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(54) **Method to obtain a spacer element for a radiant panel, corresponding apparatus to obtain a spacer element and spacer element thus obtained**

(57) Method to obtain a spacer element (10) configured to be inserted between the walls (16, 17) of a radiant panel (12) containing a heat-carrying fluid. The method comprises at least a first step to obtain a spacer body (28), hollow inside and having a lower base (25), a lateral

wall (26) and an upper wall (27) substantially parallel to said lower base (25), so as to define a compartment (32) of a substantially cylindrical shape, and a second step in which a plurality of lateral apertures (33, 35) are made on said lateral wall (26).

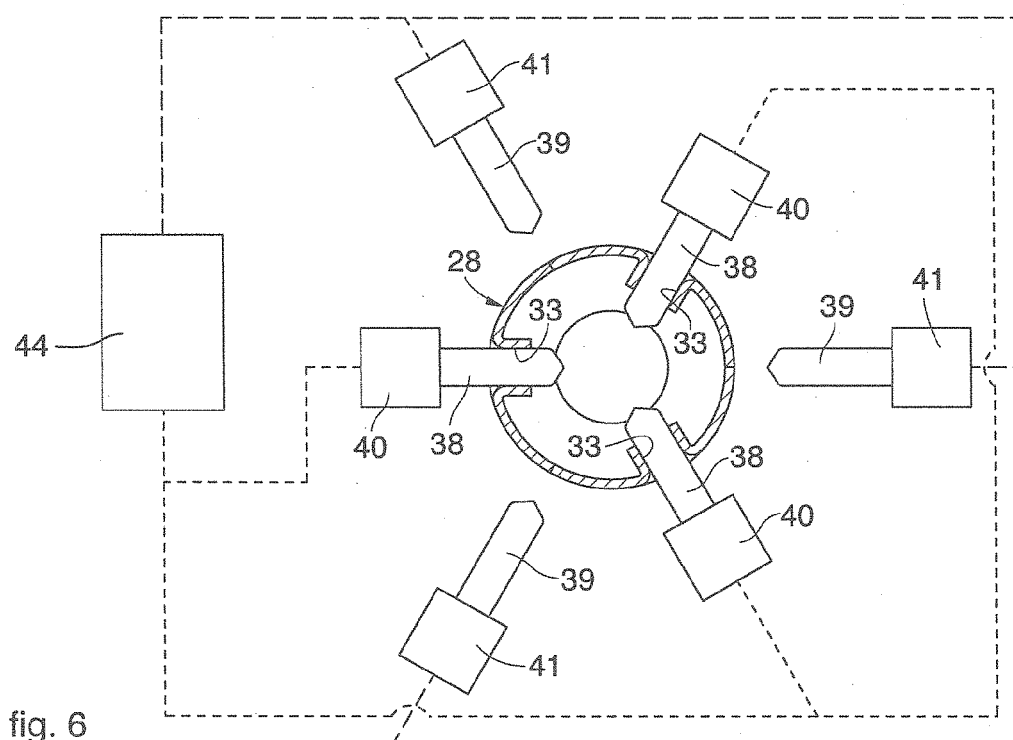


fig. 6

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a method and the corresponding apparatus to obtain a spacer element insertable inside a radiant panel of a heat radiator, so as to prevent its lateral walls from being crushed during the steps when it is connected under pressure with a corresponding connector.

[0002] The present invention also concerns the spacer element obtained with said apparatus and method.

BACKGROUND OF THE INVENTION

[0003] Heat radiators are known, such as for example radiators, comprising one or more radiant panels shaped so as to define inside them a substantially closed compartment to contain a heat-carrying fluid and make it circulate.

[0004] The radiant panels are hydraulically connected to each other by interposing, in twos, a connection element or connector. The connector is welded under pressure to the corresponding radiant panels, to guarantee the fluid-tight seal of the connection.

[0005] To prevent the radiant panels from deforming during the pressure welding steps, it is known to insert inside them a spacer element that contrasts the pressure exerted, thus preventing any possible deformations.

[0006] A method to obtain a spacer element is known, used to connect two radiant panels to a connector, with a substantially cylindrical shape and defining an internal compartment. The spacer element comprises axial and lateral apertures, which allow the passage of the heat-carrying fluid. The method provides that all the lateral apertures are obtained at the same time by drilling, or by shearing, with the subsequent removal of material.

[0007] One disadvantage is that the lateral apertures reduce the resistance to compression, in that they weaken the structure of the spacer element.

