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(54) **Furnace**

(57) A furnace suitable for forging comprising an inner chamber, which inner chamber receives the workpieces (5) supported by at least one support element (4), and which inner chamber is delimited by an outer casing (1).

At least one flame generating source (3), such as a burner or the like, is provided in the inner chamber, and the furnace has at least one opening (6) for access to the inner chamber, formed in a wall (112) oriented substantially perpendicular to the longitudinal axis (A) of the furnace.

The outer casing (1) is composed of at least two parts, i.e. a first upper part (11) and a second lower part (12), which two parts are in mutual contact along a parallel separating plane, containing the longitudinal axis (A) of the furnace and having a substantially horizontal orientation.

The section of the first inner chamber (111) is larger than the section of the second inner chamber (121), such that the first upper part (11) is only connected with the second lower part (12) along a lateral longitudinal edge, and forms a slot on the opposite longitudinal edge, for accommodation and/or access of said flame generating source (3).

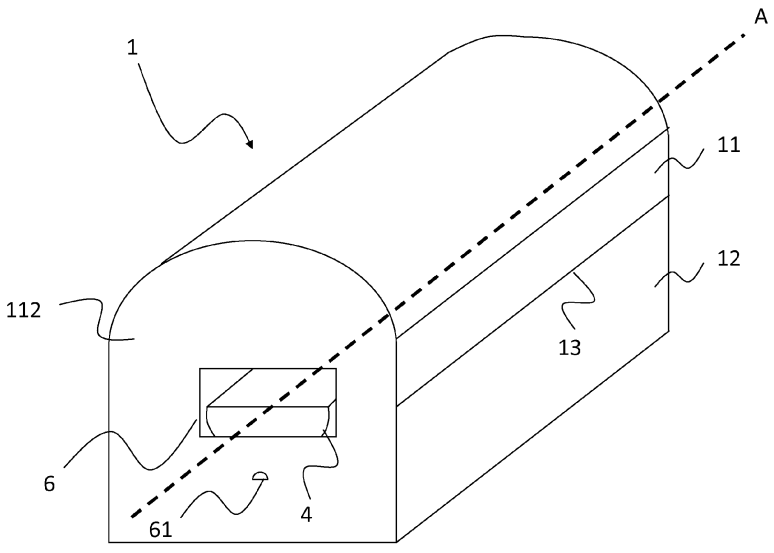

Fig. 1a

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Description

[0001] The present invention relates to a furnace suitable for forging comprising an inner chamber, which receives the workpieces supported by at least one support element, which inner chamber is delimited by an outer casing.

[0002] At least one flame generating source, such as a burner or the like, is provided in the inner chamber, and the furnace has at least one opening for access to the inner chamber, formed in a wall oriented substantially perpendicular to the longitudinal axis of the furnace.

[0003] Prior art furnaces have a configuration that is similar to that described above, i.e. an inner chamber that receives the workpieces, with the latter being exposed to a high temperature, due to a flame source.

[0004] One possible embodiment of prior art furnaces is well described in the documents US 3334879 and US 1904427.

[0005] The flame source generally consists of a device such as a burner or the like, which is connected to an external gas source, and gas combustion in the inner chamber results in high temperatures that allow the workpiece, usually made of a metal material, to be machined by plastic deformation.

[0006] Prior art furnaces have their flame source in the upper part of the furnace and generate a flame burning from top to bottom directly to the workpiece, thereby significant oxidation thereof. As a result, particular and complex machining processes, such as pattern forge welding, require huge amounts of a deoxidizer, the most commonly used of such deoxidizers being sodium borate.

[0007] The use of a deoxidizer involves cost issues and longer processing times, and causes workpiece deterioration as the deoxidizer has a high corrosive effect at high temperatures.

[0008] Furthermore, the flame directly acts upon the workpiece and this does not allow full combustion of all the gases in the inner chamber, most of which remain unburned, and cause higher fuel consumption, thereby reducing combustion efficiency.

[0009] Therefore, common furnaces have openings formed on their outer casing for escape of unburned gases, which prevent total closure of the furnace, thereby causing waste of energy.

[0010] Therefore, there exists a yet unfulfilled need for a furnace that obviates the typical drawbacks of prior art furnaces, and particularly reduces or eliminates the use of a deoxidizer, reduces workpiece corrosion and improves combustion efficiency, thereby avoiding energy waste.

