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## (54) A soleplate for an iron

(57) The invention is related to a soleplate for ironing having, a steam chamber and a steam channel for passaging of steam, provided with an inner wall a steam entrance located in the steam chamber, and a steam outlet.

The soleplate according to the invention is characterised in that at least a part of the inner wall near the entrance of the steam channel is provided with a non-stick layer. Keeping the channels open is important for the performance of the iron. Applying the non-stick layer prevents adhesion of lime-scale to the inner wall of the steam channel and keeps the steam channels open for a longer time. This increases the life time of the sole plate and hence of the iron in a simple manner.

The invention further relates to an iron having a body and comprising the soleplate according to the invention.

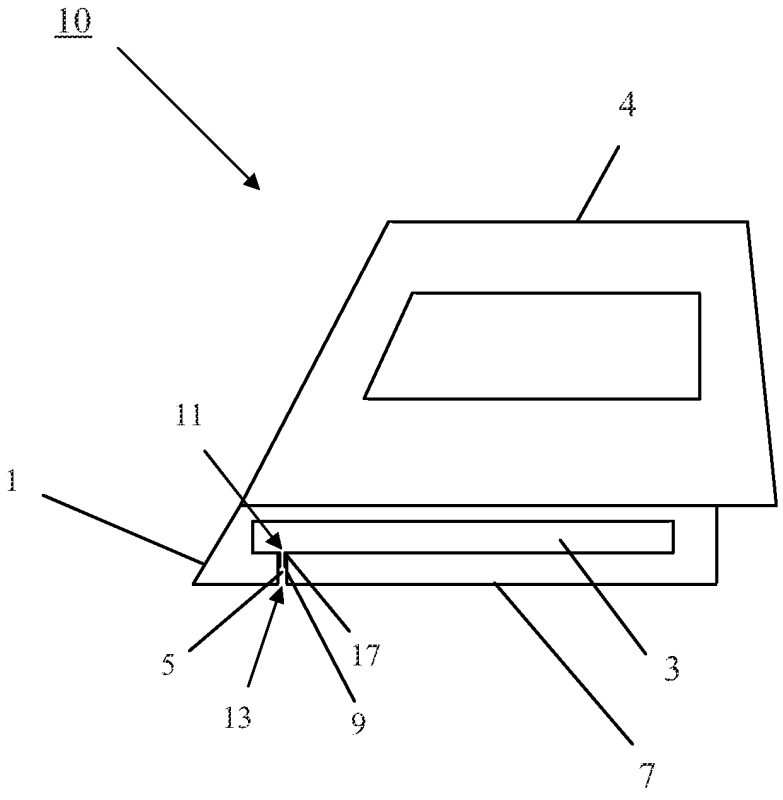


Figure 1

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## Description

FIELD OF THE INVENTION

**[0001]** The invention is related to a soleplate for ironing, having a steam chamber and a steam channel for passing steam, provided with an inner wall, a steam entrance located in the steam chamber and a steam outlet.

DESCRIPTION OF THE PRIOR ART

**[0002]** Such a sole plate is known as being part of irons known on the market today. These irons have a problem to produce an accumulation of lime-scale which progressively obstructs the passage of steam through the steam channels in the soleplate.

**[0003]** EP1 561 855 discloses a steam iron comprising a vaporization chamber including a rear outlet that communicates with the front opening of the vaporiser by way of a pair of deep channels that are integrated into a vaporiser and that extends co-laterally to the vaporization chamber itself. This solution assumes a considerable increase in size of the section of the passage for circulation of steam, due both to the greater depth of the channels as well as to the provision of two channels instead of one. At the same time, the possession of two channels provides an alternative that ensures circulation of steam towards the plate in the possible event that one of the channels becomes obstructed or considerably constricted.

**[0004]** A drawback of these measures is that additional parts and space are needed to provide the greater depth as well as the two channels in the iron.

SUMMARY OF THE INVENTION

**[0005]** It is an object of the invention to provide a simple way to minimize the risk of clogging of the steam channels.

**[0006]** This object is achieved by applying a non-stick layer on at least a part of the inner wall of the steam channel. The soleplate according to the invention is defined in claim 1.

