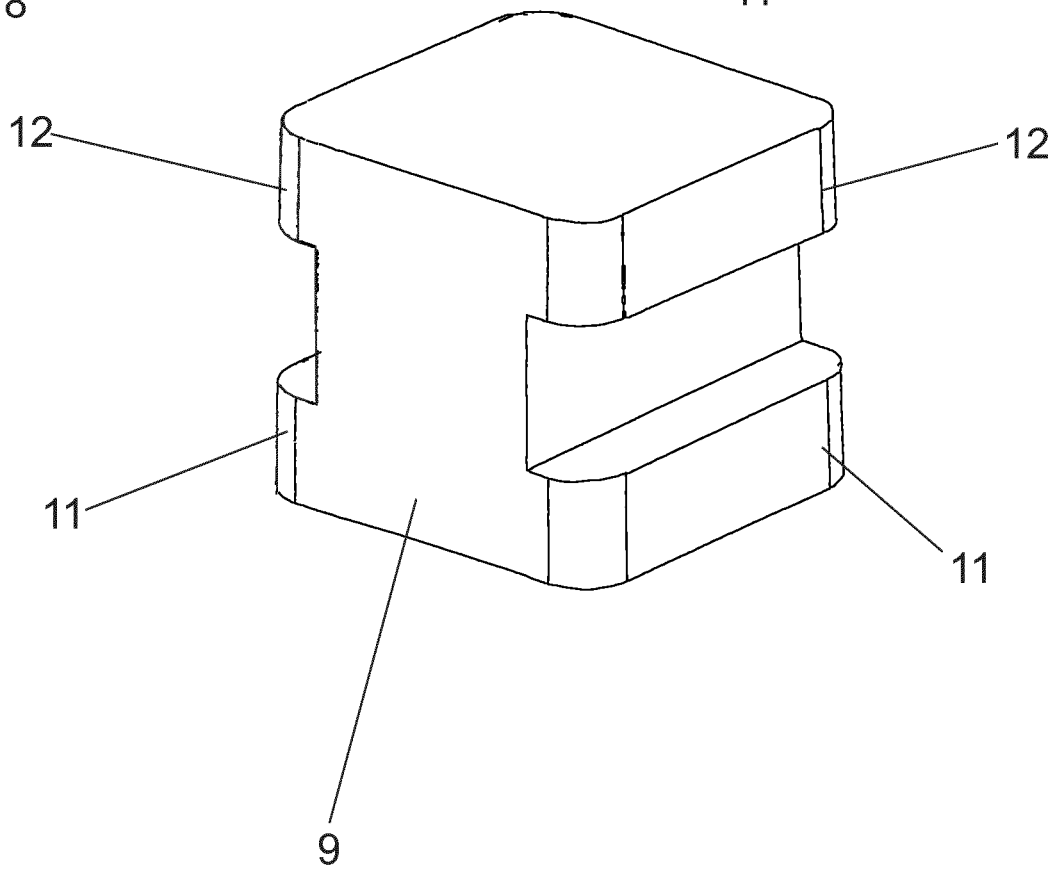


Fig. 9

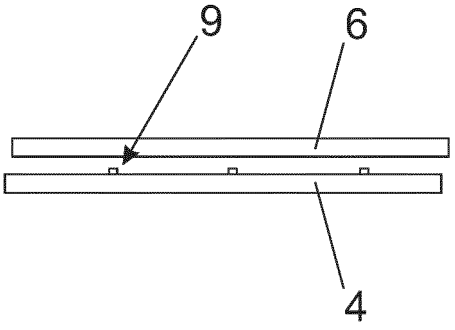


Fig. 10

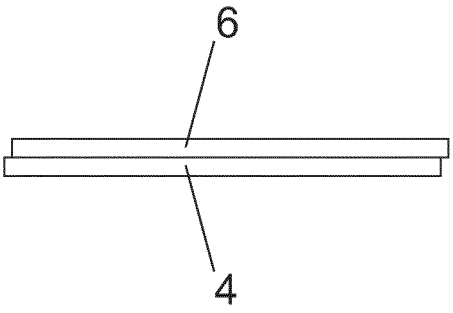


Fig. 11

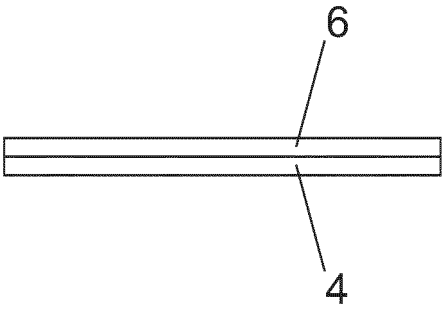


Fig. 12

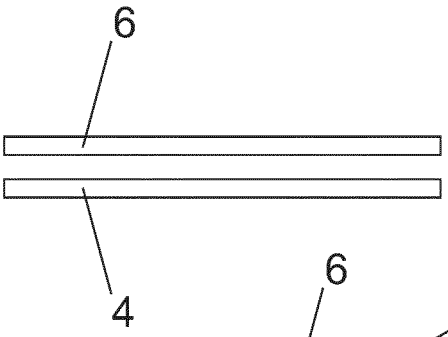


Fig. 13

