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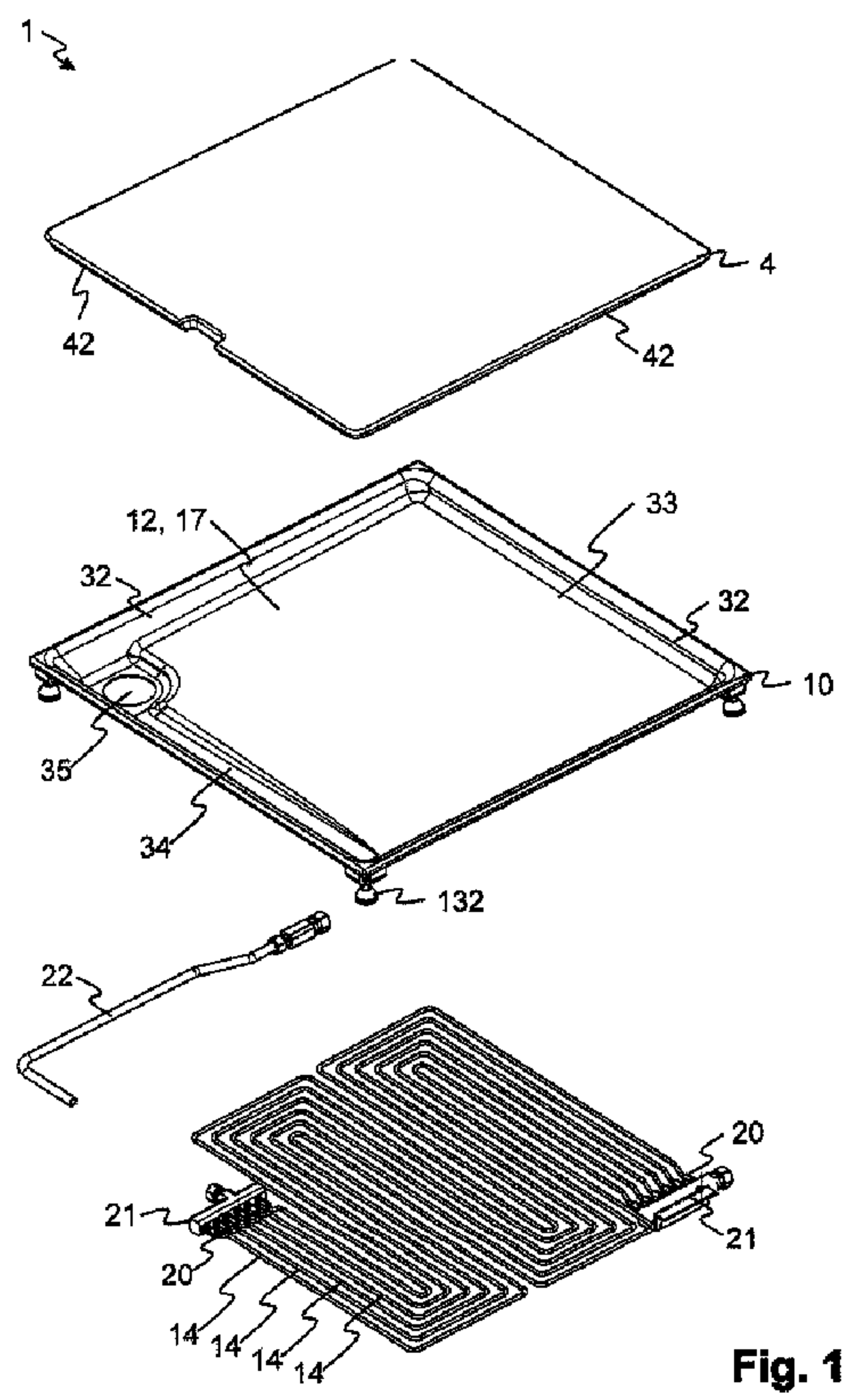

Fig. 1

(57) Abrégé/Abstract:
Shower tray (10) having a heat exchanger (1), wherein the heat exchanger (1) is arranged beneath the shower tray (10) for recovering heat from waste water in order to heat up clean water, wherein a first heat-exchanger surface (17) is in contact with the

(57) Abrégé(suite)/Abstract(continued):
waste water and a second heat-exchanger surface is in contact with the clean water, and the first heat-exchanger surface (17) forms the floor, or part of the floor, of the shower tray (10). The shower tray here is produced from aluminium or from an aluminium alloy, or the shower tray is produced from a steel alloy and, in the region of the tray floor (12), beneath the shower tray (10), a base plate (13) made of some other metal is fastened on the tray floor (12), as a result of which a heat-conducting connection to the tray floor (12) is formed substantially over the entire surface of the base plate (13), and, once again beneath said base plate (13), tubes (14) are connected to the base plate (13) in an integral manner, in particular by welding or soldering, wherein said tubes (14) form the second heat-exchanging surface.

ABSTRACT

Shower tray (10) having a heat exchanger (1), wherein the heat exchanger (1) is arranged beneath the shower tray (10) for recovering heat from waste water in order to heat up clean water, wherein a first heat-exchanger surface (17) is in contact with the waste water and a second heat-exchanger surface is in contact with the clean water, and the first heat-exchanger surface (17) forms the floor, or part of the floor, of the shower tray (10). The shower tray here is produced from aluminium or from an aluminium alloy, or the shower tray is produced from a steel alloy and, in the region of the tray floor (12), beneath the shower tray (10), a base plate (13) made of some other metal is fastened on the tray floor (12), as a result of which a heat-conducting connection to the tray floor (12) is formed substantially over the entire surface of the base plate (13), and, once again beneath said base plate (13), tubes (14) are connected to the base plate (13) in an integral manner, in particular by welding or soldering, wherein said tubes (14) form the second heat-exchanging surface.

SHOWER TRAY AND METHOD FOR PRODUCING A SHOWER TRAY

The invention relates to the field of heat exchangers and in particular to a shower tray, according to the preamble of the respective independent claims, as well as to a method for manufacturing a shower tray.

Such a shower tray is known for example from WO 2010/088784 A1 of the same applicant. The heat exchanger comprises a plane cover plate as a run-off surface, over which waste water runs off. The cover plate is formed from chrome steel, forms the base of the shower tray and can be integrally formed with the shower tray. The plate either consists of two layers, of which the one is profiled and is placed below the other, by which means meandering channels are defined between the plates, or pipes through which water to be heated flows, are soldered against a plate.

DE 44 06 971 shows a shower tray, on whose lower side channels, through which cold water flows, are attached by way of welding on pipes (tubes) or profiles.

NL 1031082 shows a heat exchanger below a shower tray, with which pipes are soldered via a narrow web onto a run-off surface.

WO 2009/030503 describes the manufacture of thermal solar collectors, with which heat fluid pipes are welded onto an absorber plate with a laser.

GB2420973 shows a shower tray with a heat exchanger with an undercut tray wall, into which an elastic region of an insertable tray base snaps. In another embodiment, a further undercut region of the tray edge can cooperate with projections of the tray base, in order with a rotation of the tray base, to lock or release this.

As a whole, the construction height is too high and the cleaning too difficult with existing heat exchangers of this type. The cleaning is also technically relevant, since the cleanliness of the heat exchanger has a large influence on the efficiency of the heat exchanger. Moreover, the manufacture is complicated and the material weight very large.

It is therefore the object of the invention, to create a shower tray of the initially mentioned type which has a comparatively small construction height and is simple to clean. A further object is to provide a suitable manufacturing method for a shower tray.

These objects are achieved by a shower tray and a method for manufacturing a shower tray, with the features of the respective independent patent claims.

According to a **first aspect of the invention**, thus a **shower tray** with a heat exchanger is present, wherein the heat exchanger is arranged below the shower tray for a heat recovery from waste water, for heating fresh water, wherein a first heat exchanger surface is in contact with the waste water, and a second heat exchanger surface is in contact with the fresh water, and the first heat exchanger surface forms the base or a part of the base of the shower tray. Thereby, the shower tray is manufactured of aluminium or of an aluminium alloy. Metal alloys which have a weight component of at least 80% aluminium are considered as aluminium alloys. Hereinafter, when one speaks of aluminium, this is also to be understood as an aluminium alloy. It is also possible to manufacture the tray from a metal with a thermal conductivity of above 100 W/(mk).

In one embodiment, the second heat exchanger surface is formed by pipes (tubes), which are connected to the base of the shower tray by way of a material-fit connection, in particular welding or soldering

In further embodiments, instead of pipes, intermediate spaces are present between the base and one or more plates, for example of metal. Thereby, the intermediate spaces form channels for leading the fresh water, as described in the already mentioned WO 2010/088784, which is herewith included by way of reference, in particular with its Figures 2-6 and 9 and the respective description parts.

It is the case with all embodiments: in order to effect a good heat transfer, a turbulent flow should be present in the pipes or the channels. For this reason, the inner diameter of the pipes is kept small, or the inner side of the pipes is profiled, which for example can also be effected by way of deforming the pipes from the outside. The flow resistance of the pipes increases by way of such measures, which is why several pipes are led in parallel. Thereby, the length of the pipes is essentially the same.

In one embodiment, the pipes are composite pipes (or dual pipes) with an outer layer of aluminium or of an aluminium alloy and with an inner layer of copper or a copper alloy. Copper alloys which have a weight component of at least 50% copper are considered as copper alloys. Hereinafter, a copper alloy is also meant when one speaks of copper.

In another embodiment, a copper pipe is welded onto the tray base of aluminium, in particular by way of laser welding. For this, a weldable anodising layer is formed on the tray base preferably beforehand.

In one embodiment, the shower tray and the outer side of the pipes are anodised. The pipes are closed with a cap for example during the anodisation, so that the copper layer in the pipes is not dissolved by the anodisation bath. Preferably, the anodising is effected after the welding, by which means the welding procedure is simplified. The other way round however would make the connection of the pipes to connection elements of copper after the anodising more complicated, since the occurrence of a galvanic element is to be prevented.

In one embodiment, an edge region of the shower tray comprises a further or a reinforced coating, in particular a layer produced by powder coating, for example with aluminium oxide, or paint layer. An increased abrasion resistance can be achieved in the edge region by way of this.

In one embodiment, the complete shower tray comprises a coating which permits a corrosion protection or wear protection, and/or a wetting of the surface (hydrophilic coating).

In another embodiment, the shower tray is shaped by way of a forming process, in particular by way of deep-drawing or hydroforming or by way of superplastic deformation. It can additionally also be formed by bending and welding individual sections of the shower tray.

