(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 554 741 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.02.2013 Bulletin 2013/06

(51) Int Cl.:
D06F 67/08 *(2006.01)*

(21) Application number: **12179006.7**

(22) Date of filing: **02.08.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **05.08.2011 BE 201100483**

(71) Applicant: **Laco Machinery NV**
8520 Kuurne (BE)

(72) Inventor: **Lapauw, Dominique**
8510 Heule (BE)

(74) Representative: **De Clercq, Ann G. Y. et al**
De Clercq & Partners
Edgard Gevaertdreef 10a
9830 Sint-Martens-Latem (BE)

(54) **Bed for ironing device**

(57) Trough (10) for an ironing device (1), comprising a first heat-conducting plate and a second heat-conducting plate (12), in which both heat-conducting plates (11, 12) are attached to one another by means of weld spots (13) and/or weld seams (14) across the surface of the heat-conducting plates (11, 12) and in which the first heat-conducting plate (11) is deformed in such a way that a space (16) is provided between both plates (11, 12), in which the trough (10) comprises one or more perforations (15) through both heat-conducting plates (11, 12), and in which the one or more perforations (15) are not in open contact with the space (16) between both plates (11, 12).

Also, a method of manufacturing said trouh (10) is disclosed in which the perforation extend through the weld spots (13) and /or weld seams (14).

Aditionally, a method of ironing linen with an ironing device (1) comprising said trough (10) is disclosed.

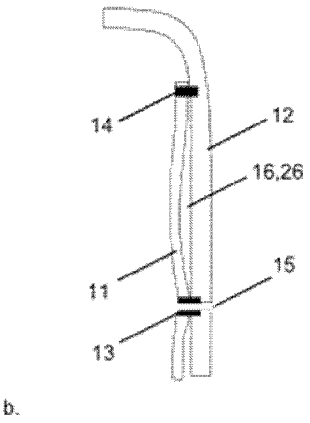

Figure 2

EP 2 554 741 A2

Description

TECHNICAL FIELD

[0001] The invention relates to a trough for an ironing device. The invention also relates to an ironing device comprising a trough. The invention also relates to a method for producing a trough. The invention also relates to a method for drying and/or ironing flat material.

TECHNOLOGICAL BACKGROUND OF THE INVENTION

[0002] An industrial ironing machine, also referred to here as an ironing device, is often used in industrial laundries and consists of a cylindrical ironing roller and a trough (a heated ironing bed), between which the moist flat material, such as bed linen or table linen, is introduced. The trough and/or the ironing roller are heated to the temperatures required to iron and/or to dry the flat material. The trough usually consists of a heavy steel plate which has to closely adjoin the ironing roller in order to achieve a good ironing result. Usually, the trough is heated: this is achieved by welding steam chambers or a steam space onto the trough. By introducing a heating liquid or gas into these steam chambers or steam space, the trough will reach the desired temperatures. The trough is pushed against the ironing roller and the flat material is passed in between. Then, the flat material is ironed and dried while the ironing roller is rotating.

[0003] Patent application BE1005950 describes an industrial ironing machine consisting of an ironing cylinder and a trough which extends virtually around half of this ironing cylinder. Patent application BE1018329 describes an ironing roller for an ironing device. Patent application BE1018069 describes a feed-in device for an ironing device.

[0004] During ironing, the flat material is also dried. Typically, the flat material will still have a residual moisture content of between 25% and 60% after washing and spinning. This drying is carried out by evaporation using the heat of the trough, but the excess moisture has to be removed somehow. Usually, the ironing roller is coated with a moisture-absorbing material, for example felt, for this purpose. This felt will absorb the moisture along the entire ironing path of the flat material, which typically covers half the circumference of the casing of the cylindrical ironing roller. The other half of the circumference of the casing of the ironing roller will not be covered with the flat material and/or the trough, due to which the felt can dry along this free drying length. In another configuration, the ironing path will be equal to two thirds of the circumference of the casing of the ironing roller, and the free drying length will only be one third of the circumference of the casing of the ironing roller. The wetter the flat material, the wetter the felt and the longer the felt takes to dry. However, the residual moisture has to be evaporated within one complete rotation of the ironing roller which is dependent on the throughput rate (typically measured in metres per minute). The longer the drying length, the shorter the ironing path is for the same diameter of the trough and/or ironing roller. In order to achieve a longer ironing path, it is possible to use ironing rollers and troughs with a larger diameter, in which case the capacity of the ironing machine is thus determined by the size of the ironing roller, or it is possible to place several relatively small ironing devices in series one behind the other. In certain cases, two or three or more ironing rollers can be placed in series.

[0005] It follows from this that there is a need for a trough for an ironing device with an increased ironing path. It follows from this that there is a need for a trough for an ironing device with increased efficiency. It follows from this that there is a need for a trough for an ironing device with an increased throughput rate.

[0006] It is an object of the invention to provide a trough which makes it possible to remove excess moisture during ironing. The invention also has the object of providing a method which makes it possible to produce such a trough.

[0007] It is an object of the invention to provide an ironing device which makes it possible to remove excess moisture during ironing. The invention also has the object of providing a method which makes it possible to iron and/or dry flat material using such an ironing device.

[0008] One or more of the above objects are achieved by the present invention. One or more of the above objects is achieved by the preferred embodiments of the present invention.

SUMMARY

[0009] In order to achieve the abovementioned objects, the invention comprises a trough for an ironing device, comprising:

- a first heat-conducting plate; and
- a second heat-conducting plate,

in which both heat-conducting plates are attached to one another by means of weld spots and/or weld seams across the surface of the heat-conducting plates and in which the first heat-conducting plate is deformed in such a way that a space is provided between both plates, characterized by the fact that the trough comprises one or more perforations through both heat-conducting plates, in which the one or more perforations are not in direct open contact with the space between both plates.