[0011] The present invention achieves the above purposes by a furnace as described hereinbefore, in which the outer casing is composed of at least two parts, i.e. a first upper part and a second lower part, which delimit a first inner chamber and a second inner chamber respectively, said two parts being in mutual contact along a parallel separating plane, containing the longitudinal axis of the furnace and having a substantially horizontal orientation.

[0012] Furthermore, the section of the first inner chamber is larger than the section of the second inner chamber, such that the first upper part is only connected with the second lower part along a lateral longitudinal edge, and forms a slot on the opposite longitudinal edge, for accommodation and/or access of the flame generating source.

[0013] This particular arrangement obviates the drawbacks of prior art furnaces, in that heat in the inner chamber generated by the flame source develops in a spiral.

[0014] Particularly, the flame does no longer directly act upon the workpiece, but is generated at the housing slot, increases the temperature in the inner chamber and the heat so generated heats the workpiece until the plastic deformation temperature is reached.

[0015] The flame does not directly act upon the workpiece and does not cause oxidation thereon, whereby the use of a deoxidizer is wholly or partially reduced to such amounts as to avoid workpiece corrosion.

[0016] Furthermore, the spiral development of heat allows total gas combustion in the inner chamber, for maximum combustion efficiency, thereby reducing fuel waste.

[0017] The above described arrangement affords the advantages as mentioned herein, irrespective of what is introduced in the inner chamber.

[0018] Spiral heat development affords advantages both in machining of workpieces made of any material, such as metal or ceramics, and other activities, such as cooking of food, such as pizza or the like.

[0019] In a variant embodiment, each the first and second inner chambers has a constant section in the longitudinal direction.

[0020] Particularly, the first inner chamber, delimited by the first upper part, has a constant section along a plane perpendicular to the longitudinal axis of the furnace and the second inner chamber, delimited by the second lower part, has a constant section along a plane perpendicular to the longitudinal axis, such that the section of the first inner chamber is larger than the section of the second inner chamber.

[0021] Advantageously, the support element is located at the separating plane between the first upper part and the second lower part.

[0022] This arrangement allows positioning of the workpieces in the first inner chamber, corresponding to the upper part of the inner chamber, where most of the heat concentrates.

[0023] Nevertheless, heat still develops in a spiral, whereby workpieces are placed in the area where most of the heat concentrates, and are heated thereby and never by direct contact of the flame therewith.

[0024] In one embodiment, the flame source is located below the separating plane between the first upper part and the second lower part.

[0025] With this arrangement, combustion starts be-

fore reaching the inner chamber, such that the latter only contains heat and not unburned gases, which have a lower temperature and would cause temperature drops in the inner chamber. The direct result thereof is higher combustion efficiency and reduced workpiece oxidation.

[0026] In a preferred variant embodiment, a first upper part delimits a first inner chamber having a semicircular section and the second lower part delimits a second inner chamber having a semicircular section, the first upper part having a greater radius of curvature than the second lower part.

[0027] The semicircular shape assists spiral development of heat and increases combustion efficiency, by reducing the amount of fuel required to reach the required workpiece machining temperature.

[0028] Preferably, the outer casing is formed from a refractory material, to reduce heat loss and allow total combustion of gases in the inner chamber.

[0029] In a variant embodiment, the support element is composed of a plurality of subunits in mutually spaced relation, such that the support element has discontinuities along its longitudinal axis.

[0030] The presence of such discontinuities allows heat circulation such that part of the heat is refracted and increases temperature and part of it follows its path thereby assisting heat circulation.

[0031] Advantageously, the distance between the various subunits may be adjustable.

[0032] In a further embodiment, the support element consists of an element having a semicircular section, whose radius of curvature is slightly smaller than or equal to the radius of curvature of said second lower part.

[0033] Advantageously, the support element is also made of a refractory material formed into a semicircular element, such that the radius of the semicircle is slightly smaller than or equal to the radius of the semicircle that forms the second inner chamber.

[0034] If the radius of curvature of the support element is smaller than the radius of curvature of the second lower part, then a spacing may exist between the support element and the second lower part, which allows heat recirculation.

[0035] As dictated by the machining and/or manufacturing requirements, the spacing between the support element and the second lower part of the furnace may be designed to be adjustable from any maximum value to a zero minimum value, i.e. a minimum value indicating contact between the support element and the second lower part.

[0036] In this configuration, the support element preferably has at least one groove formed on the outer surface, which groove extends in the direction of the longitudinal axis of the furnace.

[0037] Such groove is formed to allow escape of exceeding gases.