[0008] It is therefore known to increase the thickness of the spacer element, but this entails an increase in the primary material needed, with a resulting increase in times and costs of production.

[0009] Another method to obtain a spacer element of a cylindrical shape and defining an internal compartment is known, the lateral wall of which is cut so as to obtain at least one lip. The latter is subsequently bent, using one or more tools moved radially, toward the inside of the compartment in order to define at least one lateral aperture. Each lip thus defines a support for the lower base and upper wall of the spacer element, increasing the resistance to compression thereof.

[0010] To increase the flow rate of the heat-carrying fluid passing through the spacer element and therefore to increase the heat exchange between the radiant panels and the surrounding environment, one solution provides to increase the number of lateral apertures of the

spacer element.

[0011] From document EP 1681530 in the name of the present Applicant, a method is known which allows to obtain, in the spacer element, up to four or five lateral apertures. By increasing the number of lateral apertures, however, the problem arises of reciprocal interference between the tools and possibly also with the lips which are obtained. This means that it is not possible to further increase the number of lateral apertures to obtain a greater flow rate of the fluid.

[0012] One purpose of the present invention is to perfect a method which allows to obtain a spacer element, insertable inside a radiant panel, which allows to increase the delivery capacity of the spacer element without reducing the resistance to compression.

[0013] Another purpose of the present invention is to perfect a method which avoids interference at least between the tools used to obtain the spacer element.

[0014] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0015] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0016] In accordance with the above purposes, a method according to the present invention, which overcomes the limits of the state of the art and eliminates the defects present therein, is used to obtain a spacer element insertable inside a radiant panel containing a heat-carrying fluid.

[0017] The method comprises at least the following steps.

[0018] A first step provides to obtain a spacer body, hollow inside and with a lower base, a lateral wall and an upper wall substantially parallel to the lower base, so as to define a substantially cylindrical shaped compartment around its own longitudinal axis.

[0019] A second step provides to obtain a plurality of lateral apertures on the lateral wall of the spacer body.

[0020] According to one feature of the present invention, the second step comprises at least a first sub-step in which a first plurality of the lateral apertures is obtained, by means of a first plurality of tools, and a second sub-step, subsequent to the first sub-step, in which a second plurality of the lateral apertures is obtained, by means of a second plurality of tools.

[0021] In this way the risk of reciprocal interference between the tools which make all the lateral apertures is reduced, as the latter are made at least in two different moments.

[0022] This means that the first and the second plurality of tools which penetrate inside the compartment of the spacer body to obtain the lateral apertures move alter-

nately. The tools therefore have at their disposal an amount of space such that they do not run the risk of reciprocal interference.

[0023] Some forms of embodiment of the present invention provide that the drive of the first tools and the second tools is commanded by a command and control unit which is programmed to determine the simultaneous drive of the first plurality of tools and subsequently the simultaneous drive of the second plurality of tools.

[0024] According to another feature of the present invention, each of the first lateral apertures is made in an alternate and angularly offset position with respect to a corresponding second lateral aperture, so that the first and the second apertures are angularly equidistant with respect to each other.

[0025] This means that each tool has at its disposal a space such that it does not run the risk of, or at least limits the risk of, interfering with adjacent tools at both its sides.

[0026] Moreover, the tools corresponding to the first plurality of lateral apertures, as they are disposed angularly equidistant and thrusting along concurrent directions toward the center of the spacer body, prevent it from being displaced during the making of the lateral apertures. A similar consideration applies for the tools corresponding to the second plurality of lateral apertures.

[0027] In accordance with another feature of the present invention, before the second step of making the apertures an incision operation is provided on the lateral wall, in order to obtain, in correspondence to the position in which the lateral apertures will be made, at least one lip which is subsequently bent, respectively by the first plurality of tools and by the second plurality of tools, toward the inside of the compartment of the spacer body.

[0028] Each lip defines a stiffening element of the spacer body, increasing the resistance to compression applied between the lower base and the upper wall of the spacer body.

[0029] The present invention also concerns an apparatus to obtain a spacer element obtained as described above.

[0030] Moreover, the present invention also concerns the spacer element as described above. In particular, with the present invention it is possible to obtain a spacer element having at least six lateral apertures even though the diameter of the lower base and the upper wall has a maximum value of 25 mm.

[0031] Furthermore, the lateral apertures have a transverse width, that is, evaluated orthogonally with respect to the longitudinal axis of the spacer body, which is comprised between 0.2 and 0.3 times the diameter.