The use of aluminium as a base material leads to a series of advantageous which synergistically complement one another and which improve the efficiency and the manufacturability.

- The connection by way of soldering or welding can be designed more simply by way of the same material being used for the tray base and the pipes. A laser welding of a good quality is particularly possible. The quality and service life of the device are improved by way of this.
- The thermal conductivity of aluminium of comparatively high, which improves the efficiency.
- The anodic passivation of aluminium - in contrast to a coating with paint or enamel - leads to a hydrophilic, thin protective layer with a good heat transfer, which improves the efficiency.
- Aluminium pipes in the field of sanitation can also be used due to the use of composite pipes with an inner coating or an inner casing of copper. Due to the fact that these pipes at the outside are of aluminium, they can be connected to the tray base of aluminium, before both are anodised together. If the pipes were not of aluminium, the tray base would have to be

anodised already before the connection to the pipes, which in turn renders the welding more difficult.

- Aluminium can be formed better than steel. With this, the run-off region can be designed in a narrower manner, by which means the active surface of the heat exchanger becomes larger than is possible for example with a steel tray of a similar shape. An improvement of the efficiency also takes place with this.
- Moreover, sharper contours in the four corners of the shower tray can be shaped, so that according to one embodiment, no cutting and welding or no further elements as "gap fillers" are necessary for the installation.
- Aluminium is more than 3 times lighter than copper and somewhat less than 3 times lighter than steel, and this leads to a very significant saving of weight for the transport to the building or installation site and also additionally simplifies the installation for the precise positioning of the tray.

The combination of hydroforming for shaping the tray, and anodising as a surface treatment is advantageous: drawing traces on the upper side of the tray which arise with normal forming with a male and female die, would have to be subsequently treated or be laminated by a material-depositing method (coating, painting). Essentially no such drawing marks arise on hydroforming a tray (or not in a region where they disturb), and thus an anodisation can take place, without the trough surface having to be subjected to post-treatment.

On forming, in particular by way of hydroforming, different variants of shower trays can be manufactured in the same shape. These variants have the same shape of the recess with the shower base and the heat exchanger, but differently large outer edge regions as standing surfaces around these. A set of shower trays having different variants can be manufactured in this manner.

A further advantage of the manufacture by way of hydroforming is that undercut portions can be shaped in a particularly simple manner, thus without the use of slides.

In one embodiment, the shower tray comprises a cover (lid), and moreover a first edge and a second edge, wherein the first and the second edge lie opposite one another, and wherein an inclined support region for supporting the cover is present on the first edge, and an undercut edge region is present on the second edge of the shower tray which lies opposite the first edge. The cover due to the inclination in the support region is pressed into the undercut region when loaded. Preferably, no undercut regions are present in the support region, and the cover can be lifted upwards without further ado. In contrast, in the undercut region, the cover cannot be lifted without previously pulling the cover in the horizontal direction towards the second edge, out of the undercut region.

In one embodiment, reinforcement profiles are arranged on the lower side of the shower tray. The shower tray can be designed thinner and lighter by way of this. The reinforcement profiles can be welded to the shower tray or bonded to this. The reinforcement profiles can have a U-profile and thus encompass or bridge one or more of the pipes. This necessitates the reinforcement profiles being attached on the shower tray after attaching the pipes.

Preferably, the flowing steps are carried out for manufacturing a shower tray:

- shaping an aluminium blank by way of a forming process, into the shape of the shower tray, in particular by way of hydroforming;
- optionally: forming, in particular bending, and welding individual sections of the blank;
- welding on or soldering on pipes which at least on their outer side consist of aluminium, onto the lower side of a tray base;
- coating surfaces or the complete outer surface and/or anodising the shower tray and the pipes (wherein the pipe ends are preferably covered on anodising, above all if the pipes of aluminium comprise a layer of copper on the inner side);
- optionally, attaching the reinforcement profiles;

The method in one embodiment can comprise the further steps:

- connecting the pipes onto manifolds or onto transition pipes into manifolds, of a metal which is different to the outer material of the pipes;
- in regions of connections between the pipes and the manifolds or transition pipes, manufacturing an electrical insulation layer on the outer side of these regions.

This insulation layer prevents a flow of charge carriers in the region between the outer layer of the pipes (for example aluminium) and the manifolds or transition pipes (for example of a copper alloy) and the formation of a galvanic element in the case that this region should become contaminated and/or moist. The transition pipes for example are of copper. The insulation layer for example is formed by a shrink hose or by a coating in the region of the connection between the manifolds or transition pipes and a section of the pipes or their outer (aluminium) layer.

The method for manufacturing a shower tray, in particular with the use of hydroforming can be carried out in a repeated manner, wherein shower trays with outer edge regions extended to a differently far extent are manufactured, wherein such outer edge regions connect to edge regions of a recess of the shower tray. These outer edge regions form a standing surface after the installation of the shower tray. Thus shower trays for showers with differently large standing surfaces can be manufactured with the same forming tool.

According to a **second aspect of the invention**, thus a **shower tray** with a heat exchanger is present, wherein the heat exchanger is arranged below the shower tray for a heat recovery from waste water for heating fresh water, wherein a first heat exchanger surface is in contact with the waste water and a second heat exchanger surface is in contact with the fresh water, and the first heat exchanger forms the tray base or a part of the tray base. Thereby, the shower tray is manufactured of a steel alloy, and a base pate, also called sheet plate or heat exchanger plate, of a different material is fastened in the region of the tray base below the shower tray, on the tray base, by which means a thermally conductive connection to the tray base is formed essentially over the compete surface of the base plate. Again, pipes are connected to this base plate by way of a material-fit connection, below this base plate, in particular by way of welding or soldering, wherein these pipes form the second heat exchanger surface.

Preferably, the heat exchanger plate is fastened on the lower side of the tray base by way of a fixed connection, preferably by way of a bonding or welding method, for example with a bonding film or by way of an epoxy resin. The welding method can be friction welding. The epoxy resin can have added aggregates for increasing its thermal conductivity.

In one embodiment, the shower tray comprises an enamel layer on the upper side, and is not enamelled on the lower side, wherein ribs for the mechanical stabilisation of the shape of the tray base are arranged on the lower side. These ribs for example are about 10 mm high and stabilise the tray base during the enamelling: they prevent a warping, which would bulge out the tray base to the top or to the bottom, whereupon the waste water would no longer run off over the tray base in a uniform manner.

In one embodiment, the enamel layer has added aggregates (additives) for improving its thermal conductivity, in particular added metal particles. These for example are rust-free of stainless steel (also called Inox), in particular CrNi steel. Although such steels seen per se are poor heat conductors, as aggregates on enamelling they surprisingly lead to an improvement of the thermal conductivity of the enamel.

Such an enamel layer can also be applied independently of the application of the heat exchanger, for example for coating cooking utensils. According to a **further aspect of the invention** therefore an enamel layer is created, which has a comparatively high thermal conductivity.

The shower tray according to the first aspect of the invention can be understood and realised completely independently of a shower tray according to the second aspect of the invention.

Individual elements of the first or second aspect however, where technically realisable, can be transferred to the respective other aspect, and produce the same effect there.

The method for **manufacturing a shower tray of a steel alloy** comprises the following steps

- shaping a steel blank by way of forming process, into the shape of the shower tray;
- optionally: forming, in particular bending, and welding individual sections of the blank;
- fastening, in particular welding on or soldering on ribs for stabilising the shape of the tray base;
- enamelling the shower tray;
- bonding a base plate with pipes attached thereto, onto the lower side of the tray base, or bonding the base plate onto the lower side of the tray base and subsequent attachment of the pipes on the base plate.

Preferably, the ribs are coated, in particular by way of painting, in a further step for the corrosion protection.

According to one embodiment of the invention, the following steps are carried out for enamelling the shower tray

- enamelling the shower tray with the ribs, and the formation of an enamel layer by way of this;
- removing the enamel layer on the lower side of the tray base; for example by sand blasting.

One avoids the lower side being coated at a high temperature with a thick scale layer, by way of the lower side (with the ribs) also being enamelled.

According to an alternative embodiment of the invention, the following steps are carried out for enamelling the shower tray:

- enamelling only the upper side of the shower tray (thus the surface lying opposite the ribs), and further regions of the shower tray, but not the surface onto which the base plate is to be bonded;
- possibly machining the lower side of the tray base for removing the scaled layer; for example by way of sand blasting.

According to a further aspect of the invention, a **semifinished product for manufacturing the shower tray** is created. This comprises a plane base plate with pipes welded thereon.

In one embodiment, the base plate comprises cut-outs for leading through ribs of the shower tray.

With both aspects of the invention, thus with the shower tray as well as with the semifinished product, the heat exchanger for example has a width of between 50 cm and 150 cm and a length between 50 cm and 150 cm. The width and length according to one embodiment are at least approximately equal to 75 cm.

The term "shower tray" in this application is understood to comprise the term "bath tub". In a further embodiment, the shower tray is thus a bath tub. In this case, the heat exchanger for example has a width of between 20 cm and 70 cm and a length between 80 cm and 200 cm.

A pipe distance between the pipes of the heat exchanger which run in parallel is 1 cm to 5 cm or 2 cm to 5 cm, in particular at least approximately 2.4 cm (measured from pipe middle to pipe middle), in the embodiments of both aspects of the invention. In contrast to pipes of heat exchanger in solar collectors, where greater temperature gradients are present, the pipe distance in particular is smaller than 7 cm. Moreover, likewise in contrast to pipes of heat exchangers in solar collectors, for example the distances between welding spots are also about 2 mm (from middle to middle of the welding spots), wherein for example the welding spots themselves have a diameter of less than 2 mm, and the pipe diameters are smaller, i.e. with inner diameters of between 4 mm and 10 mm, in particular 4.75 mm.

In the embodiments of both aspects of the invention, manifolds, to which the pipes are connected, are arranged outside the run-off surface. In this manner it is possible for an as large as possible surface of the run-off surface to act as a heat exchanger.

In embodiments of both aspects of the invention, the gradient of the tray base for example is between 3% and 4.5%, in particular 3.5%. This applies to the tray base in the assembled condition. This therefore also applies to the angle between the upper edges of the tray and the tray base, amid the assumption that the edges of the tray are to be assembled horizontally. A particularly good heat transfer results with this gradient, unexpectedly better than with a smaller angle, such as 2% for example.

Further preferred embodiments are to be deduced from the dependent patent claims. Thereby, features of the method claims according to context can are combinable with the device claims and vice versa.