**[0007]** In a conventional steam iron steam is generated by a steam generating means, which comprises a water reservoir and a steam chamber. Usually, a water-dosing pump is provided to pump the water from the water reservoir to the steam chamber (as drops rather than a large flow of water). The water may be pumped via a hose under command of a pump signal from an electric control device. The rate at which water is supplied dictates the amount of steam being produced, and the amount of steam is sufficiently low that the temperature of the sole plate is not significantly affected.

**[0008]** Instead of a pumped system, water can be dosed to the steam chamber under gravity.

**[0009]** The steam chamber is typically heated by the sole plate, but an auxiliary heating element may instead be provided.

**[0010]** The steam from the steam chamber reaches a steam outlet opening or openings provided in the sole plate of the iron via a steam channel.

**[0011]** The steam ironing device as such is well-known in practice. The steam ironing device may be a steam iron or a so-called boiler ironing system. The boiler ironing system comprises a steam iron, having a sole plate with a sole plate surface and a boiler for heating water which is separately arranged from the steam iron, wherein the water tank is attached to a stand comprising the boiler. In many cases, the water tank is removably arranged, so that a user of the device comprising the water tank is capable of bringing the water tank to a tap or the like in order to fill the water tank, without having to move the entire device.

**[0012]** The soleplate according to the invention is particularly beneficial in combination with a boiler ironing system. In a boiler ironing system steam is generated inside a boiler, under pressure. The pressure is may be up to 5 bar. The boiler has an opening for letting out steam provided with a valve. If a valve is opened the steam leaves the boiler with a certain speed. In order to increase the speed with which the steam penetrates the piece of garment, the steam channels in the soleplate are narrow.

**[0013]** These narrow steam channels are more sensitive to clogging by chalk and or dirt than wider ones. Keeping the channels open is important for the performance of the iron. Applying the non-stick layer prevents adhesion of lime-scale to the inner wall of the steam channel and keeps the steam channels open for a longer time. This increases the life time of the sole plate and hence of the iron. This is especially interesting for high pressure steam systems such as boiler ironing systems having narrow stream channels. Furthermore the presence of the non-stick layer allows for the steams channels to have a smaller diameter, i.e. smaller than 5 mm. A smaller channel diameter combined with a longer steam channel length and keeping the channel volume constant results in relatively more contact surface to dry the steam from the steam chamber. This way dryer steam may be obtained.

**[0014]** In an embodiment of the soleplate according to the invention the non-stick layer comprises a non-stick material selected from a group comprising: Polytetrafluoroethylene (PTFE), fluorinated ethylene propylene polymer, polyphenylenesulphide, solgel, enamel, polyetheretherketone, polyphthalamide, perfluoroalkoxy polymer and silicone resin.

**[0015]** In an embodiment of the soleplate according to the invention the non-stick layer is a deposit. The deposit may be obtained by spray coating.

**[0016]** In an embodiment of the soleplate according to the invention the non-stick layer is a part of an insert placed in the steam channel. The insert may be made of non stick material or may be provided with a layer of non stick material. The non-stick material being in contact with steam during use.

**[0017]** In an embodiment of the soleplate according to the invention the non-stick layer has a thickness in a range of 1 nanometer - 0.3 milimeter. Preferably the non-stick coating has a thickness in a range of 10 nanometer - 50 micrometer.

**[0018]** The non-stick coating has be thick enough to provide a non-sticking effect towards lime scale. The lower limit thickness 1 nm correlates with surface grafting with for example siloxanes containing fluoroalkane groups. Such a layer is sufficient to benefit from non-sticking properties. Such thin layer causes a very small temperature drop at the surface that is in contact with steam during use.

**[0019]** The temperature drop delta T being

$$\text{delta } T = q*t/(k*A)$$

with q = energy, t = thickness, A = area and k = coefficient of heat transfer

**[0020]** Tests using a PTFE tube having a thickness of about 0.1 millimeter inside an spiral-shaped flat heating element estimated a temp drop of 60C . With the temperature of the soleplate set at 200C, the Teflon surface is estimated to have a temp of 140C. At such a temperature steam formation still occurs.