[0010] In a preferred embodiment, the invention comprises a trough as described above for this purpose, **characterized in that** one or more weld spots and/or weld seams comprise one or more perforations through both heat-conducting plates, in which the diameter of the perforation is always smaller than the diameter of the weld spot and/or the width of the weld seam in which said perforation is present so that both plates remain attached

to one another by means of the weld spots and/or weld seams.

[0011] In an aspect, the invention also comprises a method for producing a trough as described above, comprising the following steps:

- welding together a first and a second heat-conducting plate by means of a laser technique, in which several weld spots and/or weld seams are formed across the surface of the plates;
- perforating one or more weld spots and/or weld seams through both plates, in which the plates remain connected by means of the weld spots and/or weld seams;
- deforming both plates in order to form a trough of the desired diameter; and
- deforming the first heat-conducting plate by injecting a pressurized liquid or gas, preferably water and preferably at 30 bar, between the plates, as a result of which a space is formed between both plates, but in which case both plates remain connected by means of the weld spots and/or the weld seams.

[0012] In an aspect, the invention also comprises an ironing device comprising a trough as described above, furthermore comprising a cylindrical ironing roller which comprises a casing, **characterized in that** the trough extends along at least one third of the circumference of the casing of the cylindrical ironing roller, preferably along at least half the circumference of the casing of the cylindrical ironing roller, more preferably along at least two thirds of the circumference of the casing of the cylindrical ironing roller.

[0013] In an aspect, the invention also comprises a method for drying and/or ironing moist flat material, for example bed linen or table linen, using an ironing device as described above, comprising the following steps:

- heating the trough by introducing a heated liquid or gas, preferably steam or thermal oil, in the space between both plates up to a temperature of at least 100°C, preferably at least 150°C, more preferably at least 170°C;
- rotating the cylindrical ironing roller with respect to the trough ; and
- introducing the flat material between the trough and the cylindrical ironing roller while the cylindrical ironing roller is rotating with respect to the trough.

[0014] In a preferred embodiment, the invention to this end comprises a method for drying and/or ironing moist flat material as described above, further comprising the following step:

- applying a negative pressure to the interior of the cylindrical ironing roller, as a result of which excess moisture is removed from the flat material and/or the moisture-absorbing material through the perforations in the casing of the cylindrical ironing roller.

DESCRIPTION OF THE FIGURES

[0015] The reference numerals refer to the attached figures.

1 - Ironing device

2 - Circumference of the casing of the ironing roller

3 - Ironing path

4 - Free drying length

5 - Extraction means

10 - Trough

11 - First heat-conducting plate

12 - Second heat-conducting plate

13 - Weld spots

14 - Weld seams

15 - Perforations in the trough

16 - Space between heat-conducting plates

20 - Ironing roller

21 - Casing of the ironing roller

22 - Diameter of the ironing roller

23 - Moisture-absorbing material

24 - Springs

25 - Perforations in the casing of the ironing roller

26 - Heating liquid or heating gas

Fig. 1 illustrates a trough (10) according to a preferred embodiment of the invention, indicating the diameter (22), the ironing path (3), the weld seams (14) and the weld spots (13) which comprise perforations (15). The weld spots (13) and the perforations (15) are distributed evenly across the surface of the trough (10). The rectangular frame indicates the part of the trough (10) which is illustrated in detail in Fig. 2.

Figs. 2a and 2b show a detailed illustration and

cross section of the trough (10) according to Fig. 1, indicating the first heat-conducting plate (11), the second heat-conducting plate (12), the space (16) between the heat-conducting plates in between which the heating liquid or the heating gas (26) flows, the weld spots (13), a weld seam (14) and perforations (15) in the trough (10).

Fig. 3 illustrates an ironing device (1) according to a preferred embodiment of the invention, indicating the trough (10), the first heat-conducting plate (11), the second heat-conducting plate (12), the ironing roller (20), the casing of the ironing roller (21), the diameter of the ironing roller (22), the circumference of the casing of the ironing roller (2), the ironing path (3), the free drying length (4), and the extraction means (5). The grey arrows indicate the air which is sucked in, both via the free drying length (4) and via the ironing path (3), through the flat material and which is removed by means of the extraction means (5) via the ironing roller (20). The circle illustrates the part of the ironing roller (20) which is illustrated in detail in Fig. 4.

Fig. 4 shows a detailed illustration of the casing (21) of the ironing roller (20) of the ironing device (1) from Fig. 3, indicating the perforations (25) in the casing (21), the moisture-absorbing material (23) and the springs (24). The grey arrow indicates the air which is sucked in through the flat material and the moisture-absorbing material (23).

Fig. 5 shows the surface of a trough (10) according to a preferred embodiment of the invention, in which both the weld spots (13) and the weld seams (14) may comprise perforations (15).

DETAILED DESCRIPTION

[0016] As used hereinbelow in this text, the singular forms "a", "an" and "the" comprise both the singular and the plural, unless the context clearly denotes otherwise.

[0017] The terms "comprise", "comprises" as used hereinbelow are synonymous with "inclusive", "include" or "contain", "contains" and are inclusive or open and do not exclude additional items, elements or method steps which have not been mentioned. The terms "comprise", "comprises" are inclusive of the term "contain".

[0018] The enumeration of numerical values by means of ranges of figures comprises all values and fractions included in these ranges as well as the cited end points.

[0019] The term "approximately" as used when referring to a measurable value, such as a parameter, a quantity, a time period and so on, is intended to include variations of +/- 10% or less, preferably +/-5% or less, more preferably +/-1% or less, and still more preferably +/-0.1% or less, of and from the specified value, in so far as the variations are applicable in order to function in the disclosed invention. It should be understood that the value to which the term "approximately" refers per se has also been disclosed.

[0020] All documents which are cited in the present specification are incorporated herein in full by way of reference.