[0032] Indeed, in view of the reduced sizes of the diameter of the lower base and upper wall, with the methods known in the state of the art it was not possible to obtain this large number of apertures having such widths, given that this entailed the disadvantages listed above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] These and other characteristics of the present invention will become apparent from the following description of one form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a part of a heat radiator in which two spacer elements according to the present invention are inserted;
- fig. 2 shows a step in the assembly of the heat radiator in fig. 1;
- fig. 3 is a plan sectioned view of the spacer element in fig. 1;
- fig. 4 is a lateral sectioned view of the spacer element in fig. 1;
- fig. 5 shows a sequence of operations to obtain part of the spacer element in figs. 3 and 4;
- fig. 6 is a schematic representation of one step in the method to make the spacer element in figs. 3 and 4;
- fig. 7 is a schematic representation of another step in the method to make the spacer element in figs. 3 and 4.

[0034] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings.

DETAILED DESCRIPTION OF ONE FORM OF EMBODIMENT

[0035] With reference to fig. 1, a spacer element 10 is inserted inside a heat radiator 11 comprising two radiant panels 12, which are only partly shown, parallel to each other, and a connector 13 interposed between the two radiant panels 12 and connected to them in a sealed manner, so as to form a hydraulic circuit.

[0036] Each radiant panel 12 comprises an inner wall 16 and an outer wall 17 which define a compartment 18 able to contain a heat-carrying fluid, such as for example hot water.

[0037] Normally, the connector 13 is connected to the inner wall 16 of each of the two radiant panels 12 by pressure welding. This operation occurs by bringing a first electrode 19 and a second electrode 20 reciprocally closer (fig. 2), positioned in contact with the corresponding outer walls 17 of the two radiant panels 12.

[0038] The spacer element 10 is able to contrast the pressure exerted by the two electrodes 19 and 20, to prevent the inner walls 16 and the outer walls 17 from deforming, so as to keep the width of each radiant panel 12 unchanged.

[0039] The spacer element 10 is made in the following steps.

[0040] In a metal disk 23 (fig. 5a), obtained for example by cutting a round piece or bar with a circular section, a

deformation is performed on said metal disk 23, so as to obtain a cup 24 (fig. 5b).

[0041] The cup 24 comprises a lower base 25, a lateral wall 26 and is substantially axial-symmetric with respect to its longitudinal axis X.

[0042] Subsequently, the cup 24 is deformed, for example by a deep-drawing operation, so as to increase the height of the lateral wall 26 (fig. 5c).

[0043] The upper part of the lateral wall 26 is subjected in sequence to a first and second bending (figs. 5d and 5e), so as to obtain an upper wall 27 substantially parallel to the lower base 25.

[0044] The second bending also defines an upper central aperture 30 on the upper wall 27, which allows, during use, the heat-carrying fluid to pass from the connector 13 to the corresponding radiant panel 12, or vice versa.

[0045] After the second bending, the upper central aperture 30 is subjected to a calibration operation, to confer upon it a circular shape with its center on the longitudinal axis X. After this operation, the lower base 25 can be holed to make a lower central aperture 31, also circular and having its center on the longitudinal axis X.

[0046] The lower base 25, the lateral wall 26 and the upper wall 27 define a spacer body 28, hollow inside and defining a compartment 32 having a substantially cylindrical shape.

[0047] A first plurality of lateral apertures is made in the lateral wall 26, in this case three first lateral apertures 33, and a second plurality of lateral apertures, in this case three second lateral apertures 35.

[0048] Each of the first lateral apertures 33 is made angularly offset and equidistant with respect to a corresponding second lateral aperture 35.

[0049] The first lateral apertures 33 and the second lateral apertures 35 are identical to each other and are made as described hereafter.

[0050] The lateral wall 26 is cut in a longitudinal direction with respect to the axis X and subsequently in a direction transverse to the axis X, so as to obtain, for each lateral aperture 33 and 35, an incision shaped like an H rotated by 90°, which defines two lips 34, associated with the lateral wall 26 in a connection zone 37 (fig. 3).

[0051] Subsequently, the lips 34 corresponding to the first lateral apertures 33 are bent with respect to their connection zone 37 by means of a first plurality of tools 38, which enter inside the compartment 32 so as to simultaneously obtain the three first lateral apertures 33 (fig. 6).