**[0021]** Since temperature drop goes linear with the thickness in the equation, it is expected that a PTFE layer thicker than around 0.3 mm will generate an insulating layer that might prevent steaming.

**[0022]** It is however noted that when the surface of the Teflon coated area is relatively small compared to that of the total steam surface, the formation of droplets in the steam (spitting) will be minimal.

**[0023]** In an embodiment of the soleplate according to the invention the non-stick layer extends along at least a part of a wall portion of the steam chamber surrounding the steam entrance of steam channel.

**[0024]** In an embodiment of the soleplate according to the invention the non-stick layer is provided along at least a part of a wall portion of the steam chamber surrounding the steam outlet of steam channel.

**[0025]** In an embodiment of the soleplate according to the invention the inner wall is completely covered with the non-stick layer. In practice this may be doen using an insert made from non stick material such as polytetrafluoroethylene (PTFE), fluorinated ethylene propylene polymer, polyphenylenesulphide, solgel, enamel, polyetheretherketone, polyphthalamide, perfluoroalkoxy polymer and silicone resin.

**[0026]** The invention further relates to an iron having a body and comprising the soleplate according to the invention as claimed in claims 1-9. The soleplate being mounted to the body. Such an iron has the benefits described for the soleplate.

**[0027]** It is to be noted that US 5199486 discloses a steam type humidifier for heating, ventilating and airconditioning comprising a.o. a rectangular box-shaped housing defining an evaporation chamber and a heat exchanger located in said evaporation chamber comprising upper and lower layers of parallel tubes being covered with a non-stick surface.

## BRIEF DESCRIPTON OF DRAWINGS

**[0028]**

Figure 1 schematically depicts a first embodiment of the iron according to the invention.

Figure 2a schematically depicts a part of a first embodiment of the sole plate according to the invention.

Figure 2b schematically depicts a part of a second embodiment of the sole plate according to the invention.

Figure 3a schematically depicts a part of a third embodiment of the sole plate according to the invention.

Figure 3b schematically depicts a part of a fourth embodiment of the sole plate according to the invention.

Figure 3c schematically depicts a part of a fifth embodiment of the sole plate according to the invention.

Figure 4 schematically depicts a second embodiment of the iron according to the invention.

Figures 5a and 5c show pictures taken of a detail of the sole plate according to the invention taken before and after testing, respectively.

Figure 5b shows a picture taken of a detail of the reference sole plate after testing.

## DETAILED DESCRIPTON OF DRAWINGS

**[0029]** In figure 1 the first embodiment of the iron according to the invention is schematically depicted. The steam iron 10 comprises a soleplate 1 for ironing having a steam chamber 3 for evaporation of water to generate steam. The soleplate 1 is mounted to a body 4. A steam channel 5 is provided for the passing of steam. The soleplate has a garment contact surface 7 for contacting a piece of garment. A water reservoir (not shown) may be provided inside the body 4 or in a separate stand.

**[0030]** The steam channel has an inner wall 9, a steam entrance 11 located in the steam chamber 3 and a steam outlet 15. A part of the inner wall 9 near the entrance of the steam channel 11 is provided with a non-stick layer 17. The steam channel perforates a wall portion of the soleplate and connects the steam chamber 3 with the outside environment so steam can be transferred from the steam chamber to the piece of garment.

**[0031]** Preferably the non-stick layer comprises a material selected from a group comprising: polytetrafluoroethylene, fluorinated ethylene propylene polymer, polyphenylenesulphide, solgel, enamel, polyetheretherketone, polyphthalamide, perfluoroalkoxy polymer and silicone resin.

**[0032]** In figure 2a a part of a first embodiment of the

sole plate 1 according to the invention is schematically depicted. The soleplate 1 has the steam channel 5 having the inner wall 9 provided with the non-stick layer 17 near the entrance 11 of the steam channel.

**[0033]** In figure 2b a part of a second embodiment of the sole plate 1 according to the invention is schematically depicted. The steam channel 5 in the soleplate 1 is provided with the non-stick layer 17 near the entrance 11 of the steam channel and along at least a part of a wall portion of the steam chamber surrounding the steam entrance of steam channel 19. In a practical embodiment the non-stick coating 17 encircles the steam entrance 11. Preferably the non stick coating has an outer circle having a radius of 1-3 cm.