[0021] Unless otherwise defined, all terms disclosed in the invention, including technical and scientific terms, have the meanings which those skilled in the art usually give them. As a further guide, definitions have been incorporated in order to further explain terms which are used in the description of the invention.

[0022] The invention comprises a trough (10) for an ironing device (1), comprising a first heat-conducting plate, in which the trough (10) comprises one or more perforations (15) through the heat-conducting plate (11). The perforations (15) are preferably made in the zone of the trough (10) in which the flat material comes into contact with both the trough (10) and the cylindrical ironing roller (20).

[0023] Due to the fact that such perforations (15) make it possible to dry the ironing roller (20) and the flat material over the entire circumference (2) of the casing (21) of the ironing roller (20), the efficiency and the throughput rate of an ironing device (1) comprising a trough (10) as described above will be increased.

[0024] The term "ironing device" comprises industrial ironing machines. These comprise a trough (10) and an ironing roller (20), in between which the flat material is introduced.

[0025] The term "trough" comprises the ironing bed for an ironing device (1). This ironing bed is usually heated. The trough (10) can be pressed against the ironing roller (20) by means of mechanical, hydraulic, pneumatic or electrical pressure. This makes it possible to achieve an optimum evaporation effect of the moisture in the flat material. This also makes it possible to achieve an optimum ironing effect of the flat material. This also makes it possible to achieve an optimum conveying effect of the flat material between the ironing roller (20), which usually rotates, and the trough (10). In a preferred embodiment of the invention, the trough (10) comprises several perforations (15) distributed across the surface, or a part of the surface, of the trough (10). The perforations (15) in the trough (10) may form any desired pattern. Preferably, the perforations (15) in the trough (10) form a regular pattern. More preferably, the perforations (15) in the trough (10) form a triangular, rectangular or rhombic pattern across the surface, or a part of the surface, of the trough (10).

[0026] In an aspect, the invention comprises a trough (10) for an ironing device (1), comprising:

- a first heat-conducting plate (11); and
- a second heat-conducting plate (12),

in which both heat-conducting plates (11, 12) are attached to one another by means of weld spots (13) and/or

weld seams (14) across the surface of the heat-conducting plates (11, 12) and in which the first heat-conducting plate (11) is deformed in such a way that a space (16) is provided between both plates (11, 12), characterized by the fact that the trough (10) comprises one or more perforations (15) through both heat-conducting plates (11, 12), in which the one or more perforations (15) are not in open contact with the space (16) between both plates (11, 12).

[0027] The term "weld spot" comprises the common contact surface between two plates (11, 12) which are attached to one another by a welding technique, in which case the contact surface is local. Such weld spots (13) are usually round. In a preferred embodiment of the invention, such weld spots (13) are distributed evenly across the entire surface of the plates (11, 12), as a result of which the space (16) between two plates (11, 12) comprises chambers, such as those in a padded cushion. Such weld spots (13) can be formed by means of a laser-welding technique as known in the prior art.

[0028] The term "weld seam" comprises the common contact surface between two plates (11, 12) which are attached to one another by a welding technique, in which the contact surface is continuous in one dimension. Such a weld seam (14) is usually applied along the circumference of the two plates (11, 12), thus closing the space (16) between the two plates (11, 12). Such weld seams (14) can also be made parallel to one another, as a result of which the space (16) between two plates (11, 12) comprises elongate chambers. Such weld seams (14) can be formed by means of a laser-welding technique as known in the prior art.

[0029] In a preferred embodiment of the invention, the trough (10) comprises a weld seam (14) running along the circumference of the plates (11, 12) and the trough (10) comprises weld spots (13) which are situated at equal distances from one another on the surface of the trough (10), preferably as a padded cushion. The weld spots (13) may form any desired pattern. Preferably, the weld spots (13) form a regular pattern. More preferably, the weld spots (13) form a triangular, rectangular or rhombic pattern on the surface of the plates (11, 12). Between the weld spots (13) and/or the weld seams (14), flow passages for the heating liquid or the heating gas (26) are created.

[0030] The expression "not in open contact" as used here is understood to mean that the perforations (15) do not provide openings to the flow passages formed by the space (16) between the plates (11, 12). The result thereof is that the heating liquid or the heating gas (26) which will flow into the space (16) when the ironing device (1) is operative cannot flow out via the perforations (15). As the perforations (15) extend simultaneously through both plates (11, 12), it is essential that this lack of open contact applies to both heat-conducting plates (11, 12).

[0031] The term "ironing roller" comprises the cylindrical ironing roller (20) for an ironing device (1). Said ironing roller (20) comprises a casing (21), which casing (21) comprises a diameter (22) and a circumference (2).

[0032] The term "ironing path" comprises the contact distance between the trough (10) and the casing (21) of the ironing roller (20). The term "free drying length" comprises the distance over which the casing (21) of the ironing roller (20) is not surrounded by the trough (10). The sum of the ironing path (3) and the free drying length (4) corresponds to the circumference (2) of the casing (21) of the ironing roller (20).

[0033] The term "flat material" comprises any material which can be introduced into an ironing device (1) in order to be dried and/or ironed. Preferably, the flat material has a minimum width of 1.0 m. Preferably, the flat material has a maximum width of 3.3 m. Preferably, said flat material comprises bed linen or table linen. The term "bed linen" comprises sheets, fitted sheets, drawsheets, bedspreads, duvet covers and pillow cases. The term "table linen" comprises tablecloths and napkins.

[0034] In a preferred embodiment, the invention comprises a trough (10) as described above, **characterized in that** one or more weld spots (13) and/or weld seams (14) comprise one or more perforations (15) through both heat-conducting plates (11, 12), in which the diameter of the perforation (15) is always smaller than the diameter of the weld spot (13) and/or the width of the weld seam (14) in which said perforation (15) is present, so that both plates (11, 12) remain attached to one another by means of the weld spots (13) and/or weld seams (14).