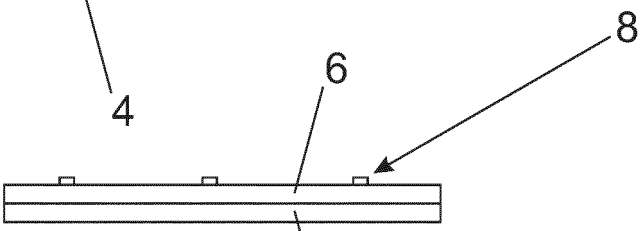


Fig. 14

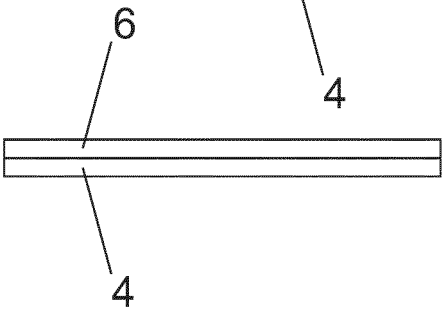


Fig. 15

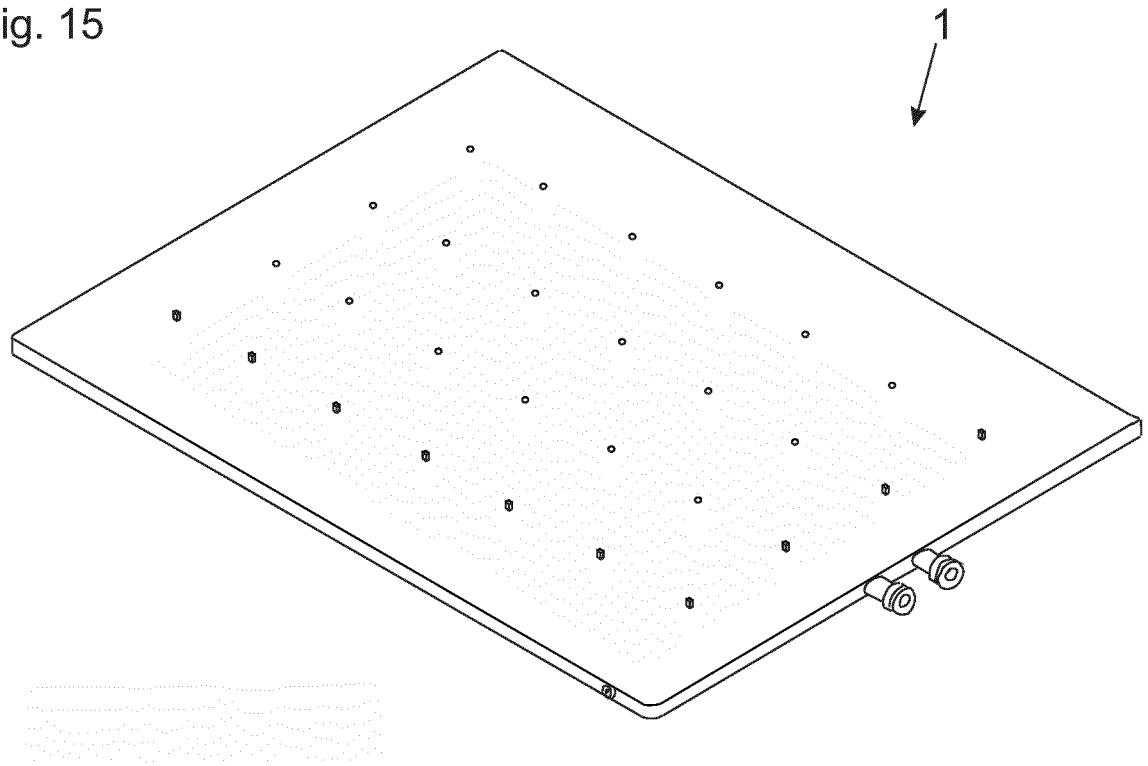


Fig. 16

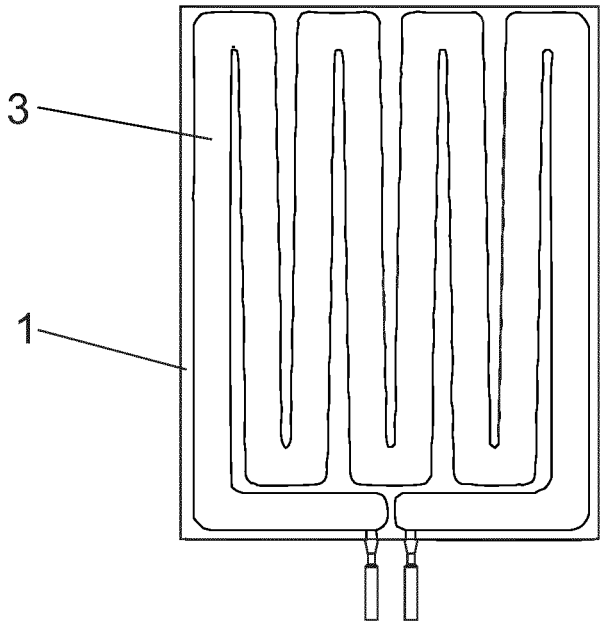
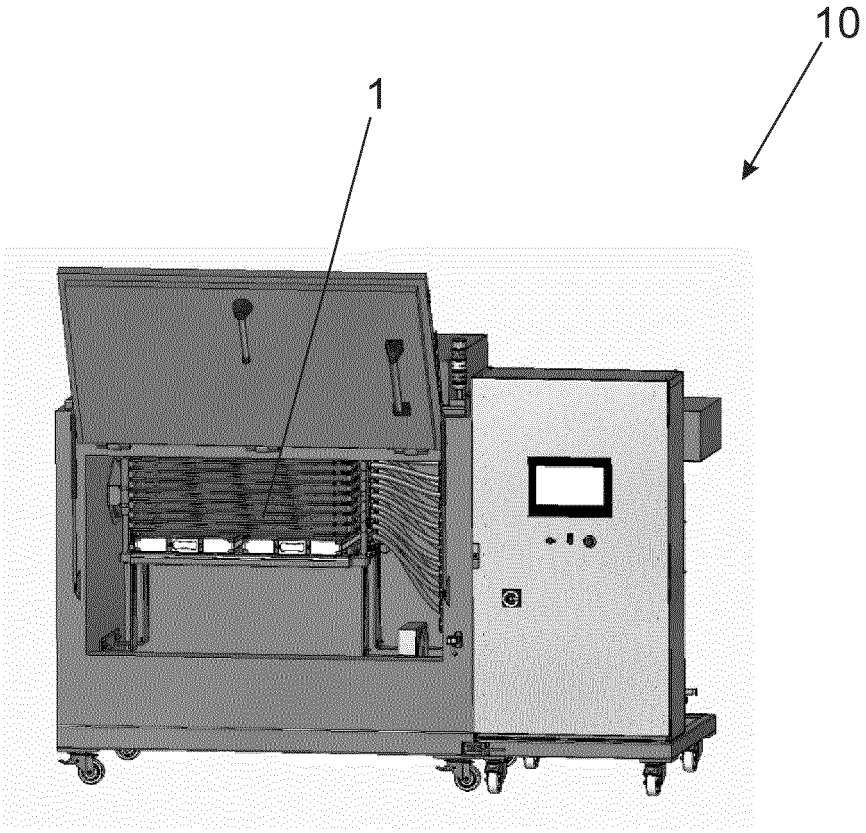


Fig. 17



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EUROPEAN SEARCH REPORT

Application Number
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F28F
F25D
F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 March 2022	Canköy, Necdet

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