The subject-matter of the invention is explained in more detail hereinafter by way of preferred embodiment examples which are represented in the accompanying drawings. In each case schematically are shown in:

Figure 1	a shower tray in a first embodiment;
Figure 2	a shower tray in a second embodiment;
Figure 3	a cross section of the construction of a heat exchanger with a shower tray of aluminium
Figures 4 and 5	cross sections of the construction of a heat exchanger with a shower tray of steel;
Figure 6	a shower tray with a projection for the arrangement of a run-off;
Figure 7	a base plate with heat exchanger pipes;
Figures 8 and 9	a shower tray in a third embodiment;
Figure 10	variants of edge regions to a shower tray; and
Figure 11	a shower tray with an undercut edge region.

The reference numerals applied in the drawings and their significance are listed conclusively in the list of reference numerals. Basically, the same parts are provided with the same reference numerals in the figures.

Figure 1 shows a shower tray 10 in a **first** embodiment in an exploded drawing. The shower tray 10 is designed as a heat exchanger 1, by way of a tray base 12, over which waste water flows during showering, being connected in a thermally conductive manner to pipes 14, through which fresh water is led. The pipes 14 for this extend over an as large as possible part of the tray base 12. The fresh water is fed to the pipes 14 through a feed conduit 22 and a first manifold 21, and there is distributed to onto several (two, three, four, five, six or more) parallel pipes 14, flows in the counter direction to the waste water or in the same direction through meandering pipes 14 to a second manifold 21. Thereby, the pipes 14 are led to one another in an essentially equidistant manner, by which means a balanced heat transfer over the surface takes place. In the shown embodiment, the pipes 14 are distanced to one another in the region, in which they run transversely to the gradient of the tray base 12, as well as in the region, in which they run parallel to the gradient. The distance of the pipes 14 is between 20 mm and 30 mm, for example 24 mm (measured from middle to middle). The sections of the individual pipes 14 between the manifolds 21 are all equally long, so that their flow resistance and thus also their flow is essentially the same. Transition pipes 20 can be arranged at the transition between pipes 14 and manifolds 21 for reasons of manufacturing technology. On operation of the shower, the waste water flow over a slightly inclined cover 4 to one side of the shower tray 10 to a run-in region 33, and from this in turn, in a manner distributed over the width of the tray base 12, over the tray base 12 to a run-off region 34 and from there to a run-off 35. An edge region 32, which is preferably led around the shower tray 10, is designed obliquely with an angle of between about 40° to 70°. Height-adjustable feet 132 can be present for setting the level of the shower tray 10 on installation. The cover 4 is designed with a corresponding inclination at its cover edge 342. The edge region 32 on account of this forms a seat which is trapezoidal in cross section, for a cover 4, and centres this cover in the shower tray 10.

Figure 2 shows a shower tray in a **second** embodiment in an exploded drawing. With regard to the function, the same elements are present in a somewhat different design than with Figure 1. Additionally present: the tray base 12 comprises webs or ribs 31 for reinforcement. A sheet-metal plate, hereinafter called base plate, 13 is arranged between the tray base 12 and the pipes 14. This base plate 13 comprises cut-outs 23 which correspond to the position of the ribs 31, i.e. are cut-out in each case in the region of a rib 31, so that the base plate 13 can be fastened flatly onto the lower side of the tray base 12. Bent-down or integrally formed side walls 37 can be present at the edge of the shower tray 10.

Figure 3 shows a cross section of the construction of a heat exchanger with a shower tray 10 of aluminium, as a rule an **aluminium** alloy. The shower tray is preferably manufactured as one piece by way of a forming process, in particular inner high pressure forming (hydroforming), and/or by way of cutting, bending and welding, and thus the tray base 12 is also of this material. Warm waste water 145 flows over the tray base 12 in operation. Beneath the tray base 12, pipes 14 with fresh water 144, for example in an arrangement according to **Figure 1** or **2**, are welded in particular by way of laser welding, or soldered, directly against the lower side of the tray base 12. Contact regions of soldering locations or welding spots 143 thereby have a diameter **d** of preferably less than 2 mm. The distance between welding spots 143 for example is at least approximately 1 mm (along the direction of the pipe). In one embodiment, the distance of the welding spots lies in the region between 1.5 mm and 2.5 mm, in particular at 2 mm (in each case measured from the middle of a welding spot up to the middle of the next welding spot). An improved heat transfer results with this. A greater distance worsens the efficiency of the heat exchanger and smaller distance does not improve it significantly. The diameter of a welding spot is thereby preferably smaller than 2 mm, in particular approx. 1 mm

In one embodiment, the pipes 14 are manufactured of aluminium or of an aluminium alloy. Preferably they are moreover coated on the inner side, for example with polyethylene (PE). In another embodiment, the pipes 14 are composite pipes (bimetal pipes, composite pipes, dual pipes) with an outer wall or an outer layer 141 of aluminium or of an aluminium alloy and with an inner wall or inner layer 142 of copper or a copper alloy, for example of copper deoxidised by phosphorous (Cu-DHP). Exemplarily applied composite pipes have a wall thickness of approx. 0.55 mm aluminium (alloy) and 0.25 mm copper (alloy) with an outer diameter of approx. 6.5 mm (1/4" inch; 6.35mm). The inner diameter is thereby approx. 4.75mm.

The shower tray 10 and thus also the tray base 12 and the pipes 14 are preferably anodised (eloxised), in particular hard-anodised, and by way of this are wear-resistant and at the same time thermally conductive. The edge of the tray which is visible next to the cover 14, additionally to the anodising, can be coated or painted in a different colour. Alternatively to anodising, the tray base 12 can be painted at least on the waste water side, thus the upper side, preferably with a hydrophilic paint.

On anodising the composite pipes 14, these are closed at the ends when manufacturing the shower tray 10, so that the inner layer of copper is not dissolved in the anodising bath.

Figure 10 schematically shows shower trays 10 with different variants of outer edge regions 36. Such variants are manufacturable in the same shape by way of forming, in particular hydroforming. The shape of the recess of the tray with the tray base 12 and the heat exchanger 1 is the same with this variant, and an outer edge region 16 connecting to the recess is designed in a manner extending differently far in one or more directions. Given an assembled shower tray 10, these outer edge regions 36 are essentially horizontal and form a stepping surface. Variants can be manufactured in this manner for example, with which the base area is 90 cm times 90 cm (standard size), or 90 cm times 120 cm, or 90cm times 140cm. What are not shown are optional lateral additional regions which are bent downwards, in order to form side walls 37 such as in the embodiment of **Figures 8** and **9** for example.

In an alternative embodiment, the shower tray 10 is rust-free of stainless steel, in particular CrNi steel, and the pipes 14 of copper or a copper alloy are welded on. Such an arrangement however has a reduced efficiency as a heat exchanger.

Figure 4 shows a cross section of the construction of a heat exchanger with a shower tray 10 of **steel**, as a rule from enamelled steel. The shower tray 10 is preferably manufactured as one piece by a forming process and/or by cutting, bending and welding, and thus the tray base 12 is also of this material. Warm waste water 145 flows over the tray base 12 in operation. Pipes 14 with fresh water 144, for example in an arrangement according to **Figure 1** or **2**, are welded, in particular by laser welding, or soldered, against the lower side of a base plate 13, below the tray base 12. Contact regions of solder locations or welding spots 143 thereby have a diameter **d** of preferably less than 2 mm. Standards for potable water can be adhered to by way of this. The base plate 13 in turn is bonded against the tray base 12 by way of an adhesive layer 15. A cover layer, typically paint or enamel layer 16 is deposited on the upper, i.e. water-water-side of the tray base 12.

The material of the base plate 13 and pipes 14 is preferably essentially the same or of the same type, thus for example in each case aluminium (alloy) or in each case copper (alloy). They can be more easily connected to one another by way of this, in particular by way of welding or soldering. In the case that the material is aluminium or an aluminium alloy, the pipes 14 for example are composite pipes, as described above, thus are of aluminium or an aluminium alloy at least at the outer side of the pipes.

The adhesive or bonding layer 15 on the one hand effects a compensation of different expansion of the tray base 12 and base plate 13 on heating, and on the other hand the heat transfer from the tray base 12 to the pipes 14. The bonding layer 15 according to one variant is formed by a bonding film, i.e. by a bonding material which is provided as a thin layer or foil, for example of a thermoplastic material. It can have added aggregates or be strewn with aggregates (on one or both sides), for improving its thermal conductivity, in order to improve the thermal conductivity of the bonding foil. Such aggregates for example are powder of a metal (aluminium, copper, etc...) or of a carbide or boride (SiC, TiC, TiB_2).

According to another variant, the adhesive layer 15 is an epoxy resin which can likewise have added one of the mentioned materials as an aggregate for improving the thermal conductivity. **Figure 5** accordingly shows a variant of Figure 4 with metal particles 151 in the bonding layer 15.

In the case that the cover layer is an enamel layer 16, then according to one embodiment, the parent substance for the enamel layer 16 is provided with a material for improving the thermal conductivity before the enamelling.

According to one embodiment of the invention, this material is a rust-free stainless steel (Inox), in particular a CrNi steel.

Exemplary embodiments for thermally conductive enamel layers are:

- Example 1: mixture of commercially available ground enamel slip and 50% by weight of stainless steel powder Cold 100. Result after burning-in (baking) at 850°C on a shower tray: the layer thickness was 150 μm and the surface was melted smoothly. The adhesion according to EN 10209 Annex D was at 1. Cold 100 is a material with 19.1% Ni, 20% Cr and 6.3% Mo.

- Example 2: mixture of commercially available, acid-resistant direct enamel and 30% by weigh of stainless steel powder 304 LHD. Result after baking at 830°C on a shower tray: the layer thickness was 100 μm and the surface was smoothly melted. The adhesion according to EN 10209 Annex D was 1. 304 LHD is a material with 11.8% Ni and 19% Cr.
- Example 3: mixture of commercially available titanium white [vitreous] enamel and 20% by weight of 316 LHD. The result after baking at 820 °C on a shower tray: the layer thickness of the titanium white enamel was 150 μm. The surface was melted smoothly and slightly coloured by way of the stainless steel particles. 316 LHD is a material with 12.7% Ni, 17% Cr and 2.2% Mo.
- Example 4: mixture of commercially available ground enamel and 70% by weight of stainless steel powder 434 LHC. The result after baking at 850° on a shower tray: the adhesion according to EN 10209 Annex D was 2. The surface was uniformly smooth. 434 LHC is a material with 16.8% Cr and 1.0% Mo.

With the manufacture of the enamel layer, at least of a ground enamel layer, the shower tray 10 must be enamelled as a whole. Ribs 31 can be welded or soldered on below the tray base 12, in order to prevent a deformation of the shower tray 12 at the high temperatures (850°C) on enamelling. The lower side of the tray base 12 is sand blasted, or the enamel layer removed in another manner before bonding on the base plate 13 with the pipes 14. The ribs 31 finally receive a new corrosion protection in place of the removed enamel layer.