[0038] Unlike prior art furnaces, which generally have an opening formed on the outer casing, communicating with the inner chamber for escape of unburned gases, the particular shape of the furnace of the present invention achieves total closure of the inner chamber, thereby affording reduced fuel consumption.

[0039] Furthermore, the furnace of the present invention may be used in continuous processing cycles, thereby affording further energy savings.

[0040] Also, since the furnace is divided into two distinct parts, the inner chamber may be fully opened, which will facilitate any maintenance and/or inspection of the workpiece machining area.

[0041] In one improvement, the furnace of the present invention has a hinge element located at the lateral longitudinal edge connecting the first upper part to the second lower part, such that the first upper part pivots about the connecting edge.

[0042] These and other features and advantages of the invention will be more apparent from the following description of a few embodiments shown in the accompanying drawings, in which:

Figs. 1a, 1b and 1c are three perspective views of the furnace of the present invention, according to a possible embodiment;

Figs. 2a and 2b are sectional views of the furnace of the present invention, as taken along a vertically oriented plane perpendicular to the longitudinal axis of the furnace.

[0043] It shall be noted that the figures show a preferred embodiment of the inventive furnace, suitable for forging, although this variant is for illustrative purposes only, and for better understanding the meaning and advantages of the present invention, and shall not be deemed to limit the concepts as set forth in the present application.

[0044] Figures 1a, 1b and 1c show three perspective views of the furnace of the present invention, particularly one view of the outer casing and two views of the inner chamber.

[0045] The furnace of the present invention comprises an inner chamber, which receives the workpieces 5 supported by at least one support element 4, and which is delimited by an outer casing 1.

[0046] At least one flame generating source 3, such as a burner or the like, is provided in the inner chamber, and the furnace has an opening 6 for access to the inner chamber, formed in a wall 112 oriented substantially perpendicular to the longitudinal axis of the furnace.

[0047] The outer casing 1 is composed of at least two parts 11 and 12, i.e. a first upper part 11 and a second lower part 12, which delimit a first inner chamber 111 and a second inner chamber 121 respectively, and which are in mutual contact along a parallel separating plane, containing the longitudinal axis A of the furnace and having a substantially horizontal orientation.

[0048] Furthermore, the section of the first inner chamber 111 is larger than the section of the second inner chamber 121, such that the first upper part 11 is only

connected with the second lower part 12 along a lateral longitudinal edge 13, and forms a slot 31 on the opposite longitudinal edge, for accommodation and/or access of the flame generating source 3.

[0049] In the variant embodiment as shown in figures 1a to 2b, both the first inner chamber 111 and the second inner chamber 121 have a constant section in the direction of the longitudinal axis A of the furnace, such that the section of the first inner chamber 111 is larger than the section of the second inner chamber 121.

[0050] Advantageously, the support element is located at the separating plane between the first upper part 11 and the second lower part 12.

[0051] Due to this particular arrangement, the workpieces 5 may be introduced through the opening 6 for access to the inner chamber, into the inner chamber 111 which corresponds to the area where most of the heat developed by the flame source 3 is concentrated.

[0052] The first upper part 11 and the second lower part 12 may have any shape and size, but in the variant as shown in the figures, the first upper part 11 delimits a first inner chamber 111 having a semicircular section and the second lower part 12 delimits a second inner chamber 121 having a semicircular section, the first upper part 11 having a radius of curvature larger than the radius of curvature of the second lower part 12.

[0053] Particularly referring to Figure 1b, the support element 4 consists of an element having a semicircular section, whose radius of curvature is smaller than the radius of curvature of the second lower part 12.

[0054] Particularly, the support element 4 is a semicylindrical element that comprises two base surfaces 41 having a semicircular section, a side wall 42 and a support wall 43 for supporting the workpieces 5.

[0055] The radius of the semicircular base surfaces 41 is smaller than the radius of curvature of the second lower part 12 such that a region 142 is formed between the side wall 42 and the inner wall of the second lower part 12, for heat circulation, as shown in Figures 2a and 2b.

[0056] In the variant embodiment as shown in Figure 1b, the side wall 42 of the support element 4 has a groove 421 extending in the direction of the longitudinal axis A of the furnace.

[0057] Such groove 421 communicates with the inner chamber and allows escape of exceeding gases therein, while allowing total closure of the furnace, e.g. by means of removable cover panels for covering the access opening 6.

[0058] Figure 1c shows a variant embodiment of the support element 4, in which the latter is composed of a plurality of subunits 411 in mutually spaced relation, such that the support element 4 has discontinuities 412 along its longitudinal axis.