[0035] In a preferred embodiment of the invention, the weld spots (13) and/or weld seams (14) are produced by means of a laser-based welding technique. Due to the fact that the perforations (15) are made in the weld spots (13) and/or weld seams (14), there is no direct open contact between the perforations (15) and the space (16) between the plates (11, 12) and the heating liquid or the heating gas (26) which will flow into the space (16) during operation of the ironing device (1) cannot flow out via the perforations (15).

[0036] In a preferred embodiment, the one or more perforations (15) extend through the one or more weld spots (13).

[0037] In an embodiment, the weld spots (13) are weld circles. In an embodiment, the one or more perforations (15) extend inside the circumference of the weld circles. In such an embodiment, the perforations (15) do not have to extend through the welding region per se, but the perforations are nevertheless completely surrounded by a weld circle.

[0038] In a preferred embodiment, the invention comprises a trough (10) as described above, in which the heat-conducting plates (11, 12) comprise flexible metal. In a preferred embodiment of the invention, the heat-conducting plates (11, 12) comprise steel, preferably stainless steel.

[0039] In a preferred embodiment, the invention comprises a trough (10) as described above, in which the first heat-conducting plate (11) has a thickness of between 0.4 mm and 1.5 mm and in which the second heat-con-

ducting plate (12) has a thickness of between 2.0 mm and 6.0 mm. Preferably, the first heat-conducting plate (11) has a thickness of between 0.8 mm and 1.2 mm. Most preferably, the first heat-conducting plate (11) has a thickness of approximately 1.0 mm. Preferably, the second heat-conducting plate (12) has a thickness of between 4.0 mm and 5.5 mm. Most preferably, the second heat-conducting plate (12) has a thickness of approximately 5.0 mm. In a preferred embodiment, the first heat-conducting plate (11) has a thickness of approximately 1.0 mm and the second heat-conducting plate (12) has a thickness of approximately 5.0 mm. In a preferred embodiment of the invention, the weld spots (13) and perforations (15) are round. In a preferred embodiment, the invention comprises a trough (10) as described above, in which the weld spots (13) have a diameter of between 5 mm and 25 mm and in which the perforations (15) have a diameter of between 2 mm and 8 mm. Preferably, the weld spots (13) have a diameter of approximately 10 mm. Preferably, the perforations (15) have a diameter of approximately 4 mm.

[0040] In a preferred embodiment, the invention comprises a trough (10) as described above, in which several perforations (15) are evenly spaced apart, with the mutual distance between two perforations (15) being between 2.0 cm and 15.0 cm, preferably between 3.0 cm and 7.5 cm, more preferably approximately 4.0 cm.

[0041] In a preferred embodiment, the invention comprises a trough (10) as described above, in which the trough (10) has a diameter (22) of between 200 mm and 2000 mm, for example a diameter (22) of 300 mm, 500 mm, 600 mm, 800 mm, 900 mm, 1200 mm, or 1600 mm.

[0042] The term "diameter of a trough" comprises the diameter (22) of the circular arch which the trough (10) describes. This diameter (22) approximately corresponds to the diameter (22) of a cylindrical ironing roller (20) which fits inside the trough (10). The diameter (22) of the trough (10) will determine the drying and ironing path (3) of the flat material in the ironing device (1). The larger the diameter (22) of the trough (10), the longer this ironing path (3) can be.

[0043] In an aspect, the invention also comprises a method for producing a trough (10) as described above, comprising the following steps:

- welding together a first and a second heat-conducting plate (12) by means of a laser technique, in which several weld spots (13) and/or weld seams (14) are formed across the surface of the plates (11, 12);
- perforating one or more weld spots (13) and/or weld seams (14) through both plates (11, 12), in which the plates (11, 12) remain connected by means of the weld spots (13) and/or weld seams (14);
- deforming both plates (11, 12) in order to form a trough (10) of the desired diameter (22); and
- deforming the first heat-conducting plate (11) by injecting a liquid or gas between the plates (11, 12), as a result of which a space (16) is formed between both plates (11, 12), but in which case both plates (11, 12) remain connected by means of the weld spots (13) and/or the weld seams (14).

[0044] In a preferred embodiment of the invention, the steps of the method as described above are carried out in the abovementioned order. In a preferred embodiment, the one or more perforations (15) are not made until after the one or more weld spots (13) and/or weld seams (14) have been applied. In an alternative embodiment of the invention, the abovementioned steps are carried out in a different order. In an alternative embodiment of the invention, one of the two plates (11, 12) is first perforated and then welded on. In an embodiment, one or more perforations (15) are carried out first, following which the one or more weld spots (13) and/or weld seams (14) are applied around the perforations. In an alternative embodiment of the invention, both plates (11, 12) are perforated after the deformation of the first heat-conducting plate (11).

[0045] In a preferred embodiment of the invention, the plates (11, 12) are first pushed against one another and are then attached to one another by weld spots (13) and/or weld seams (14). In order to provide a space (16) between the plates (11, 12), a gas or a liquid will preferably be injected at high pressure. Preferably, said liquid or gas comprises water or steam. In an embodiment of the invention, said liquid or gas is injected between the plates (11, 12) at a pressure of approximately 30 bars. In this way, flow passages for the heating liquid or the heating gas (26) are created between the weld spots (13) and/or weld seams (14). Due to the very small space (16), the circulation of the heating liquid or the heating gas (26) is not associated with the same problems which are inherent to conventional steam chambers.

[0046] When the weld spots (13) and/or weld seams (14) are being perforated, it is preferably ensured that these perforations (15) will not be larger than the diameter of the weld spot (13) and/or the width of the weld seam (14). In this way, the heating liquid or the heating gas (26) which flows between the plates (11, 12) during ironing will not flow out via the perforations (15).