Figure 6 shows one embodiment, in which the run-off 35 is arranged next to the run-off surface 17 acting as a heat exchanger. The run-off surface 17 in particular forms a rectangle (or a circle or an oval), and the run-off is not arranged within this rectangular shape (or a circle or oval). Thus the complete run-off surface 17 is available as a heat exchanger surface. Moreover, a more regular leading of the for example meandering pipes over the run-off surface is possible, since there is no interruption of the rectangular (or circular or oval-shaped) surface due to the run-off. The heat transfer is improved by way of this.

Figure 7 accordingly shows a base plate 13 with an essentially rectangular contour, wherein the pipes 14 are arranged essentially outside this contour for the connection of manifolds 21 (dashed).

The run-off 35 in particular can be arranged at a projection 18 of the shower tray 10, so that the base mass of the shower tray 10 is not affected. On installation of the shower tray, for example a suitable opening in the wall 19, for example a lightweight construction wall, behind which conduits are led, is merely to be provided in the region of the projection 18. The run-off region 34 is a channel or recess, which leads the waste water to the run-off 35. A projection 18 and the further features described here with regard to the Figures 6 and 7 can be combined with other features of the embodiment according to Figure 1 as well as Figure 2.

Figures 8 and **9** show a shower tray in a third embodiment in a plan view and a lower view. The individual elements, inasmuch as not described otherwise, are designed as with the embodiment of **Figure 1**, in particular with a tray of aluminium or an aluminium alloy. A contrast with regard to **Figure 1** is the fact that the shower tray has no pronounced run-off channel towards the run-off, but a transverse gradient or drop, for example in the shape of a triangle. The tray base can have a gradient of 3.5% in the main flow direction. A further contrast to the embodiment of **Figure 1** is that here additional reinforcement profiles 131 are present, which are fixedly connected to the lower side of the tray base 12, in particular by way of bonding, soldering or welding. In the shown embodiment, the reinforcement profiles 131 for reasons of manufacturing technology are bonded onto the lower side of the tray base 12, for example with an epoxy adhesive. The reinforcement profiles 131 comprise a U-profile with additional flanges which form the connection to the tray base. The reinforcement profiles 131 each at the two ends of the two arms of the U-profile (seen in cross section) are connected to the lower side of the tray base. The reinforcement profiles 131 extend parallel to sections of the pipes 14 and thereby encompass one or more of the pipes 14. The pipes 14 thus lead through the U-profile of the reinforcement profiles 131. The reinforcement profiles 131 stiffen the tray base and this permit these to be designed of thinner material. Moreover, the reinforcement profiles 131 serve as a protection of the pipes 14 from damage on the building side, for example on putting down the heat exchanger onto an uneven surface. Connections 24 for the feed and discharge of water to/from the heat exchanger are for example arranged next to one another on the same side wall 37.

Figure 11 shows a shower tray 10 with an undercut edge region 38. This lies opposite a bevelled support region 39. These two regions form a seat for the cover 4. The edge is recessed in an undercut manner in the undercut region 38 at a side of the shower tray 10, seen in a in a cross sectional plane running perpendicularly to the edge. It forms an indentation by way of this, in which the edge of the cover 4 lies. The result of this is that the cover 4 at this location cannot be moved perpendicularly upwards, but for this must be firstly pulled out of the indentation a little, in the direction of the opposite side of the tray. This in turn, with a loading of the cover 4 on the opposite side, prevents the cover from slipping down in the support region, being tilted as a whole and lifted at the side with the indentation. The support region with respect to the normal (in the assembled condition of the tray, wherein the upper edge of the tray runs horizontally) has an inclination between 30° and 80°, in particular 45° and 70° and especially of 60°. The cover 4 thus lies on the support region 39 and can be lifted there without further ado. The cover 4 on loading is pressed into the indentation due to the inclination of the support region 39. The design of the edge regions according to **Figure 11** can be combined with all described variants of shower tray, in particular with this of **Figures 1, 2** and **8** or **9**.

PATENT CLAIMS

1. A **shower tray** (10) with a heat exchanger (1), wherein the heat exchanger (1) is arranged below the shower tray (10) for a heat recovery from waste water for heating fresh water, wherein a first heat exchanger surface (17) is in contact with the waste water and a second heat exchanger surface is in contact with the fresh water, and the first heat exchanger surface (17) forms the base or a part of the base of the shower tray (10), **characterised in that** the shower tray is manufactured of aluminium or an aluminium alloy.

2. A shower tray (10) according to claim 1, wherein the second heat exchanger surface is formed by pipes (14) or by one or more plates, which are connected by way of a material-fit connection, in particular welding or soldering, to the base of the shower tray (10).

3. A shower tray (10) according to claim 2, wherein the pipes (14) are composite pipes with an outer layer of aluminium or an aluminium alloy and with an inner layer of copper or a copper alloy.

4. A shower tray (10) according to claim 3, wherein the shower tray (10) and the outer side of the pipes (14) are anodised.

5. A shower tray (10) according to claim 4, wherein an edge region of the shower tray (10) comprises a further or a reinforced coating, in particular a layer produced by powder coating with aluminium oxide, or a paint layer.

6. A shower tray (10) according to one of the claims 2 to 5, wherein the pipes (14) are welded to the base of the shower tray (10) by way of welding spots produced by way of laser welding.

7. A shower tray (10) according to claim 6, wherein the welding spots in each case have a contact region between the pipe and the base, with a diameter of less than 2 mm and/or a distance between the middle points of the welding spots in the region between 1.5 mm and 2.5 mm, in particular at 2 mm.

8. A shower tray (10) according to one of the preceding claims, wherein the shower tray (10) is shaped by a forming process, in particular by way of deep-drawing or by way of hydroforming or by way of superplastic deformation.

9. A shower tray (10) according to one of the preceding claims, with a cover (4), wherein the shower tray (10) comprises: a first edge and a second edge of the shower tray, wherein the first and the second edge lie opposite one another, and wherein an inclined support region (39) for supporting the cover (4) is present at the first edge, and an undercut edge region (38) is present at the second edge of the shower tray which lies opposite the first edge.

10. A shower tray (10) according to one of the preceding claims, comprising reinforcement profiles (131) which are arranged on the lower side of the base of the shower tray, and in particular comprise a U-profile, whose arms are fixedly connected to the lower side of the base of the shower tray (10) and through which profile one or more of the pipes (14) lead.

11. **A method for manufacturing a shower tray** (10), comprising the steps of

- shaping an aluminium blank by way of a forming process, in particular hydroforming, into the shape of the shower tray (10);
- welding or soldering pipes (14) which at least at their outer side consist of aluminium or an aluminium alloy, onto the lower side of the tray base of the shower tray (10);
- anodising the shower tray (10) and the pipes (14).

12. A method for manufacturing a shower tray according to claim 11, comprising the further steps:

- connecting the pipes (14) to manifolds (21), or to transition pipes (20) into manifolds (21),
- in regions of connections between the pipes (14) and the manifolds (21) or transition pipes (20), manufacturing an electrical insulation layer on the outer side of these regions.

13. A method for manufacturing a shower tray (10) according to claim 11 or 12, wherein the method is carried out repeatedly and thereby shower trays (10) with differently far extended, outer edge regions (36) are manufactured, wherein such outer edge regions (36) connect to edge regions (32) of a recess of the shower tray (10).

14. A **shower tray** (10) with a heat exchanger (1), wherein the heat exchanger (1) is arranged below the shower tray (10) for a heat recovery from waste water for heating fresh water, wherein a first heat exchanger surface (17) is in contact with the waste water, and a second heat exchanger surface is in contact with the fresh water, and the first heat exchanger surface (17) forms the tray base (12) or a part of the tray base (12), **characterised in that** the shower tray is manufactured of a steel alloy, and a base plate (13) of a different metal is fastened in the region of the tray base (12) below the shower tray (10), to the tray base (12), and a thermally conductive connection to the tray base (12) is formed by way of this essentially over the complete surface of the base plate (13), and in

turn pipes (14), below this base plate (13), are connected to the base plate (13) by way of a material-fit connection, in particular by way of welding or soldering, and these pipes (14) form the second heat exchanger surface.

15. A shower tray (10) according to claim 14, in which the base plate (13) is fastened by way of a fixed connection, in particular by way of welding or by way of bonding with a adhesive layer (15), on the lower side of the tray base (12).

16. A shower tray (10) according to claim 15, wherein the adhesive layer (15) is an adhesive film.

17. A shower tray (10) according to claim 16, wherein the adhesive film has added aggregates or is strewn with aggregates, for improving its thermal conductivity.

18. A shower tray (10) according to claim 15, wherein the adhesive film (15) is an epoxy resin which preferably has added aggregates for improving its thermal conductivity.

19. A shower tray (10) according to one of the claims 14 to 18, in which the metal of the base plate (13) and the metal of the pipes (14) is copper or a copper alloy.

20. A shower tray (10) according to one of the claims 14 to 19, in which the metal of the base plate (13) and the metal of the pipes (14) at least on the outer side of the pipes (14) is aluminium or an aluminium alloy.

21. A shower tray (10) according to claim 20, in which the pipes (14) are composite pipes with an outer layer of aluminium or an aluminium alloy and with an inner layer of copper or a copper alloy.

22. A shower tray (10) according to one of the claims 14 to 21, wherein the shower tray (10) on the upper side is provided with an enamel layer (16), is not enamelled on the lower side, and comprises ribs on the lower side for the mechanical stabilisation of the shape of the tray base (12).

23. A shower tray (10) according to claim 22, in which the enamel layer (16) has added aggregates, in particular added metal particles, for improving its thermal conductivity.

24. A shower tray (10) according to claim 23, wherein the metal particles are of stainless steel and are rust-free, in particular of CrNi steel.

25. **A method for manufacturing a shower tray** (10), comprising the steps

- shaping a steel blank by way of a forming process, into the shape of the shower tray (10);
- fastening, in particular welding or soldering on ribs (31), for the stabilisation of the shape of a tray base (12) of the shower tray (10),
- enamelling the shower tray (10);
- bonding a base plate (13) with pipes (14) attached thereon, onto the lower side of the tray base (12), or bonding the base plate (13) onto the lower side of the tray base (12) and subsequently attaching the pipes (14) to the base plate (13).