**[0034]** In figure 3a a part of a third embodiment of the sole plate 1 according to the invention is schematically depicted. The steam channel 5 in the soleplate 1 is completely covered with the non-stick layer 18. The non-stick layer may be a non-stick coating deposited in the inner wall of the steam channel. Alternatively the non stick layer is provided on an insert placed in the steam channel, whereby the non stick layer is located on the side of the insert which is in contact with steam during use, i.e. located on the inside of the channel. In yet another alternative an insert made from non-stick material is placed in the steam channel and connected to the inner wall, for example by gluing.

**[0035]** In figure 3b a part of a fourth embodiment of the sole plate 1 according to the invention is schematically depicted. The steam channel 5 in the soleplate 1 is completely covered with the non-stick layer 18. The non-stick coating is also provided along at least a part of the wall portion of the steam chamber surrounding the steam entrance 11 of steam channel 19.

**[0036]** In figure 3c a part of a fifth embodiment of the sole plate 1 according to the invention is schematically depicted. The steam channel 5 in the soleplate 1 is completely covered with the non-stick layer 18. The non-stick layer 19 is also provided around the steam entrance and along at least a part of an outer wall portion of the steam chamber surrounding the steam outlet of steam channel 20.

**[0037]** In figure 4 schematically a second embodiment of the iron according to the invention is schematically depicted. The steam iron 100 has a housing 104 comprising usual equipment such as a heating element (not shown). The sole plate 101 according to the invention is mounted to the housing 104 of the iron and has an ironing plate 102 attached to it. The ironing plate 102 has the garment contact surface 107 for contacting a piece of garment.

**[0038]** The inner wall of the steam channel 105 in the soleplate 101 is completely covered with the non-stick layer 118. The non-stick layer 119 is also provided along at least a part of the wall portion of the steam chamber surrounding the steam entrance 111 of steam channel. The non-stick layer 120 is also provided along at least a part of the outer wall portion of the steam chamber surrounding the steam outlet of steam channel.

EXPERIMENTS

**[0039]** To illustrate the effect of providing a non stick coating (being an embodiment of the non-stick layer) the following examples are given herein after:

**[0040]** A hole was drilled in two sole plates to create a steam channel for testing purposes.

**[0041]** Two PTFE (polytetrafluoroethylene, Teflon® by Dupont) coating layers were applied by spray coating to the inner wall of the drilled steam channel and an area of 1-2 cm around the steam entrance. The resulting layer was cured at 250C.

**[0042]** After curing by heating sole plate S1 was obtained. The non-stick PTFE layer on the wall of the steam channel thus obtained had a thickness in a range of 20-25 micron.

**[0043]** A soleplate without the non-stick layer was used as reference. This sole plate is further indicated by sole plate S2

**[0044]** The following steps were performed to test the effect of providing a non stick coating Around 130 liter of SHW (standard hard water) was pumped at 40 ml/min into the steam chamber of the soleplate. The steam exits the steam chamber via the drilled steam channel.

**[0045]** At a given frequency (varied between 1-25 liter), the water flow was increased to 150-200 ml/min for 1 min. This leads to hot liquid including scale particles leaving the soleplate via the drilled steam channel. Afterwards, the normal pump volume of 40 ml/min is continued.

**[0046]** This alternating steaming - washing process is continued up to the 130L volume has been used.

**[0047]** The steam channels were visually inspected.

**[0048]** Figure 5a shows a picture of the steam channel of soleplate S1 before the test.

**[0049]** Figure 5b shows a picture of the steam outlet opening of reference sole plate S2 after the test in.

**[0050]** Figure 5c shows a picture of a steam outlet opening of sole plate S1 after the test

**[0051]** The channel of soleplate S1 was still substantially open (see figure 5c), the channel of soleplate S2 was almost fully clogged (see figure 5b).