[0059] Unlike the arrangement of Figure 1b, the support element 4 has a radius of curvature substantially equal to the radius of curvature of the second lower part 12, such that the side wall 42 is in contact with the second lower part.

[0060] It shall be further noted that Figures 1a to 2b show that each of the first inner chamber 111 and the second inner chamber 121 has its own constant radius of curvature, but the size thereof may be changed according to construction needs.

[0061] Also, it shall be noted that an additional opening 61 may be provided, as shown in Figure 1a, for escape of exceeding gases that flow through the groove 421.

[0062] Furthermore, a crucible may be placed in a position similar to that of the groove 421, to allow the inventive furnace to also serve for melting metals or glass.

[0063] The basic aspect of the furnace of the present invention is the formation of a housing slot 31 allowing the heat in the inner chamber to develop as shown in Figures 2a and 2b.

[0064] Figures 2a and 2b show a section taken along a vertical plane perpendicular to the longitudinal axis of the furnace of the present invention, which is particularly formed according to the variant embodiment as shown in Figures 1a and 1b.

[0065] The illustrated section clearly shows that the inner chamber of the furnace is delimited at its top by a first upper part 11 and at its bottom by a second lower part 12, which parts 11 and 12 have constant and different sections, namely the first upper part 11 having a larger section than the second lower part 12.

[0066] Accordingly, the inner chamber is divided into a first inner chamber 111 delimited by the first upper part 11 and a second inner chamber 121 delimited by the second lower part 12.

[0067] This particular arrangement leads to the formation of a housing slot 31 for the flame source 3.

[0068] The flame source 3 consists of a gas burner, which receives gas from an external gas supply connected via the conduit 312.

[0069] In a possible, embodiment, the flame source 3 is held in the slot 31 below the separating plane between the first upper part 11 and the second lower part 12.

[0070] The workpieces 5 are placed on the support element 4, whereby they are not directly contacted by the flame of the burner 3, but are heated by the heat developed in the inner chamber

[0071] The arrow 7 designates the spiral development of heat that is emitted by the flame of the burner 3, runs through the bottom wall of the first upper part 11 and propagates into the region between the support element 4 and the second lower part 12.

[0072] This will afford a homogeneous temperature increase in the inner chamber, particularly in the first part of the inner chamber 111 in which most of the heat concentrates, and allows achievement of the desired temperature for machining the workpiece 6.

[0073] Since both fuel gas and air are required to be introduced into the inner chamber, the conduit 312 shall be adapted to allow inflow of both fuel gas and air, such that the access opening 6 may be completely closed, thereby optimizing combustion efficiency and reducing energy waste.

Claims

1. A furnace suitable for forging comprising an inner chamber, which inner chamber receives the workpieces (5) supported by at least one support element (4), which inner chamber is delimited by an outer casing (1),
at least one flame generating source (3), such as a burner or the like, being provided in said inner chamber
said furnace having at least one opening (6) for access to said inner chamber, formed in a wall (112) oriented substantially perpendicular to the longitudinal axis (A) of said furnace
characterized in that
said outer casing (1) is composed of at least two parts, i.e. a first upper part (11) and a second lower part (12), which delimit a first inner chamber (111) and a second inner chamber (121) respectively, which two parts are in mutual contact along a parallel separating plane, containing the longitudinal axis (A) of said furnace and having a substantially horizontal orientation,
the section of said first inner chamber (111) being larger than the section of said second inner chamber (121), so that the first upper part (11) is only connected to the second lower part (12) along a lateral longitudinal edge (13), and forms a slot (31) on the opposite longitudinal edge, in which slot is installed the said flame generating source (3).

2. A furnace suitable for forging as claimed in claim 1, wherein each of said first (111) and second (121) inner chambers has a constant section in the longitudinal direction (A).

3. A furnace suitable for forging as claimed in claim 1 or 2, wherein said support element (4) is located at said separation plane between said first upper part (11) and said second lower part (12).

4. A furnace suitable for forging as claimed in one or more of the preceding claims, wherein said flame generating source (3) is held in said slot (31) below said separation plane between said first upper part (11) and said second lower part (12).

5. A furnace suitable for forging as claimed in one or more of the preceding claims, wherein said first upper part (11) delimits a first inner chamber (111) having a semicircular section and said second lower part (12) delimits a second inner chamber (121) having a semicircular section, said first upper part (11) having a greater radius of curvature than said second lower part (12).