26. **A method for manufacturing a shower tray** (10) according to claim 25, comprising the following steps for enamelling the shower tray:

- enamelling the shower tray (10) with the ribs (31), and, by way of this, forming an enamel layer (16) on the lower side of the tray base (12);
- removing the enamel layer on the lower side of the tray base (12)

27. A **semifinished product for manufacturing a shower tray** (10) according to one of the claims 11 to 21, comprising a plane base plate (13) with pipes (14) which are welded thereon, wherein the base plate (13) essentially has a rectangular contour, and the pipes are arranged outside this contour for connection of manifolds (21).

28. A semi-finished product according to claim 27, wherein the base plate (13) comprises cut-outs (23) for receiving ribs (31) of the shower tray (10).

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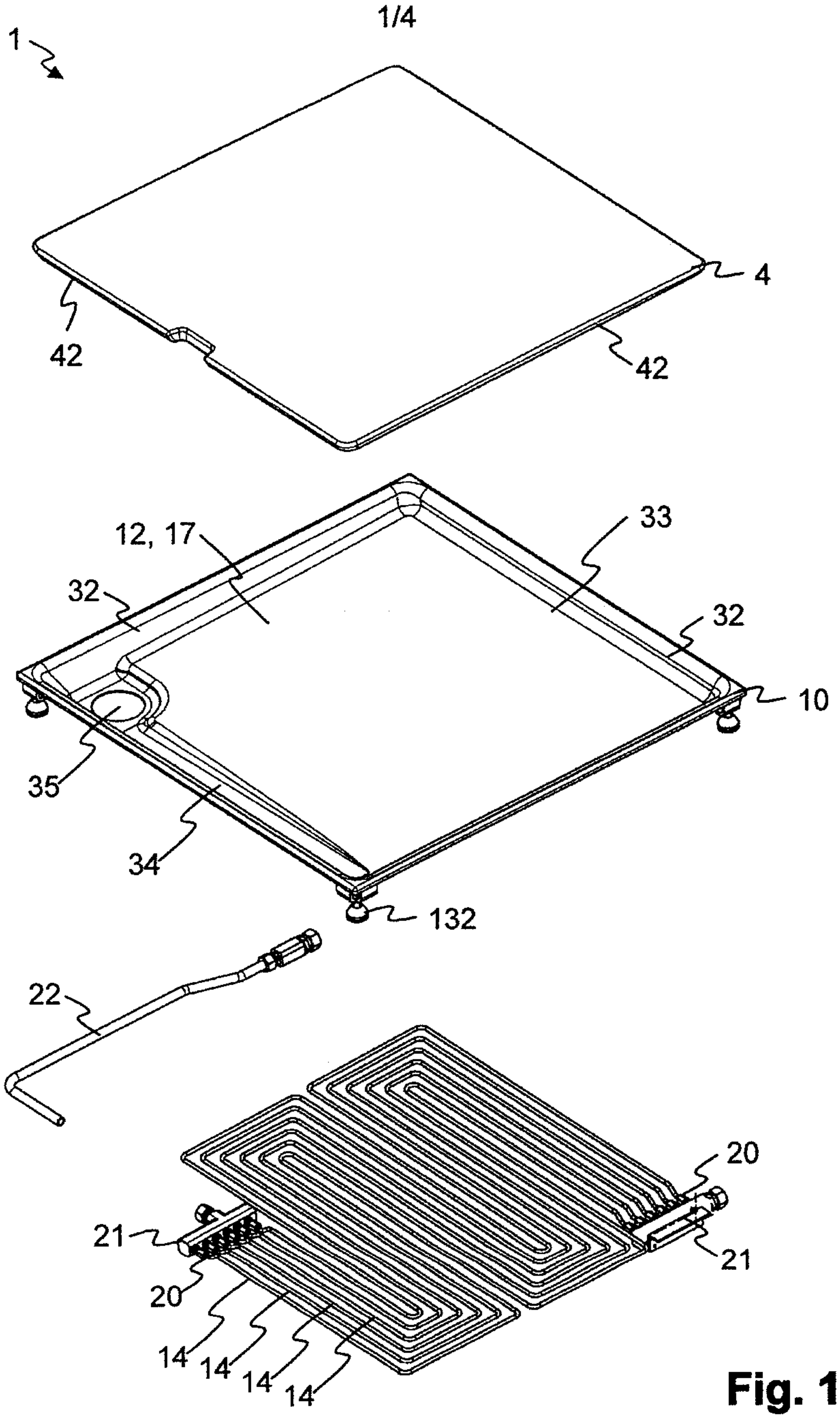