**[0052]** While the invention has been illustrated and described in detail in the drawings and foregoing description, illustration and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments. Variations to the disclosed embodiments can be understood and effected by the skilled person in practicing the claimed invention, from a study of the drawings, the description and the claims. The word "comprising" does not exclude other elements, and the indefinite article "a" or "an" does not exclude a plurality. Any reference sign in the Claims should not be construed as limiting the scope.

## Claims

1. A soleplate for ironing, having

   - a steam chamber and
   - a steam channel for passing steam, provided with an inner wall, a steam entrance located in the steam chamber and a steam outlet,

   **characterised in that** at least a part of the inner wall near the entrance of the steam channel is provided with a non-stick layer.

2. A soleplate according to claim 1, **characterised in that** the non-stick layer comprises a material selected from a group comprising:

   polytetrafluoroethylene, fluorinated ethylene propylene polymer, polyphenylenesulphide, solgel, enamel, polyetheretherketone, polyphthalamide, perfluoroalkoxy polymer and silicone resin.

3. A soleplate according to claim 1, **characterised in that** the non-stick layer is a deposit.

4. A soleplate according to claim 1, **characterised in that** the non-stick layer is a part of an insert placed in the steam channel.

5. A soleplate according to claim 1, **characterised in that** the non-stick layer has a thickness in a range of 1 nanometer - 0.3 millimeter.

6. A soleplate according to claim 1, **characterised in that** the non-stick layer extends along at least a part of a wall portion of the steam chamber surrounding the steam entrance of steam channel.

7. A soleplate according to claim 1, **characterised in that** the non-stick layer is provided along at least a part of a wall portion of the steam chamber surrounding the steam outlet of steam channel.

8. A soleplate according to claim 1, **characterised in that** the inner wall is completely covered with the non-stick layer.

9. An iron having a body and comprising the soleplate according to any one of the claims 1-9 the soleplate being mounted to the body.