6. A furnace suitable for forging as claimed in one or more of the preceding claims, wherein said support element (4) is composed of a plurality of subunits (411) in mutually spaced relation, such that said support element (4) has discontinuities (412) along its longitudinal axis.

7. A furnace suitable for forging as claimed in one or more of the preceding claims, wherein said support element (4) consists of an element having a semicircular section, whose radius of curvature is equal to and/or slightly smaller than the radius of curvature of said second lower part (12).

8. A furnace suitable for forging as claimed in one or more of the preceding claims, wherein said support element (4) has at least one groove (421) formed on the outer surface (42), which groove (421) extends in the direction of the longitudinal axis (A) of said furnace.

9. A furnace suitable for forging as claimed in one or more of the preceding claims, wherein said lateral longitudinal edge (13) connecting said first upper part (11) to said second lower part (12) has at least one hinge element, such that said first upper part (11) pivots about said connecting edge (13).

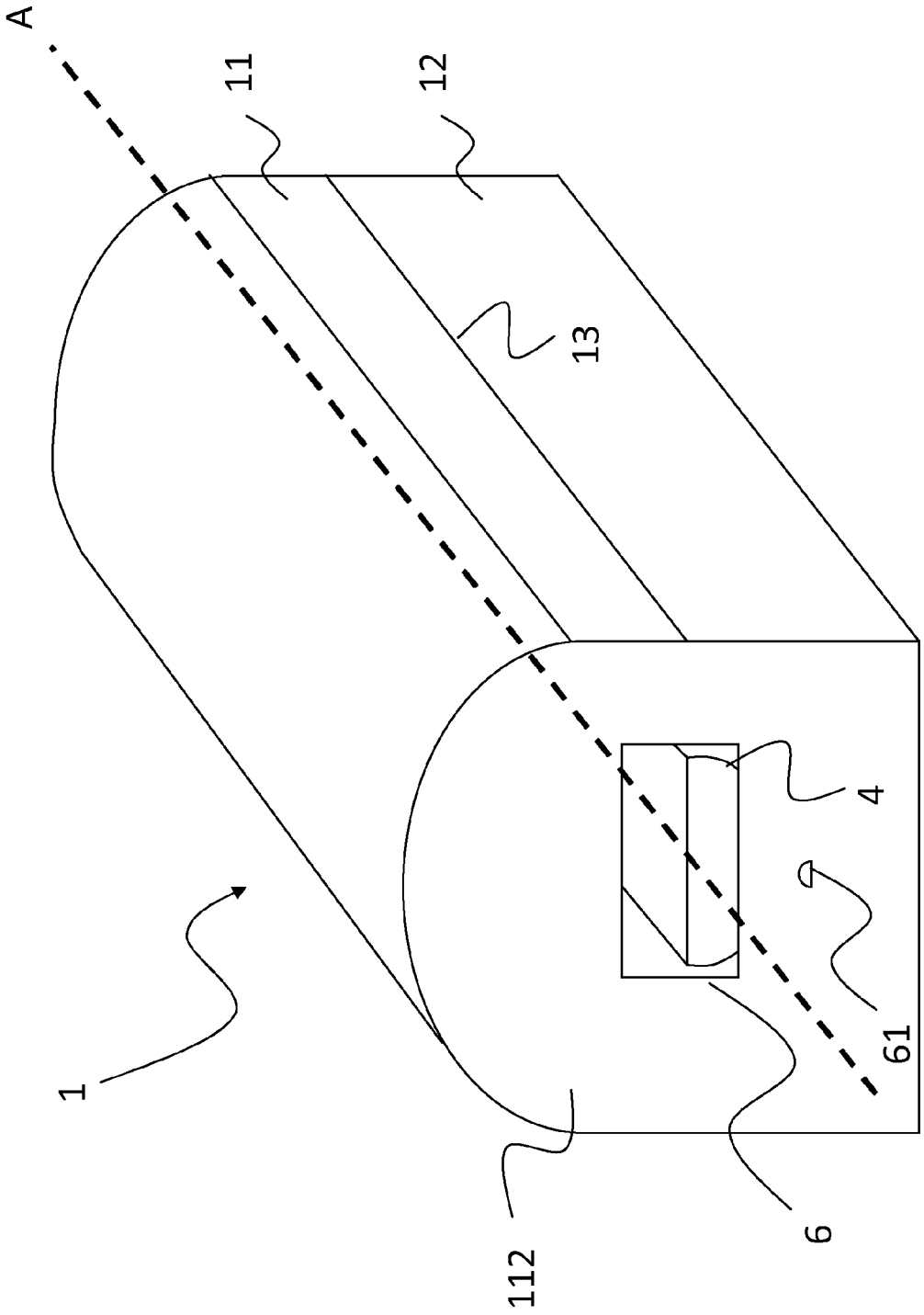

Fig. 1a

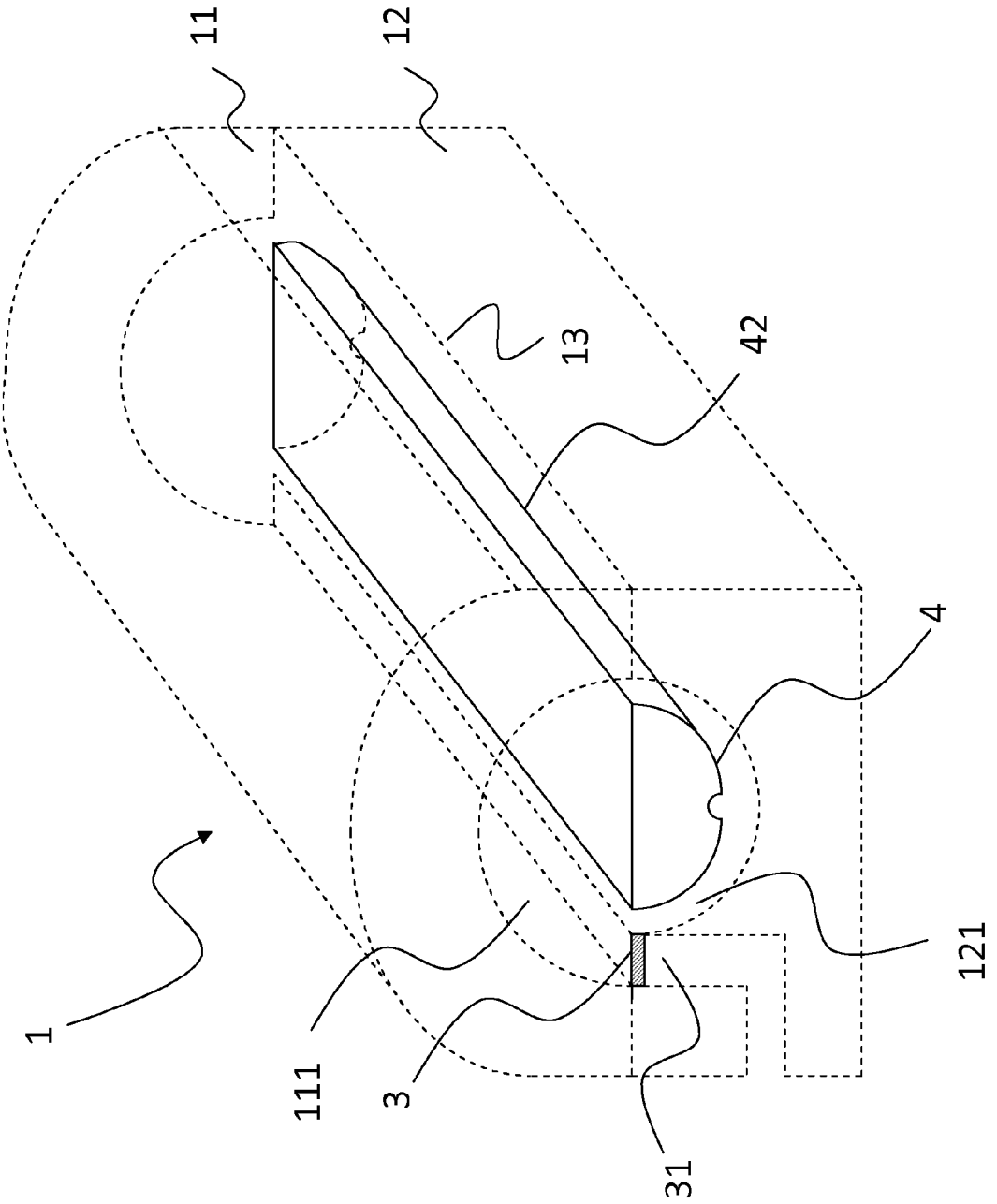

Fig. 1b

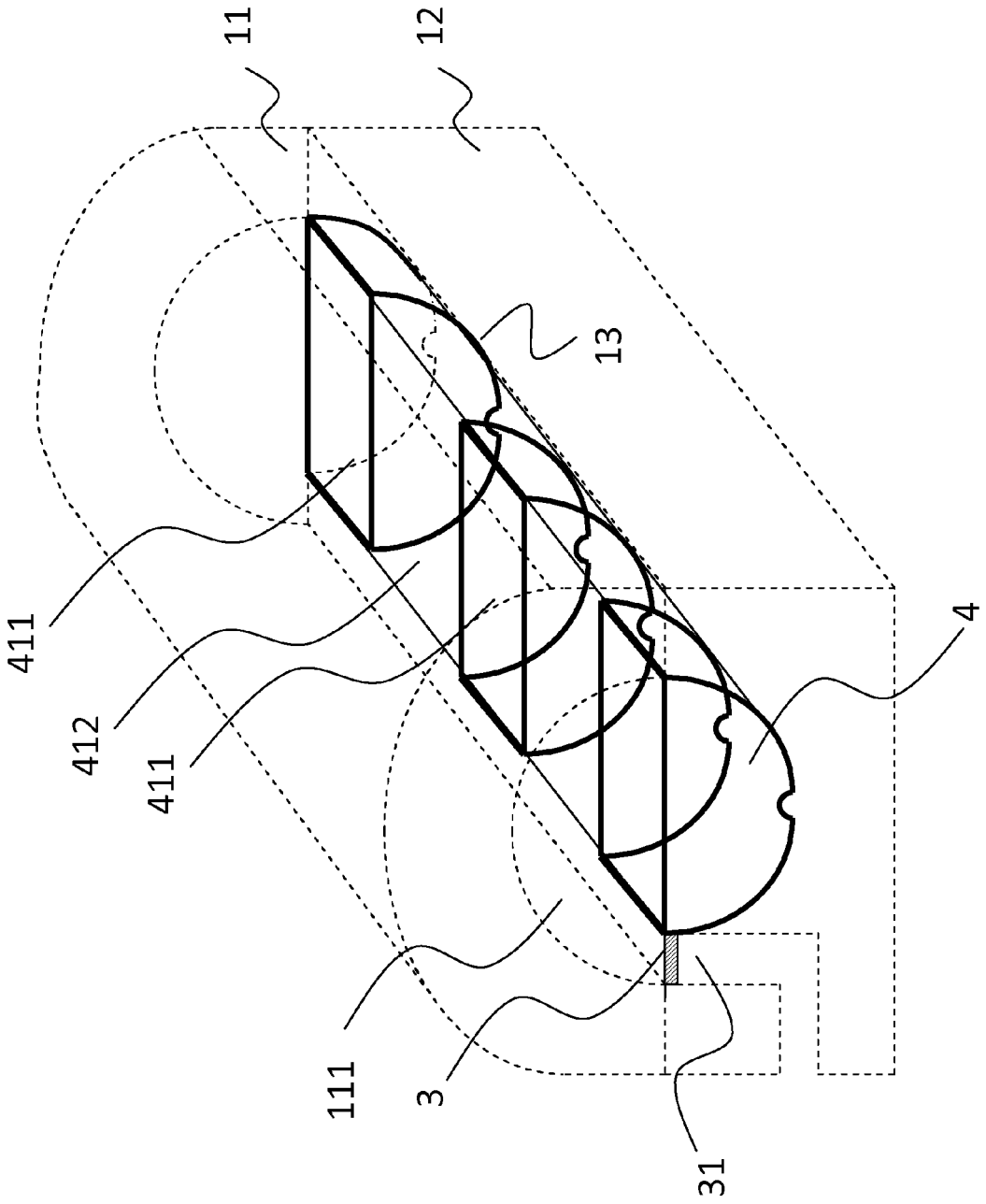

Fig. 1c

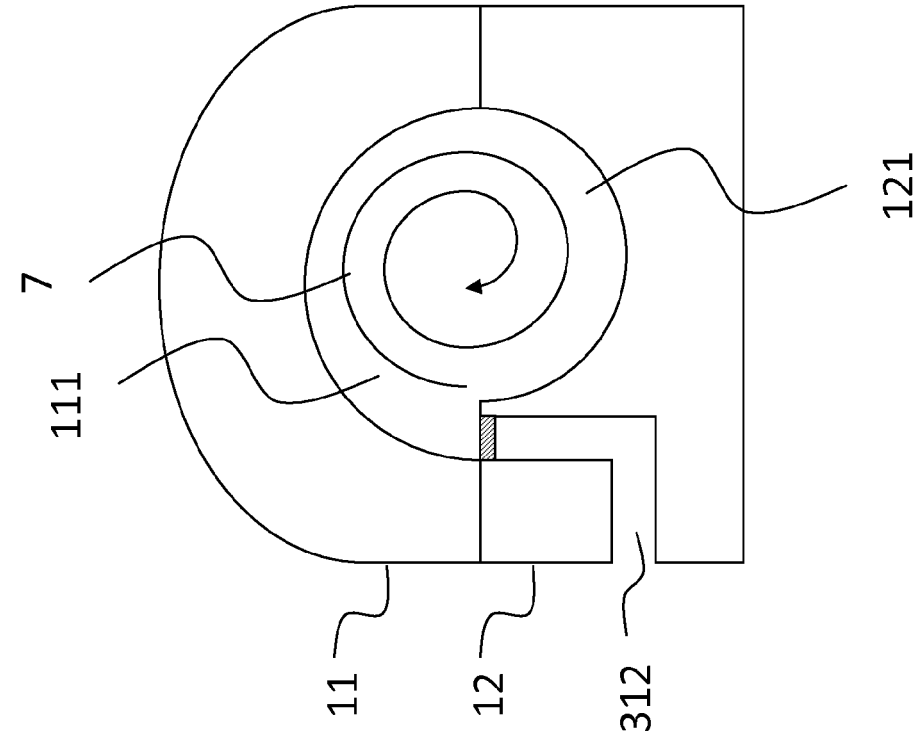

Fig. 2b

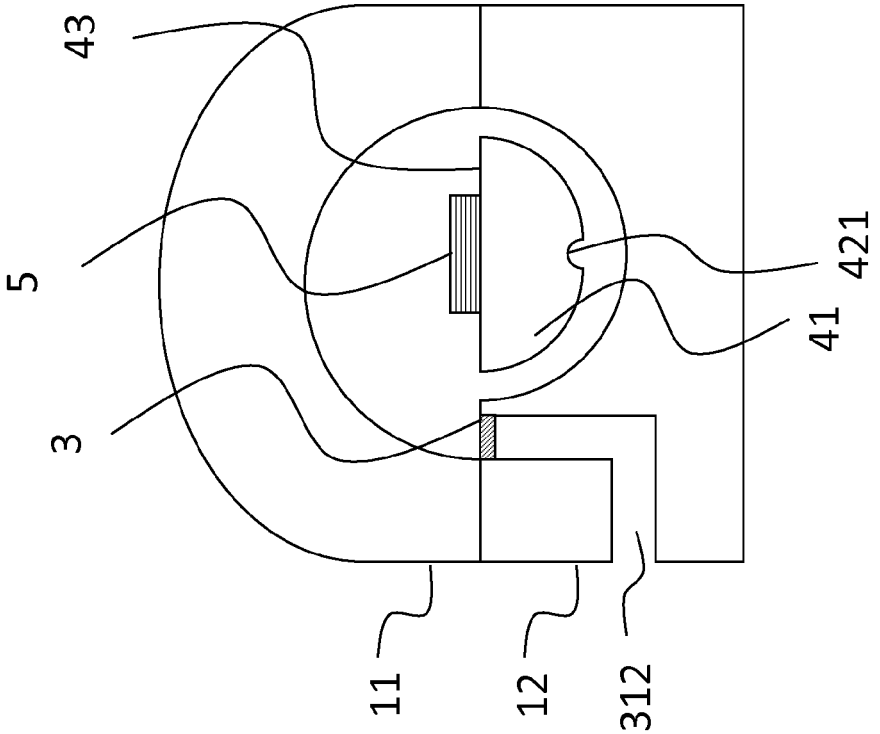

Fig. 2a

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EUROPEAN SEARCH REPORT

Application Number
EP 13 15 5139

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 3 334 879 A (AXEL NORDLING JOHAN) 8 August 1967 (1967-08-08) * figure 1 * -----	1-9	INV. F27B17/00 F27D7/02 B21J17/00
A,D	US 1 904 427 A (ELZE WALTER C) 18 April 1933 (1933-04-18) * figure 1 * -----	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

F27B
F27D
B21J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 May 2013	Peis, Stefano

CATEGORY OF CITED DOCUMENTS

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1 EPO FORM 1503 03.82 (P04C01)

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24-05-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3334879 A	08-08-1967	GB 1091799 A	22-11-1967
		US 3334879 A	08-08-1967
US 1904427 A	18-04-1933	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 1904427 A **[0004]**