Fig. 1

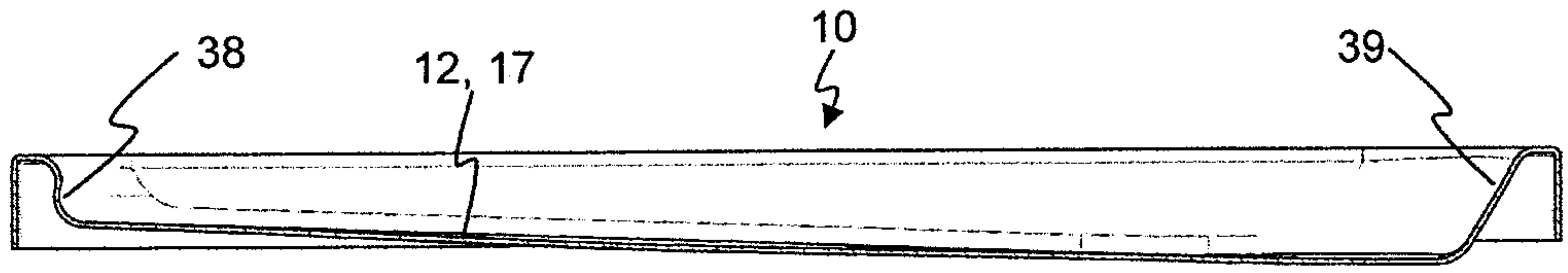

Fig. 11

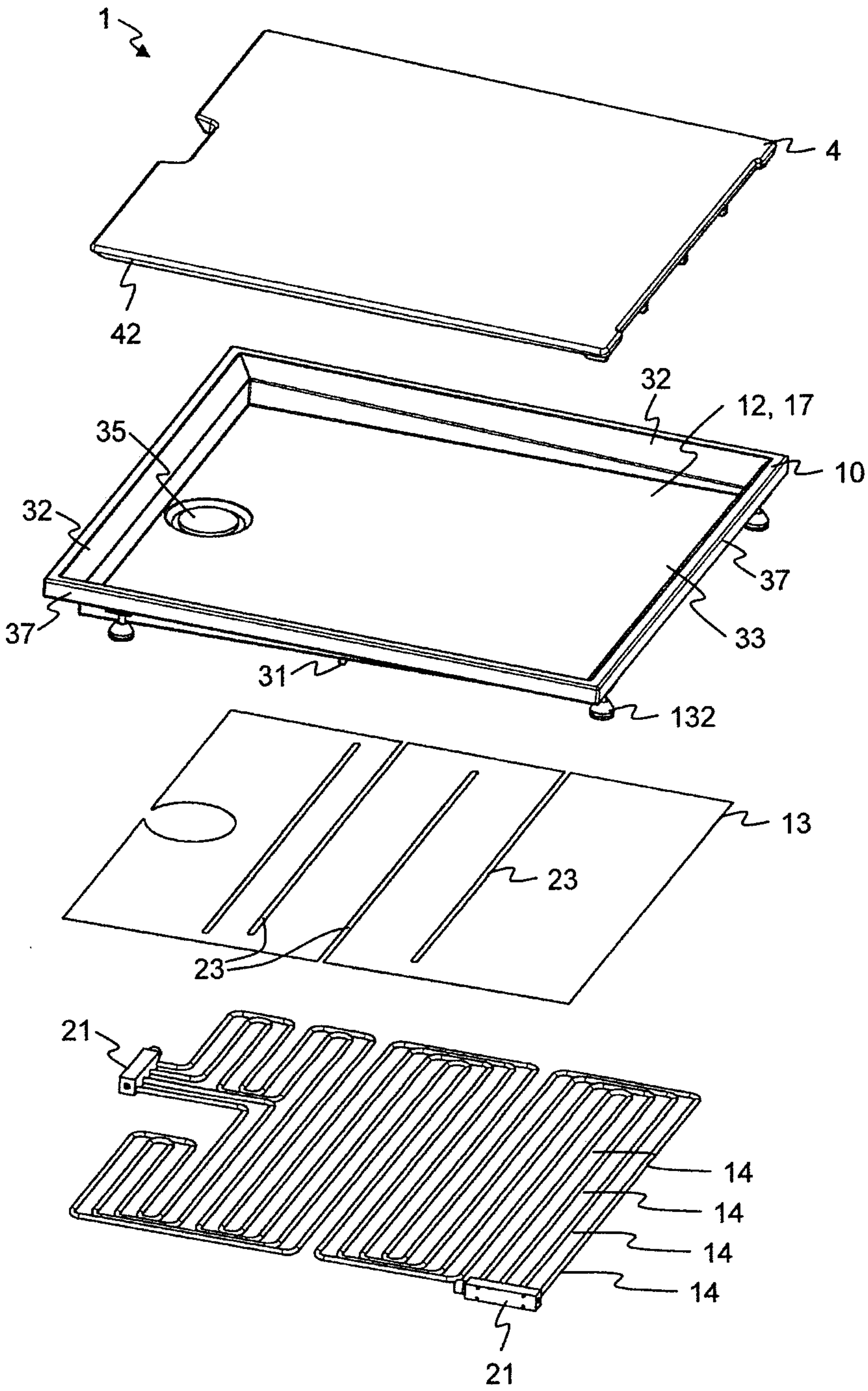

Fig. 2

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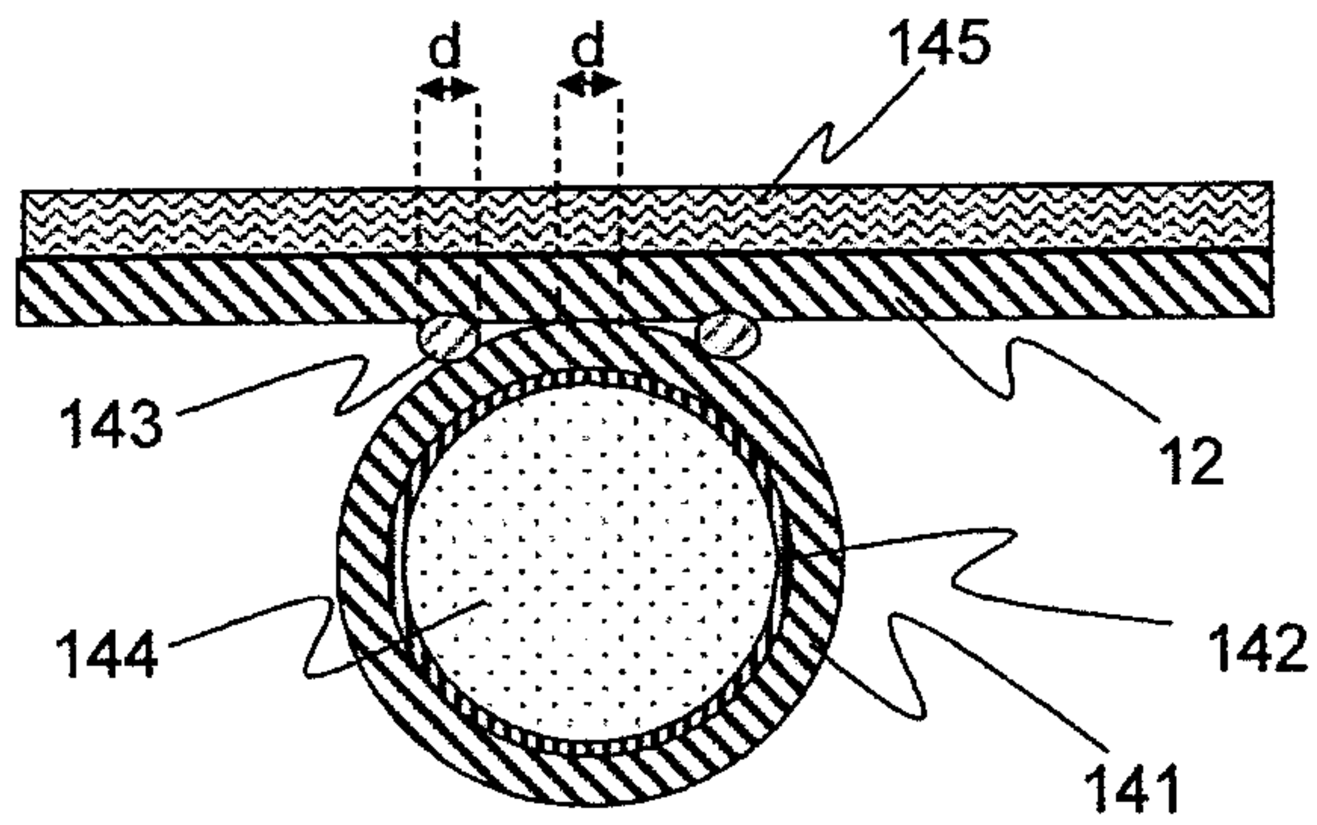