[0047] In a preferred embodiment, the invention comprises a method for producing a trough (10) as described above, in which the maximum space (16) between the plates (11, 12) has a thickness of between 1 mm and 7 mm. In a preferred embodiment, the invention comprises a trough (10) as described above, in which the maximum space (16) between the plates (11, 12) has a thickness of between 1 mm and 7 mm. Preferably, the maximum space (16) between the plates (11, 12) has a thickness of between 2 mm and 4 mm, more preferably the maximum space (16) between the plates (11, 12) has a thickness of approximately 3 mm. Said space (16) depends on the thickness of the plates (11, 12), the distance between the weld spots (13) and/or weld seams (14) and the quantity of heating liquid or heating gas (26) which is to flow between the plates (11, 12) in order to keep the

plates (11, 12) at the desired temperature.

[0048] In an aspect, the invention also comprises an ironing device (1) comprising a trough (10) as described above, furthermore comprising a cylindrical ironing roller (20) which comprises a casing (21), **characterized in that** the trough (10) extends along at least one third of the circumference (2) of the casing (21) of the cylindrical ironing roller (20), preferably along at least half the circumference (2) of the casing (21) of the cylindrical ironing roller (20), more preferably along at least two thirds of the circumference (2) of the casing (21) of the cylindrical ironing roller (20).

[0049] In an alternative preferred embodiment of the invention, the trough (10) extends along at least three fourths, preferably along at least four fifths, more preferably along at least 90%, most preferably along at least 95% of the circumference (2) of the casing (21) of the cylindrical ironing roller (20). The length of the ironing path (3) corresponds to this percentage of the circumference (2) of the casing (21) of the ironing roller (20).

[0050] The degree to which the trough (10) surrounds the ironing roller (20) can also be described using a contact angle, in which a contact angle of 0° corresponds to no contact between the trough (10) and the ironing roller (20), and a contact angle of 360° corresponds to complete enclosure of the casing (21) of the ironing roller (20) by the trough (10). In a preferred embodiment of the invention, the contact angle is between 120° and 330°, for example 130°, 140°, 150°, 160°, 170°, 180°, 190°, 200°, 210°, 220°, 230°, 240°, 250°, 260°, 270°, 280°, 290°, 300°, 310° or 320°. Preferably, the contact angle is at least 150°, more preferably at least 180°, more preferably at least 210°, more preferably at least 240°, more preferably at least 270°, more preferably at least 300°.

[0051] The more the trough (10) extends along the circumference (2) of the casing (21) of the cylindrical ironing roller (20), the longer the ironing path (3) of the flat material, but the shorter the free drying length (4) of the cylindrical ironing roller (20). It is possible to use ironing rollers (20) and troughs (10) with a larger diameter (22) or to place several small ironing devices (1) in series in order to produce a longer ironing path (3). The ironing device (1) according to the invention makes it possible to shorten the free drying length (4) and to extend the ironing path (3) using a less expensive and more efficient way. In a preferred embodiment of the invention, the free drying distance is reduced to a minimum.

[0052] In a preferred embodiment, the invention comprises an ironing device (1) as described above, **characterized in that** the casing (21) of the cylindrical ironing roller (20) comprises a layer of moisture-absorbing material (23) around the casing (21) of the cylindrical ironing roller (20). In this case, the term "layer" refers to a moisture-absorbing material which partly or completely covers the surface of the casing (21) of the cylindrical ironing roller (20).

[0053] The term "moisture-absorbing material" comprises any material which can absorb moisture from the flat material during ironing. Preferably, the moisture-absorbing material (23) is felt, for example felt of approximately 4000 g/m^2. In an embodiment of the invention, the moisture-absorbing material (23) is attached to the casing (21) of the cylindrical ironing roller (20) by means of springs (24). As a result thereof, the moisture-absorbing material (23) is pressed against the trough (10) and/or the flat material. This moisture-absorbing material (23) has to be able to dry to a sufficient degree, hence the need for a free drying length (4) which is increased in the invention to the complete circumference (2) of the casing (21) of the ironing roller (20). The springs (24) also ensure that an air cushion is created between the moisture-absorbing material (23) and the ironing roller (20).

[0054] In a preferred embodiment, the invention comprises an ironing device (1) as described above, in which the trough (10) is flexible and is pressed against the casing (21) of the cylindrical ironing roller (20). This has the advantage that, independent of the thickness of the flat material, the flat material will always be pressed tightly against the casing (21) of the ironing roller (20) and against the trough (10). This may be effected by mechanical, hydraulic, pneumatic or electrical means. Large ironing cylinders, i.e. having a diameter (22) greater than 1200 m, often suffer from the problem that the trough (10) does not closely adjoin the ironing roller (20).

[0055] In a preferred embodiment of the invention, the ironing roller (20) also comprises perforations (25). In a preferred embodiment of the invention, the ironing roller (20) comprises several perforations (25) distributed across the surface, or a part of the surface, of the casing (21) of the ironing roller (20). The perforations (25) in the ironing roller (20) may form any desired pattern. Preferably, the perforations (25) in the ironing roller (20) form a regular pattern. More preferably, the perforations (25) in the ironing roller (20) form a triangular, rectangular or rhombic pattern on the surface of the casing (21) of the ironing roller (20).

[0056] In a preferred embodiment, the invention comprises an ironing device (1) as described above, in which the interior of the ironing roller (20) is under a negative pressure compared to the exterior of the ironing roller (20).

[0057] The term "negative pressure" comprises reduced pressure and vacuum. In a preferred embodiment of the invention, the ironing roller (20) is placed under vacuum. The negative pressure or the vacuum may be produced by an extraction means (5), such as a fan roller extraction means. This ensures that the flat material is dried along the ironing path (3). It also ensures that the moisture-absorbing material (23) is dried more quickly, both along the ironing path (3) and along the free drying length (4). In other words, the moisture-absorbing material (23) can be dried along the entire circumference (2) of the casing (21) of the ironing roller (20) by extraction (5) of the moisture. Without perforations (15) in the trough (10), the negative pressure would only speed up the drying process along the free drying length (4).