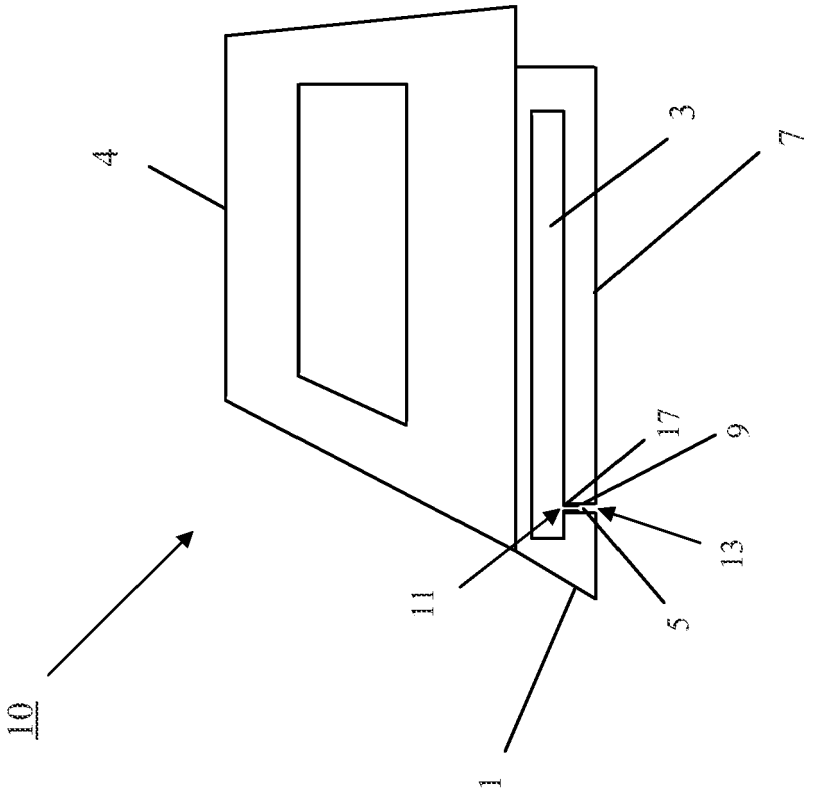


Figure 1

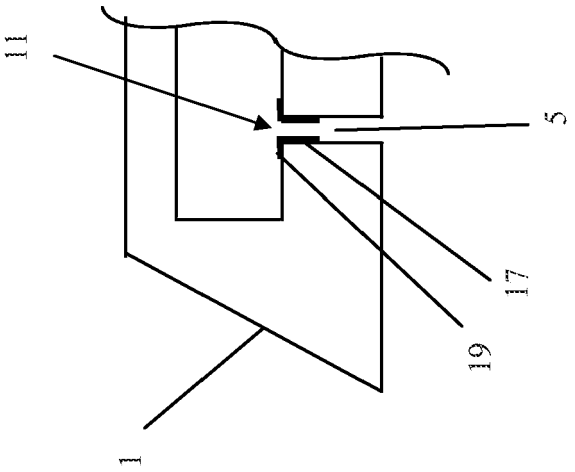


Figure 2b

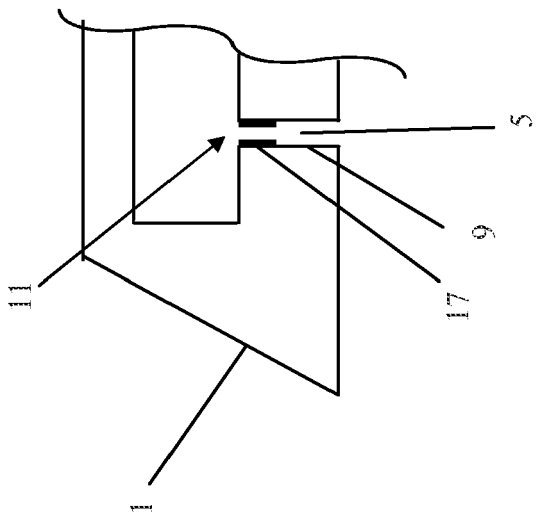


Figure 2a

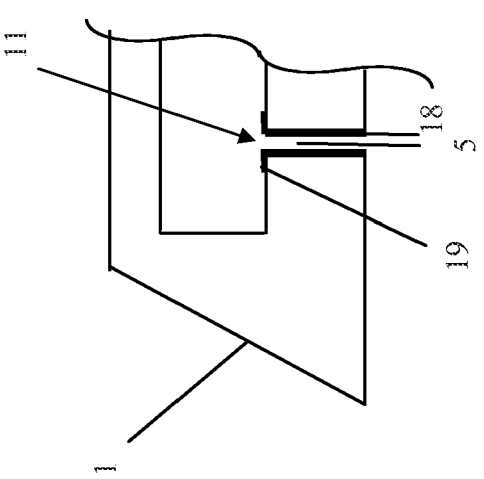


Figure 3b

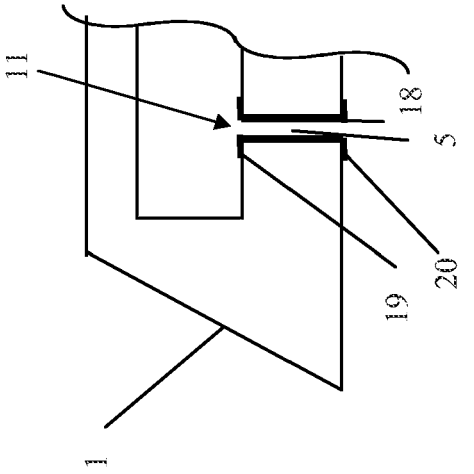


Figure 3c

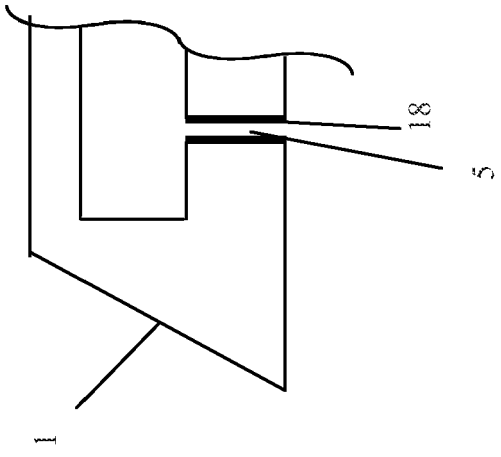


Figure 3a

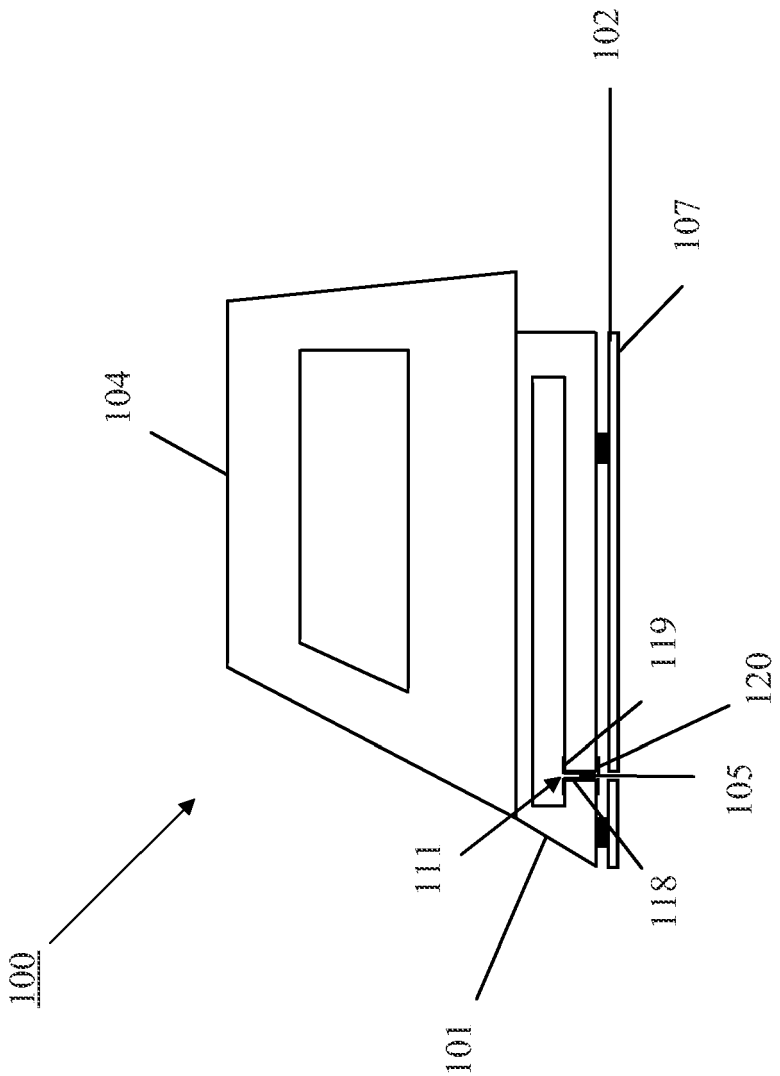


Figure 4

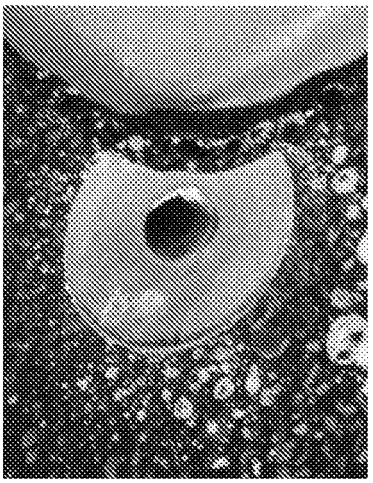

Figure 5a

Figure 5b

Figure 5c

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# EUROPEAN SEARCH REPORT

Application Number
EP 07 10 7005

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X | DE 11 62 320 B (LICENTIA GMBH)<br>6 February 1964 (1964-02-06)<br>* column 2, line 31 - line 46; claims; figures *<br>----- | 1-9 | INV.<br>D06F75/18 |

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 5 July 2007 | Courrier, Gilles |

CATEGORY OF CITED DOCUMENTS

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4

EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 10 7005

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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| DE 1162320 B | 06-02-1964 | NONE | |

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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- US 5199486 A **[0027]**