Fig. 3

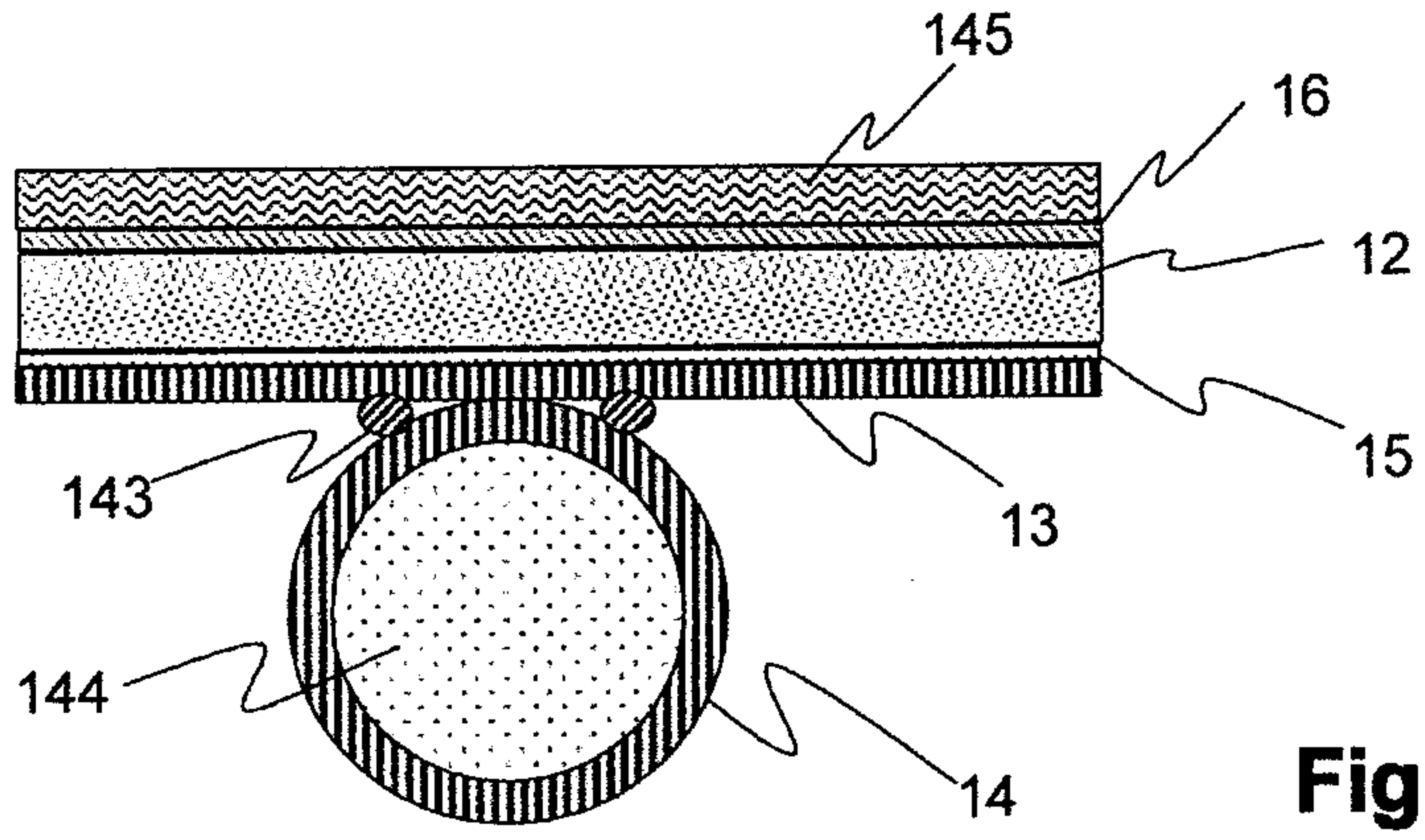

Fig. 4

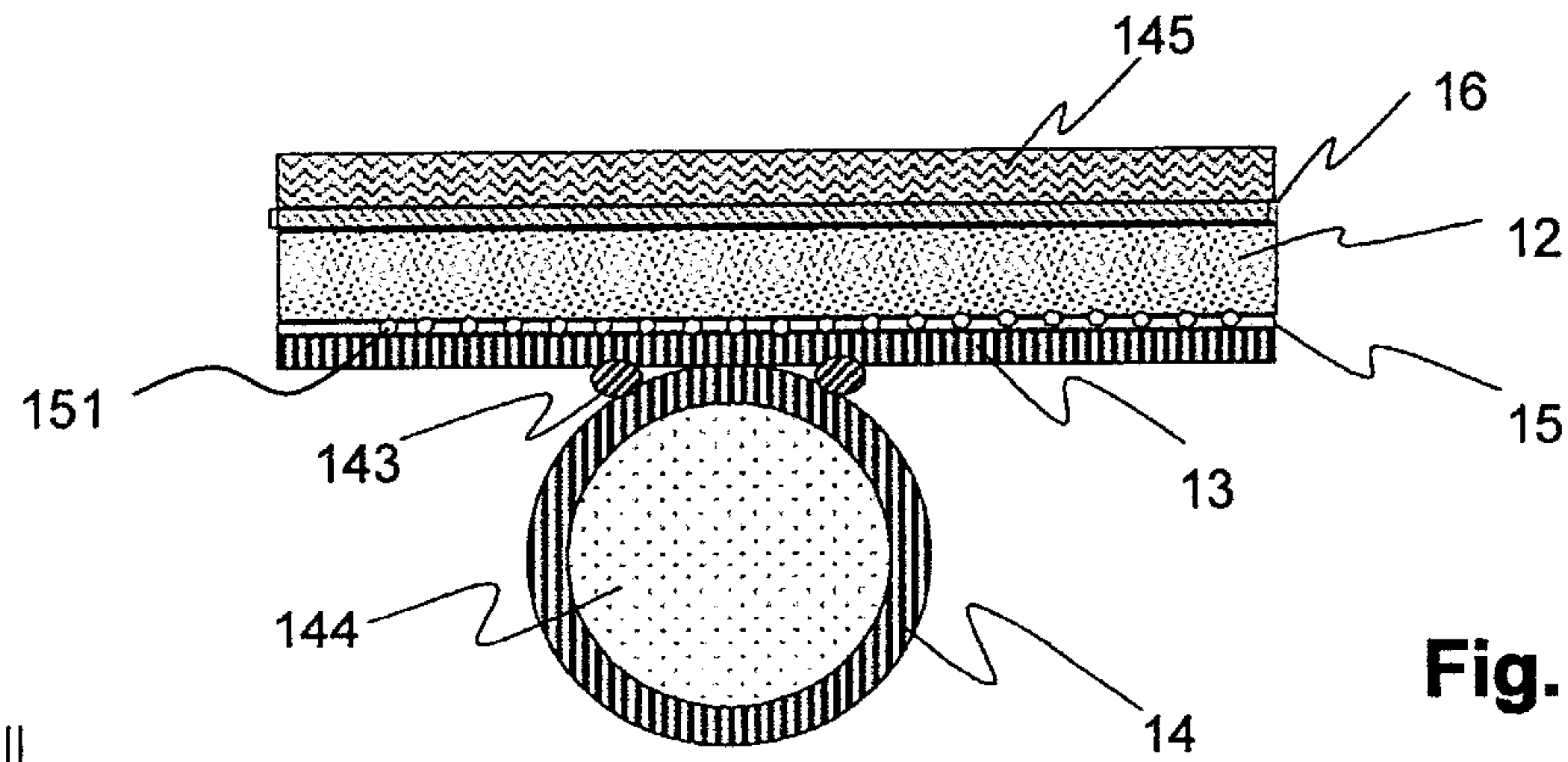

Fig. 5

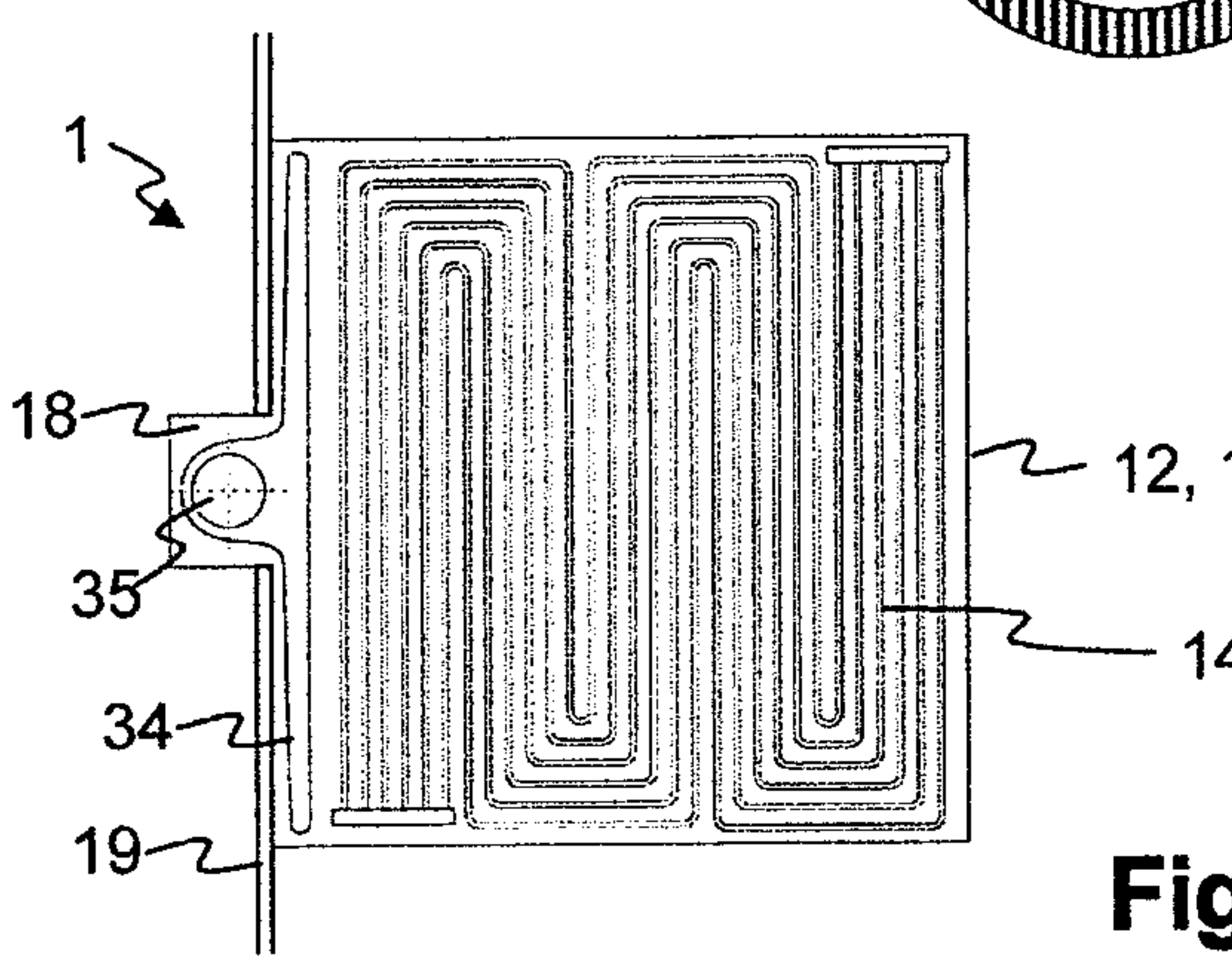

Fig. 6

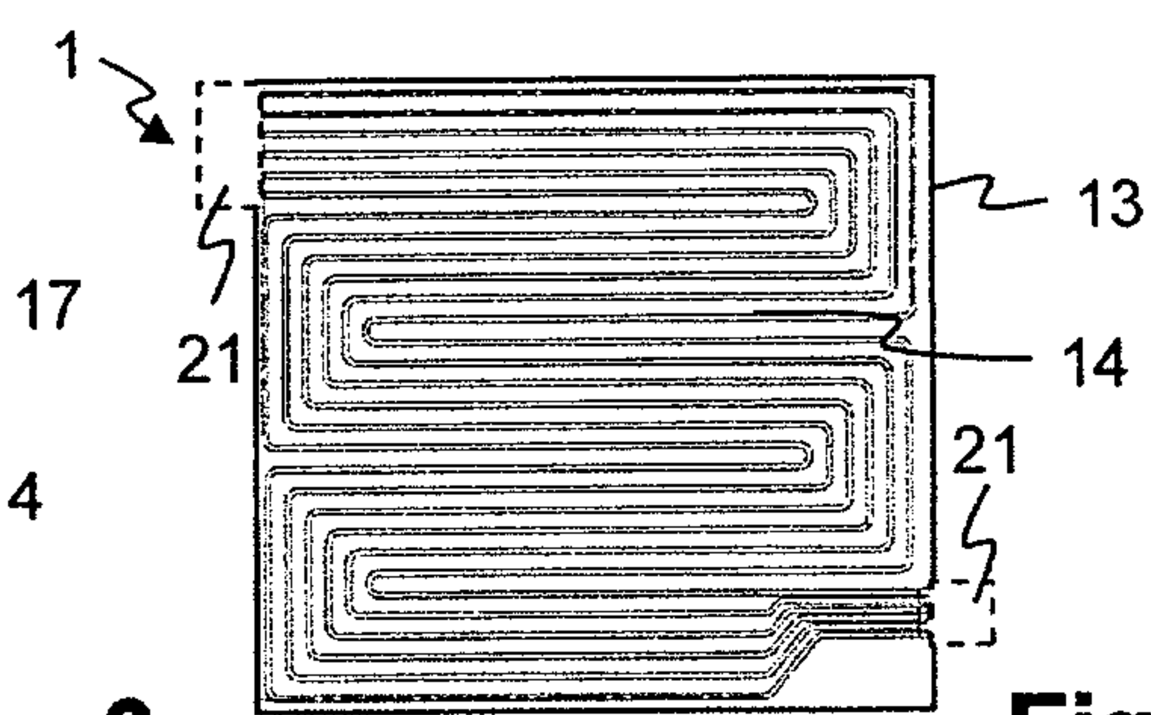

Fig. 7

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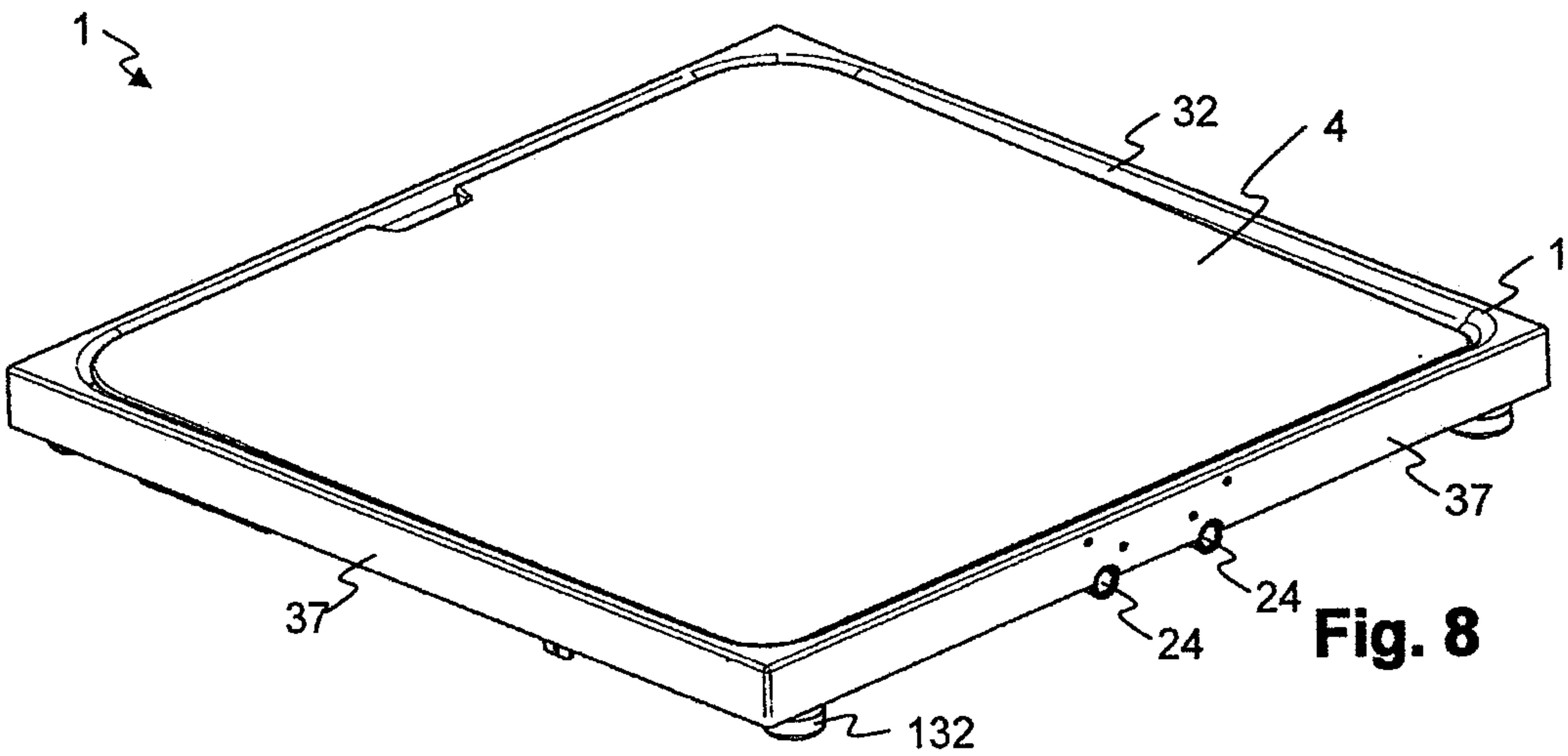