[0052] In a subsequent step, the lips 34 corresponding to the second lateral apertures 35 are bent with respect to their connection zone 37 by means of a second plurality of tools 39, which enter inside the compartment 32 so as to obtain the second lateral apertures 35 (fig. 7).

[0053] Each of the tools 38 and 39 is connected to a linear actuator 40 respectively 41, which in turn is connected to a command and control unit 44.

[0054] The command and control unit 44 is suitable to command the simultaneous drive of the first plurality of

tools 38 and respectively the second plurality of tools 39. The activation of the first plurality of tools 38 is independent from the activation of the second plurality of tools 39.

[0055] In this case therefore, the lateral apertures 33 and 35 are made in the same way, but alternately or angularly offset, at different moments. This allows the tools 38 and 39 that make the lateral apertures 33 and 35 not to interfere reciprocally inside the compartment 32, and thus have the possibility to obtain a greater number of lateral apertures compared with solutions known in the state of the art.

[0056] During the steps of making the first lateral apertures 33 and the second lateral apertures 35, the spacer element 10 is kept in position by the contrasting action respectively of the first plurality of tools 38 and the second plurality of tools 39, which are disposed angularly equidistant at 120° from each other on the lateral wall 26 and all converge toward the center.

[0057] Furthermore, to reinforce the contrasting action of the tools disposed equidistant, the spacer element 10 is housed, during the making of the lateral apertures 33, in circular shaped seating, not shown in the drawings, with a diameter equal to that of the spacer element 10 and having a cylindrical lateral wall with a maximum height equal to the thickness of the lower base 25.

[0058] It is clear that modifications and/or additions of parts may be made to the method, apparatus and spacer element as described heretofore, without departing from the field and scope of the present invention.

[0059] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to make many other equivalent forms of method, apparatus and spacer element, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