[0058] An additional advantage is the fact that the air which is sucked in by the trough (10) is already preheated. Such heated air which does not only pass through the moisture-absorbing material (23), but also through the flat material significantly increases the drying speed.

[0059] The negative pressure is always lower than the pressure outside the drum, which will generally be at atmospheric pressure. Preferably, the pressure is lower than 1000 mbar, for example between 200 and 300 mbar. Preferably, the negative pressure is between 0.01 and 100 mbar, more preferably between 0.1 and 10 mbar, more preferably between 0.1 and 1 mbar, most preferably between 0.2 and 0.3 mbar.

[0060] In an aspect, the invention also comprises a method for drying and/or ironing flat material using an ironing device (1) as described above, comprising the following steps:

- heating the trough (10) by introducing a heated liquid or gas (26) in the space (16) between both plates (11, 12);
- rotating the cylindrical ironing roller (20) with respect to the trough (10);
- introducing the flat material between the trough (10) and the cylindrical ironing roller (20) while the cylindrical ironing roller (20) is rotating with respect to the trough (10); and
- optionally, pressing the trough (10) against the cylindrical ironing roller (20).

[0061] Preferably, the flat material is introduced in a moist state. Preferably, the trough (10) is pressed against the ironing roller (20) which may, for example, be effected by hydraulic, pneumatic or electrical means.

[0062] The heated liquid or the heated gas (26) serves as heating liquid or heating gas (26). This heating liquid or this heating gas (26) can be selected from the list comprising: steam, thermal oil and hot air. Preferably, this is steam or thermal oil. The heating liquid or the heating gas (26) can be heated by means of a gas boiler or a thermal boiler. Preferably, the trough (10) is heated to a temperature of at least 100°C, more preferably to a temperature of at least 150°C, most preferably to a temperature of at least 170°C.

[0063] In a preferred embodiment, the invention comprises a method for drying and/or ironing moist flat material as described above, furthermore comprising the following step:

- applying a negative pressure to the interior of the cylindrical ironing roller (20), as a result of which excess moisture is removed through the perforations (25) in the casing (21) of the cylindrical ironing roller (20) from the flat material and/or the moisture-absorbing material (23).

[0064] In a preferred embodiment, the invention comprises a method for drying and/or ironing moist flat material as described above, in which the heat of the excess moisture is partly recovered in order to heat up the trough (10).

[0065] The heat can be recovered by means of a heat exchanger.

Claims

1. Trough (10) for an ironing device (1), comprising a first heat-conducting plate and a second heat-conducting plate (12), in which both heat-conducting plates (11, 12) are attached to one another by means of weld spots (13) and/or weld seams (14) across the surface of the heat-conducting plates (11, 12) and in which the first heat-conducting plate (11) is deformed in such a way that a space (16) is provided between both plates (11, 12), in which the trough (10) comprises one or more perforations (15) through both heat-conducting plates (11, 12), and in which the one or more perforations (15) are not in open contact with the space (16) between both plates (11, 12).

2. Trough (10) according to Claim 1, **characterized in that** one or more weld spots (13) and/or weld seams (14) comprise one or more perforations (15) through both heat-conducting plates (11, 12), in which the diameter of the perforation (15) is always smaller than the diameter of the weld spot (13) and/or the width of the weld seam (14) in which said perforation (15) is present so that both plates (11, 12) remain attached to one another by means of the weld spots (13) and/or weld seams (14).

3. Trough (10) according to Claim 2, **characterized in that** the one or more perforations (15) through both heat-conducting plates (11, 12) extend through the one or more weld spots (13).

4. Trough (10) according to one of Claims 1 to 3, in which the heat-conducting plates (11, 12) comprise flexible metal.

5. Trough (10) according to one of Claims 1 to 4, in which the first heat-conducting plate (11) has a thickness of between 0.4 mm and 1.5 mm and in which the second heat-conducting plate (12) has a thickness of between 2.0 mm and 6.0 mm.

6. Trough (10) according to one of Claims 1 to 5, in which the weld spots (13) and perforations (15) are round, in which the weld spots (13) have a diameter of between 5 mm and 25 mm, and in which the perforations (15) have a diameter of between 2 mm and 8 mm.

7. Method for producing a trough (10) according to one

of Claims 1 to 6, comprising the following steps:

- welding together a first and a second heat-conducting plate (12) by means of a laser technique, in which several weld spots (13) and/or weld seams (14) are formed across the surface of the plates (11, 12);
- perforating one or more weld spots (13) and/or weld seams (14) through both plates (11, 12), in which the plates (11, 12) remain connected by means of the weld spots (13) and/or weld seams (14);
- deforming both plates (11, 12) in order to form a trough (10) of the desired diameter (22); and
- deforming the first heat-conducting plate (11) by injecting a pressurized liquid or gas between the plates (11, 12), as a result of which a space (16) is formed between both plates (11,12), but in which case both plates (11, 12) remain connected by means of the weld spots (13) and/or the weld seams (14).

8. Method according to Claim 7, in which the maximum space (16) between the plates (11, 12) has a thickness of between 1 mm and 7 mm.

9. ironing device (1) comprising a trough (10) according to one of Claims 1 to 6, furthermore comprising a cylindrical ironing roller (20) which comprises a casing (21), **characterized in that** the trough (10) extends along at least one third of the circumference (2) of the casing (21) of the cylindrical ironing roller (20), preferably along at least half the circumference (2) of the casing (21) of the cylindrical ironing roller (20), more preferably along at least two thirds of the circumference (2) of the casing (21) of the cylindrical ironing roller (20).

10. Ironing device (1) according to Claim 9, **characterized in that** the casing (21) of the cylindrical ironing roller (20) comprises a layer of moisture-absorbing material (23) around the casing (21) of the cylindrical ironing roller (20).