Fig. 8

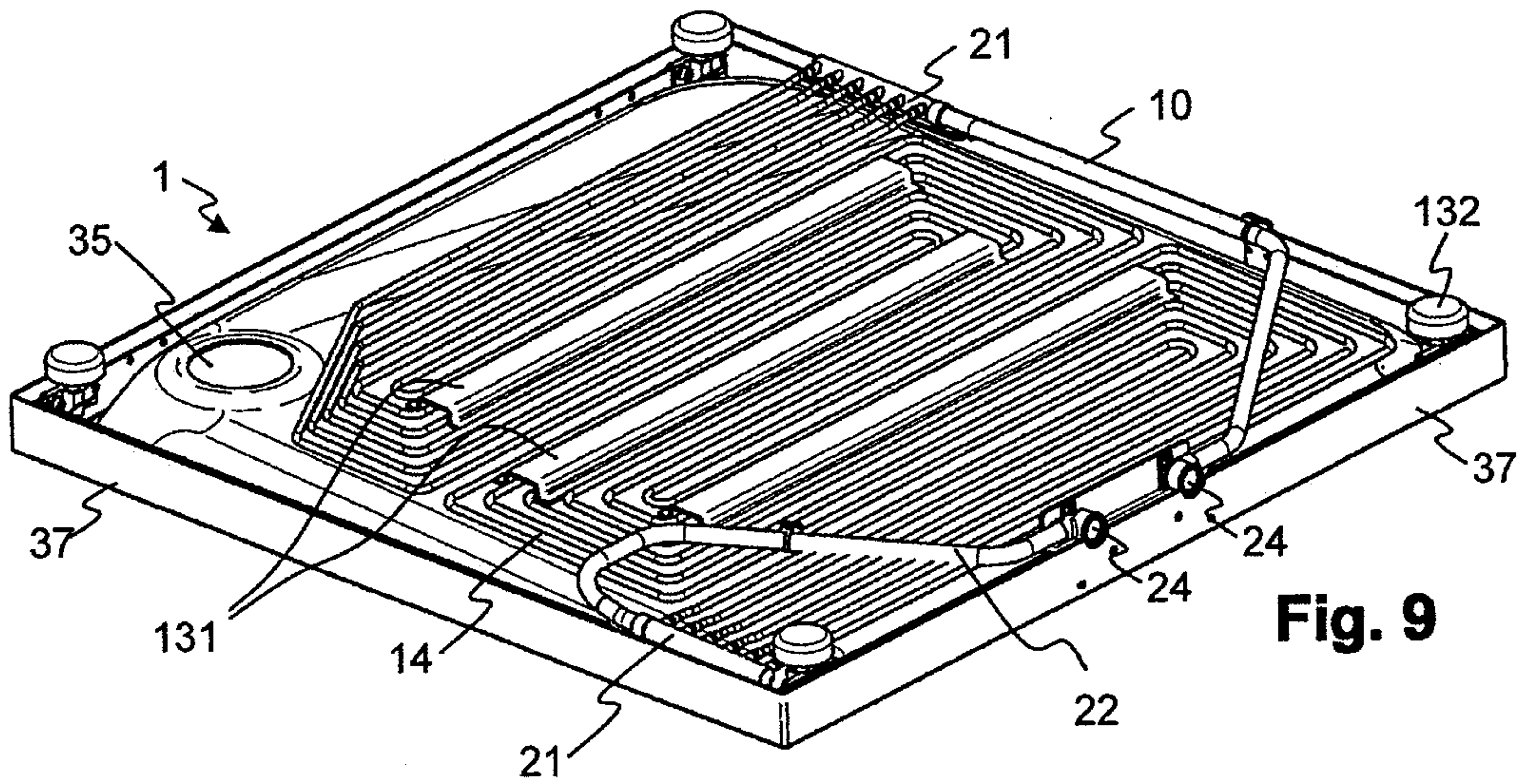

Fig. 9

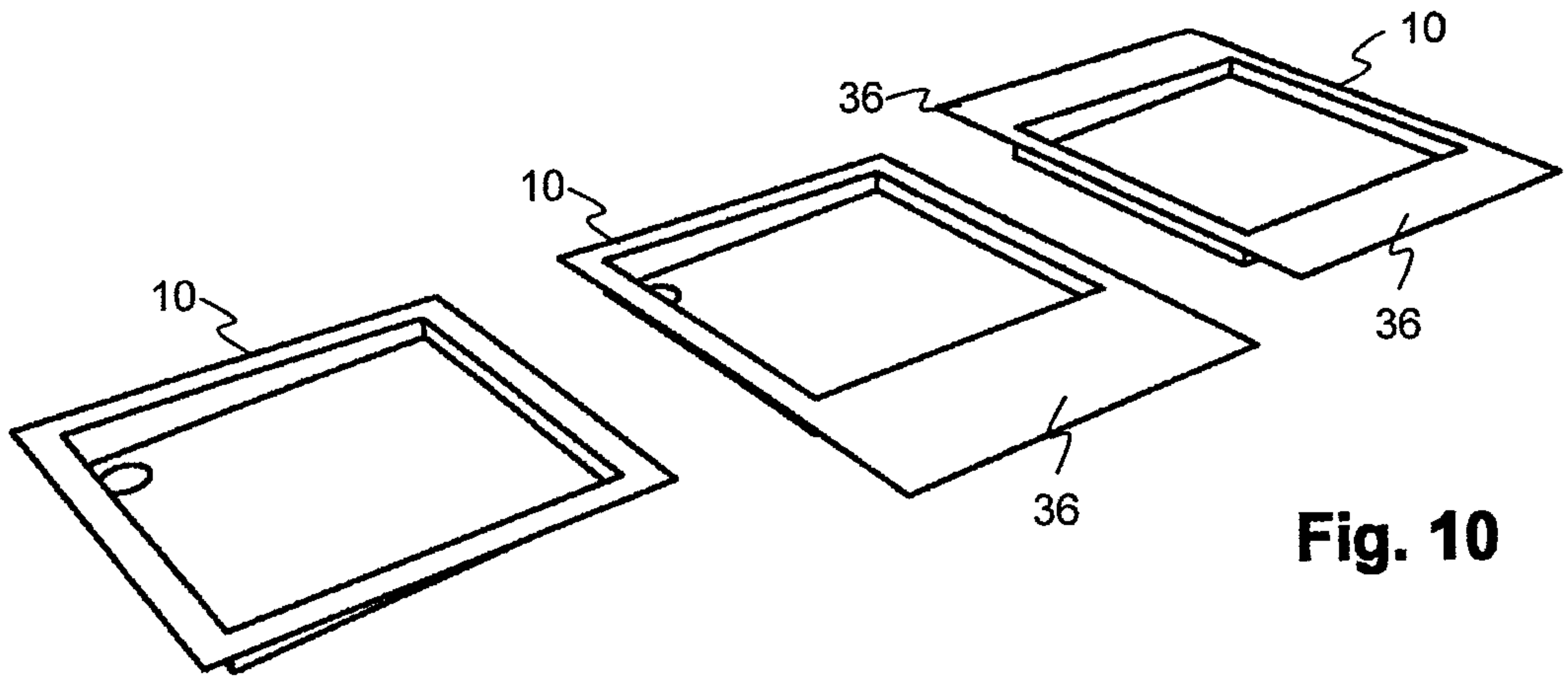

Fig. 10

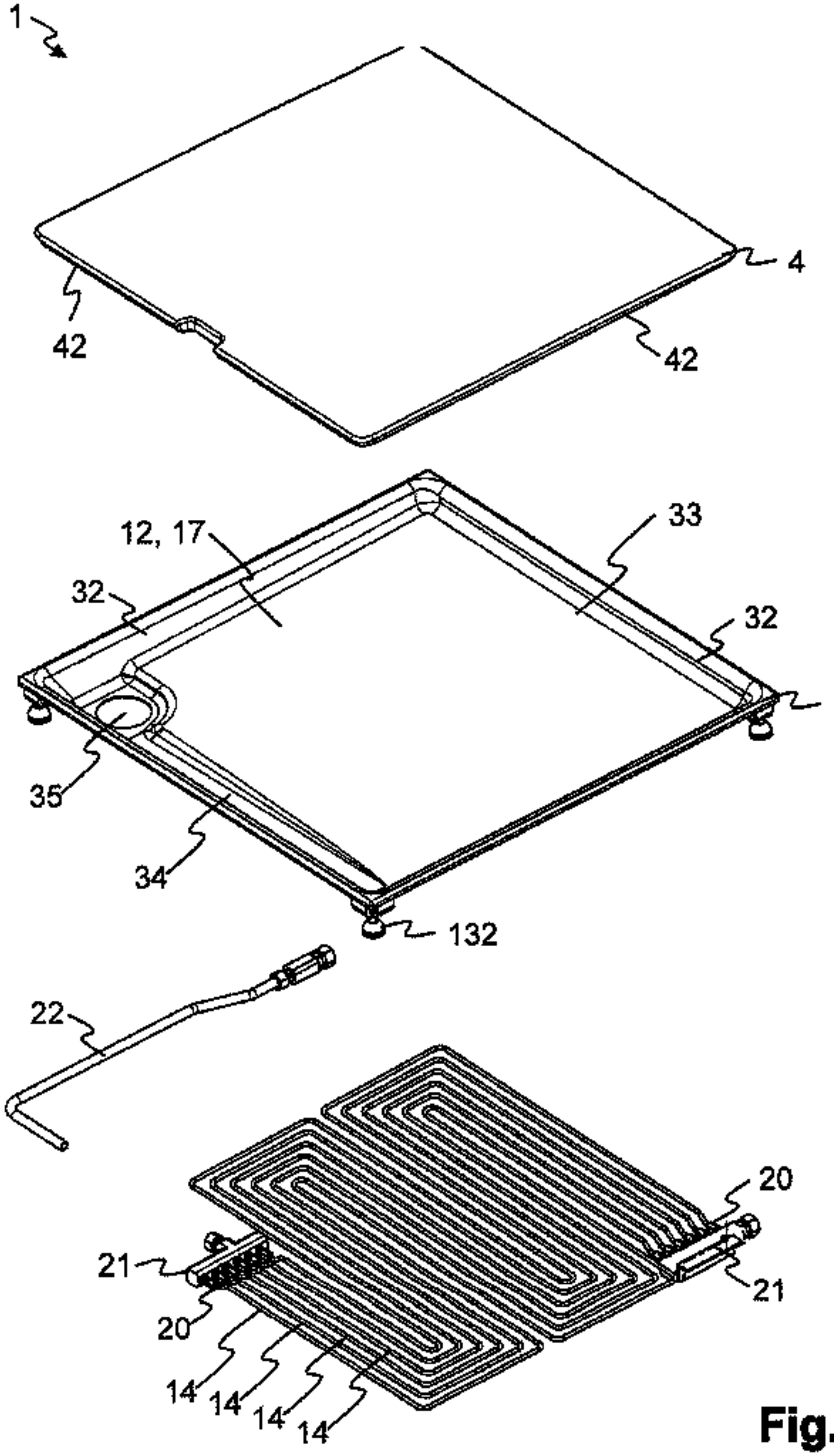

Fig. 1