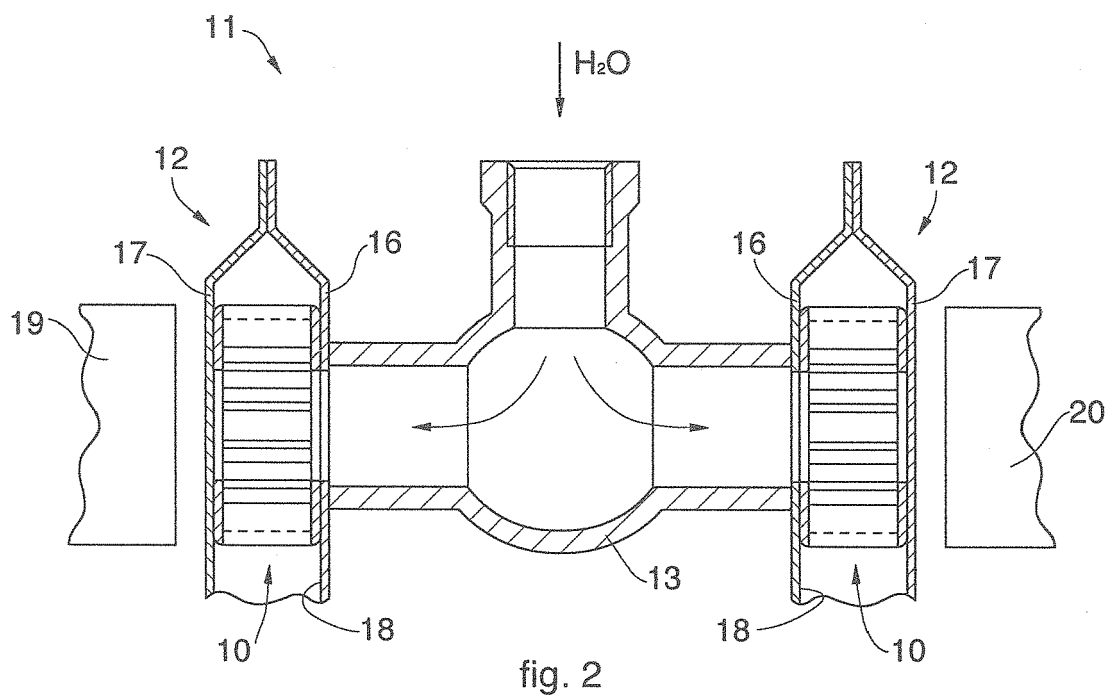
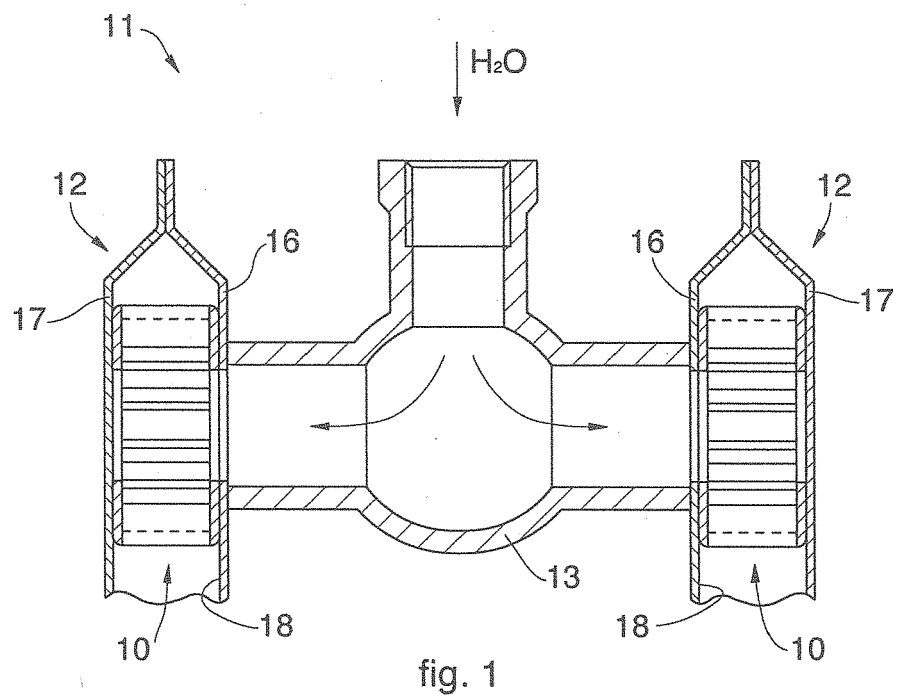
1. Method to obtain a spacer element (10) configured to be inserted between the walls (16, 17) of a radiant panel (12) containing a heat-carrying fluid, comprising at least a first step to obtain a spacer body (28), hollow inside and having a lower base (25), a lateral wall (26) and an upper wall (27) substantially parallel to said lower base (25), so as to define a compartment (32) of a substantially cylindrical shape, and a second step in which a plurality of lateral apertures (33, 35) are made on said lateral wall (26). **characterized in that** said second step comprises at least a first sub-step in which a first plurality of said lateral apertures (33) are made by means of a first plurality of tools (38) and a subsequent second sub-step in which a second plurality of said lateral apertures (35) are made by means of a second plurality of tools (39).
2. Method as in claim 1, **characterized in that** each of

said first lateral apertures (33) is made in an alternate position and angularly offset with respect to a corresponding second lateral aperture (35),

3. Method as in claim 1 or 2, **characterized in that** each of said first (33) and second (35) lateral apertures is made offset and angularly equidistant with respect to said first (33) and adjacent second (35) lateral aperture.
4. Method as in any claim hereinbefore, **characterized in that** before said second step an incision operation is provided on said lateral wall (26) in order to make at least a lip (34) which is subsequently bent, respectively by the first plurality of tools (38) and by the second plurality of tools (39), toward the inside of the compartment (32) of the spacer body (28) so as to make said first (33) and second (35) lateral apertures.
5. Method as in claim 4, **characterized in that** two lips (34) are made for each of said lateral apertures (33, 35).
6. Method as in any claim hereinbefore, **characterized in that** at least three first lateral apertures (33) are made in said first sub-step, **and in that** at least three second lateral apertures (35) are made in said second sub-step.
7. Apparatus to obtain a spacer element (10) configured to be inserted between the walls (16, 17) of a radiant panel (12) containing a heat-carrying fluid, in which said spacer element (10) comprises a spacer body (28), hollow inside and having a lower base (25), a lateral wall (26) and an upper wall (27) substantially parallel to said lower base (25), so as to define a compartment (32) of a substantially cylindrical shape, said apparatus comprising a plurality of tools (38, 39) suitable to obtain, during an execution step, a plurality of lateral apertures (33, 35) in said lateral wall (26) of said spacer body (28), **characterized in that** it comprises a first plurality of tools (38) and a second plurality of tools (39) associated to a command and control unit (44), said command and control unit (44) being suitable to command, in a first sub-step of said execution step, the simultaneous drive of said first plurality of tools (38) and to make a first plurality of said lateral apertures (33) and, in an independent and temporally staggered manner with respect to said first plurality of tools (38), and in a second sub-step of said execution step, the simultaneous drive of said second plurality of tools (39) to make a second plurality of said lateral apertures (35).
8. Apparatus as in claim 7, **characterized in that** each of said first tools (38) is disposed in an alternate po-

sition and angularly offset with respect to a corresponding second tool (39).