11. Ironing device (1) according to Claim 9 or 10, **characterized in that** the ironing roller (20) comprises several perforations (25) distributed across the surface of the casing (21) of the ironing roller (20).

12. Ironing device (1) according to one of Claims 9 to 11, **characterized in that** the ironing device (1) comprises an extraction means (5), suitable for applying a negative pressure to the interior of the ironing roller (20) compared to the exterior of the ironing roller (20).

13. Method for drying and/or ironing moist flat material using an ironing device (1) according to one of Claims 9 to 12 comprising the trough according to one of Claims 1 to 6, comprising the following steps:

- heating the trough (10) by introducing a heated liquid or gas (26) in the space (16) between both plates (11, 12);
- rotating the cylindrical ironing roller (20) with respect to the trough (10);
- introducing the flat material between the trough (10) and the cylindrical ironing roller (20) while the cylindrical ironing roller (20) is rotating with respect to the trough (10); and
- optionally, pressing the trough (10) against the cylindrical ironing roller (20).

14. Method according to Claim 13, furthermore comprising the following step:

- applying a negative pressure to the interior of the cylindrical ironing roller (20), as a result of which excess moisture is removed from the flat material and/or the moisture-absorbing material (23) through the perforations (25) in the casing (21) of the cylindrical ironing roller (20).

15. Method according to Claim 14, in which the heat of the excess moisture is partly recovered in order to heat up the trough (10).