9. Apparatus as in claim 7 or 8, **characterized in that** each of said first (38) and second (39) tools are disposed offset and angularly equidistant with respect to one of said adjacent first (38) and second (39) tools.
10. Apparatus as in any claim from 7 to 9, **characterized in that** each of the first (38) and second (39) tools is connected to a linear actuator (40, 41) associated to said command and control unit (44),
11. Apparatus as in any claim from 7 to 10, **characterized in that** it comprises at least three of said first tools (38) and three of said second tools (39).
12. Spacer element insertable between the walls (16, 17) of a radiant panel (12) containing a heat-carrying fluid, and comprising a spacer body (28), hollow inside and having a lower base (25), a lateral wall (26) provided with a plurality of lateral apertures (33, 35) and an upper wall (27) substantially parallel to said lower base (25), so as to define a compartment (32) of a substantially cylindrical shape and having a longitudinal axis (X), **characterized in that** it is made according to the method in claim 1, **in that** there are at least six of said lateral apertures (33, 35) **and in that** the diameter of said lower base (25) and of said upper wall (27) has a maximum value of 25 mm.
13. Spacer element as in claim 12, **characterized in that** the transverse width, that is, orthogonal to said longitudinal axis (X), of each lateral aperture (33, 35), is comprised between 0.2 and 0.3 times said diameter.



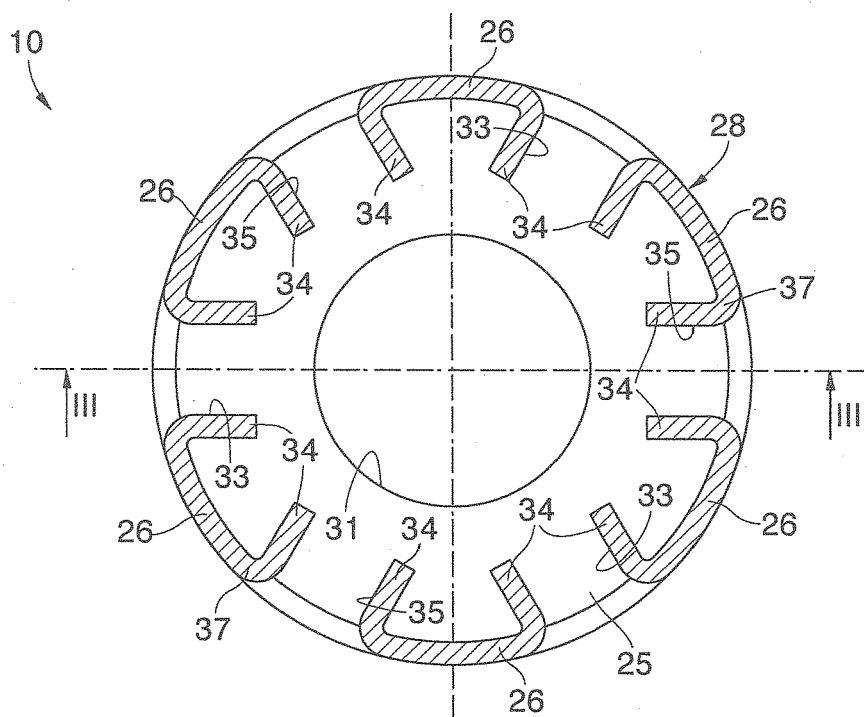


fig. 3

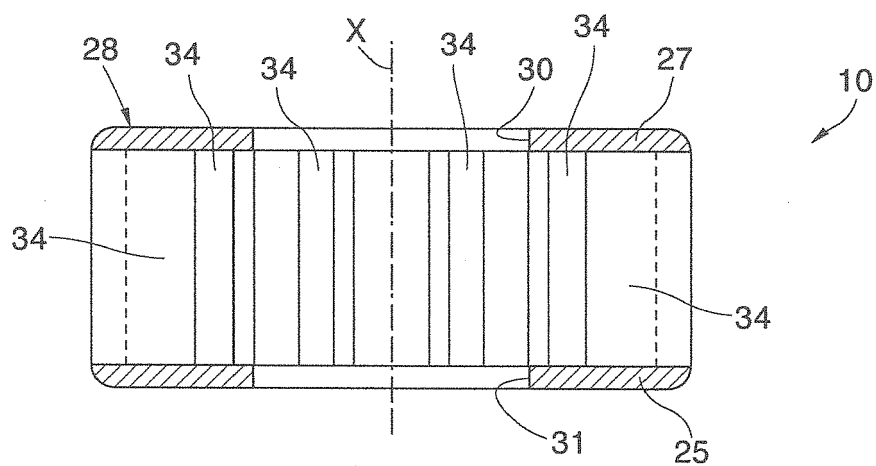


fig. 4

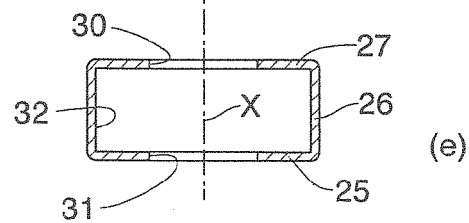
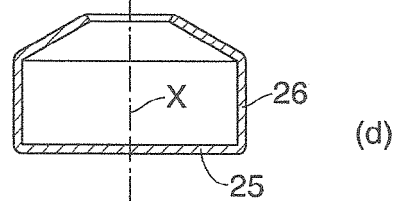
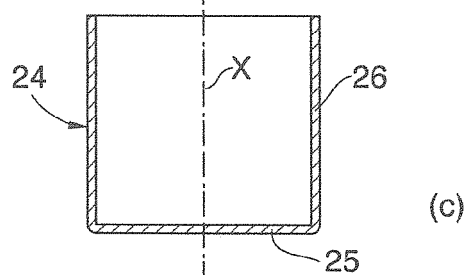
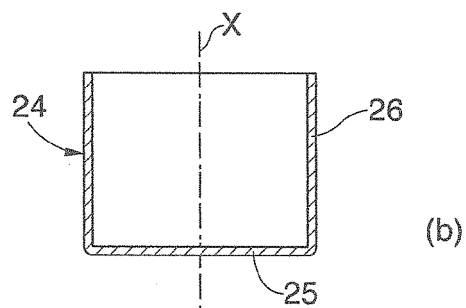
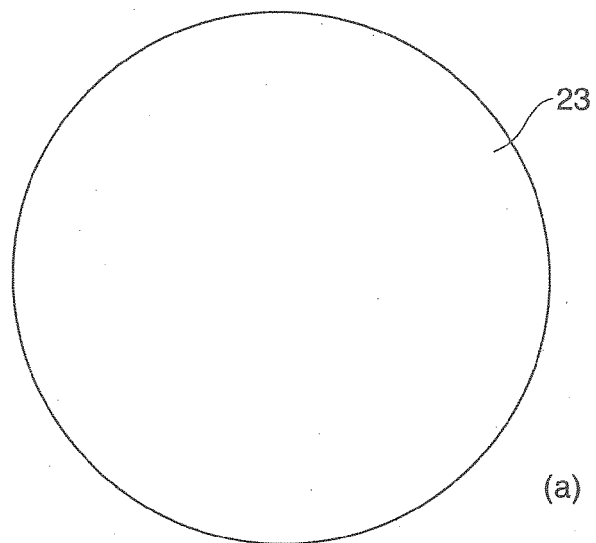
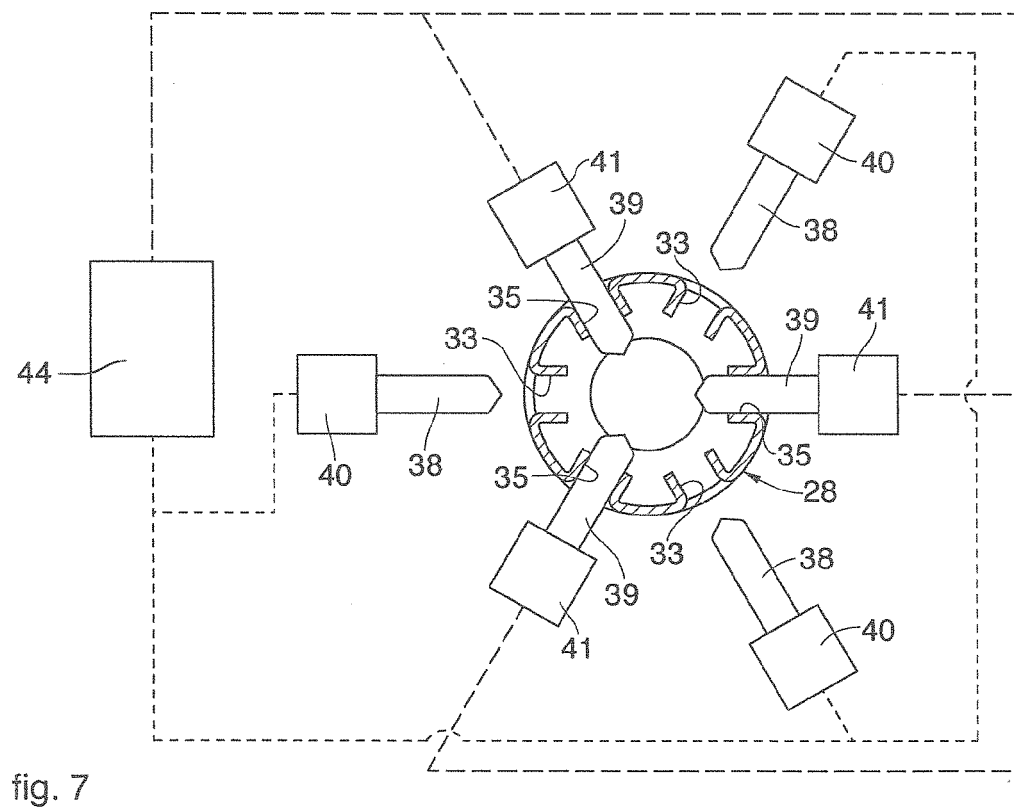