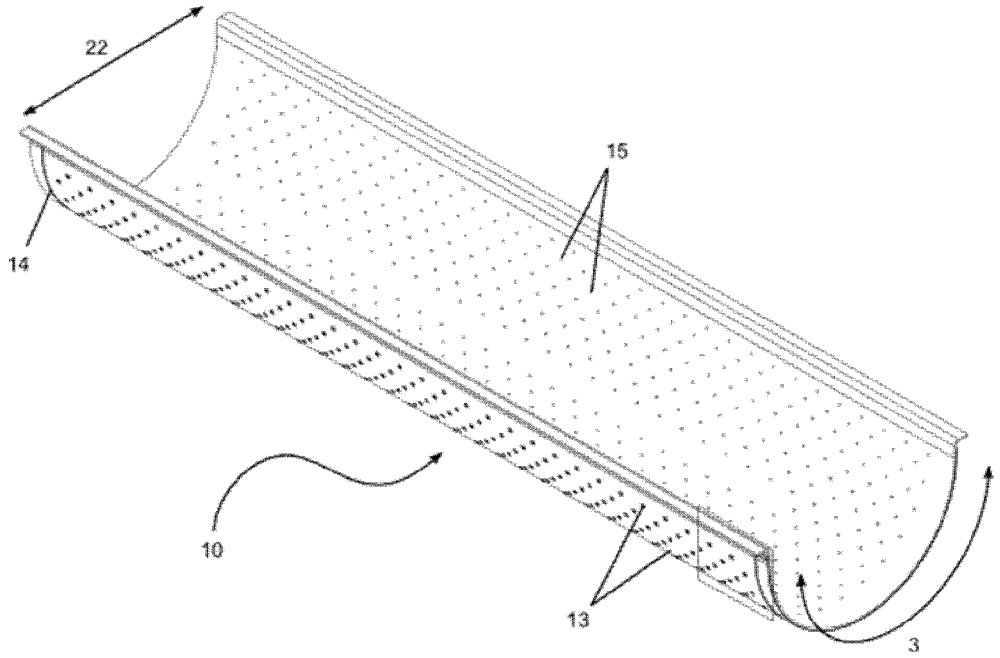

Figure 1

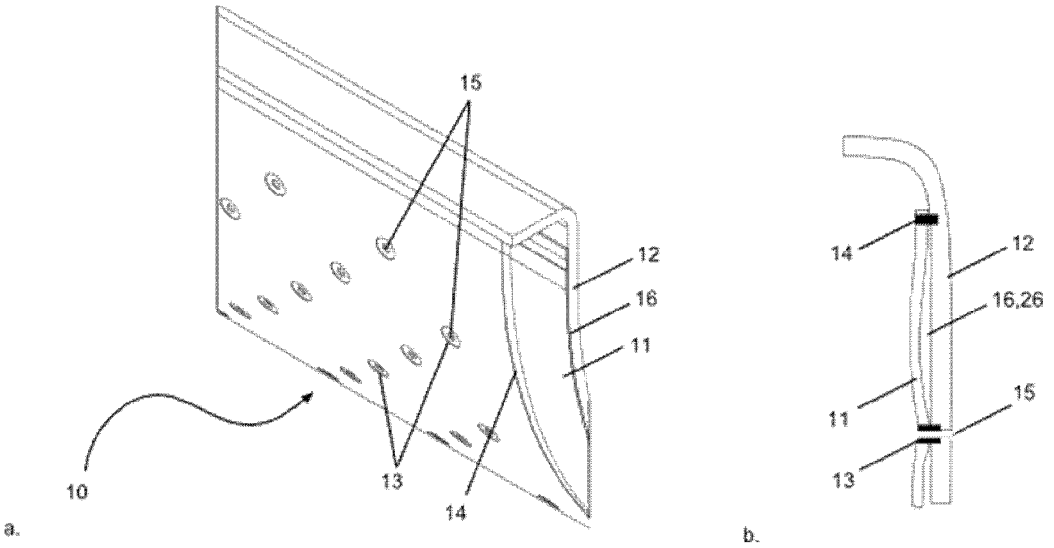

Figure 2

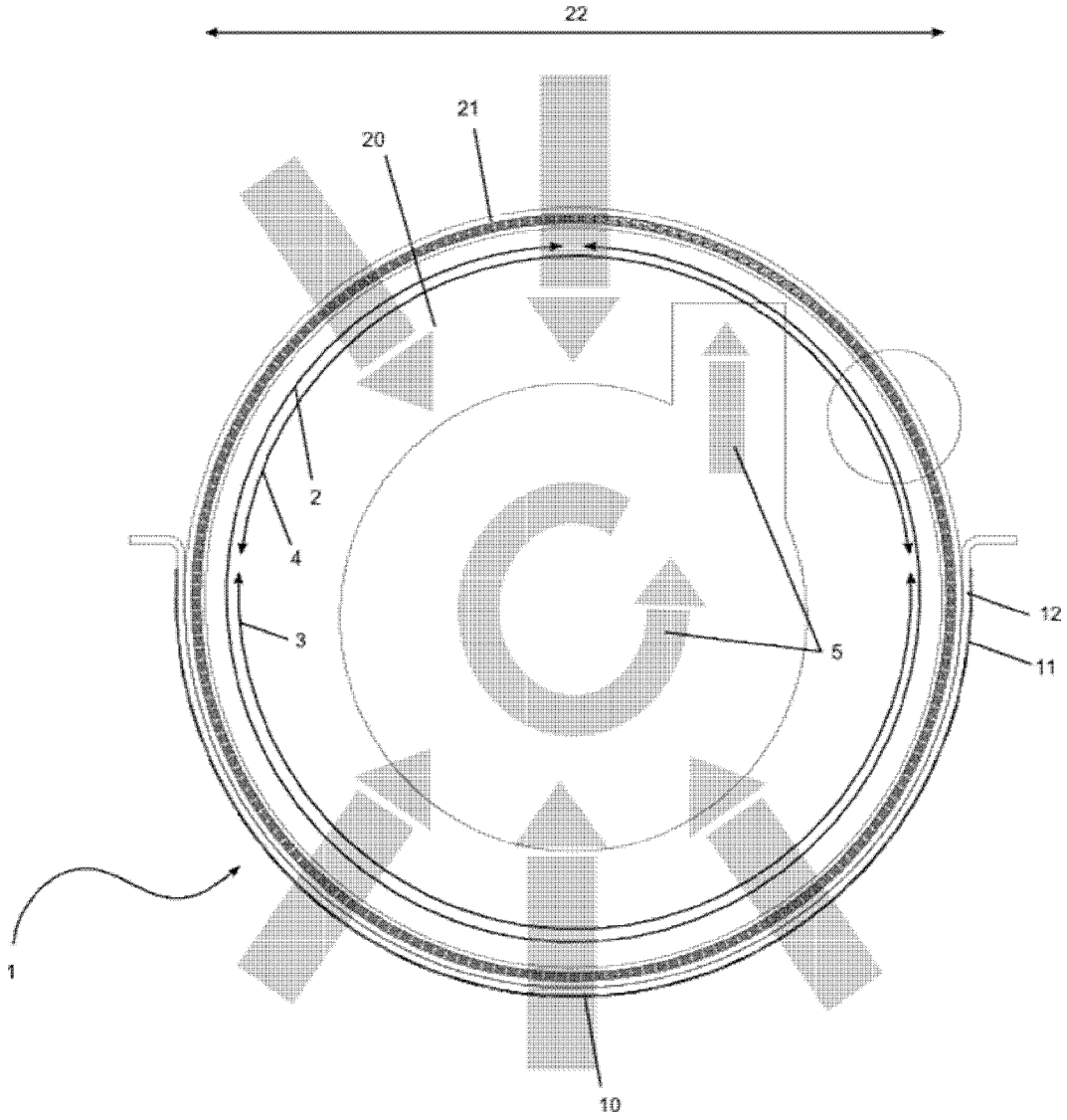

Figure 3

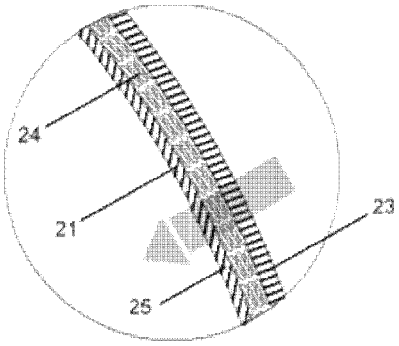

Figure 4

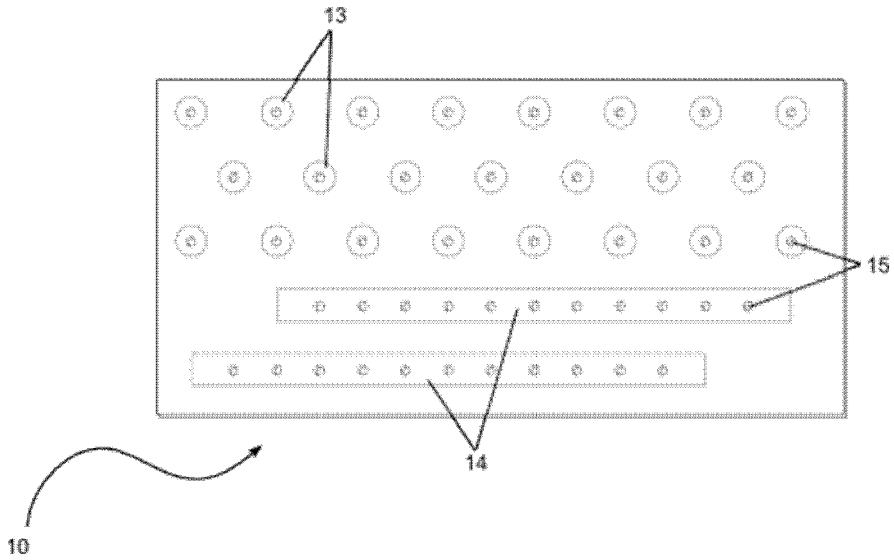

Figure 5

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- BE 1005950 **[0003]**
- BE 1018329 **[0003]**
- BE 1018069 **[0003]**