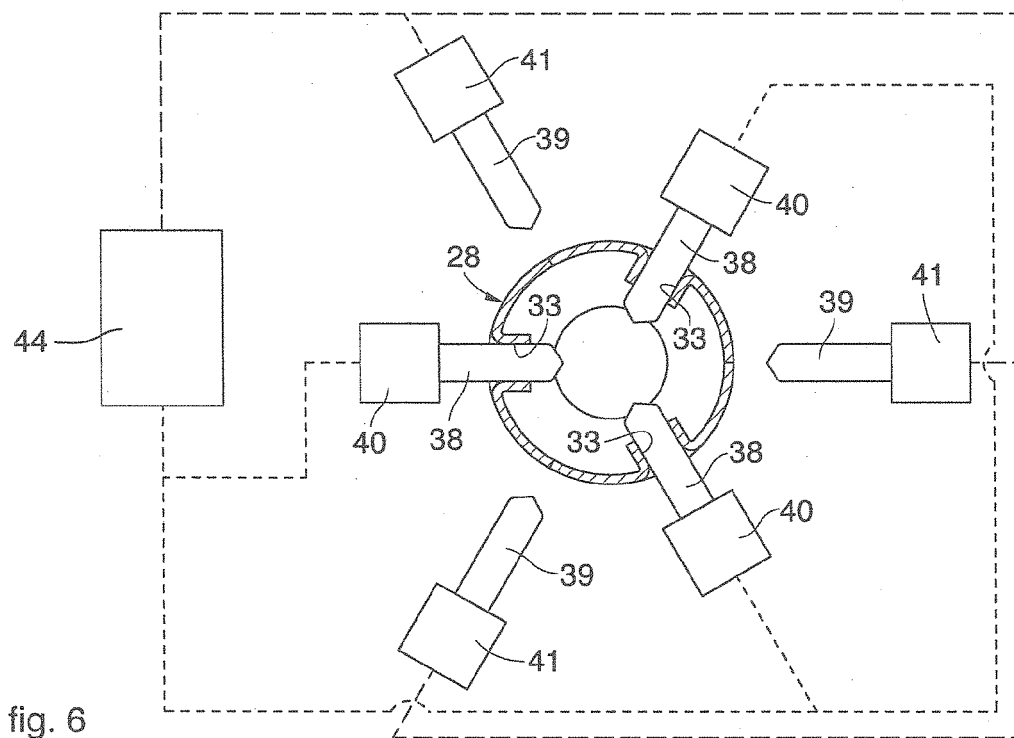


fig. 5





EUROPEAN SEARCH REPORT

Application Number
EP 13 17 5747

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 September 2013	Examiner Knecht, Frank
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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