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(54) Title: VALVE PLATE ASSEMBLY

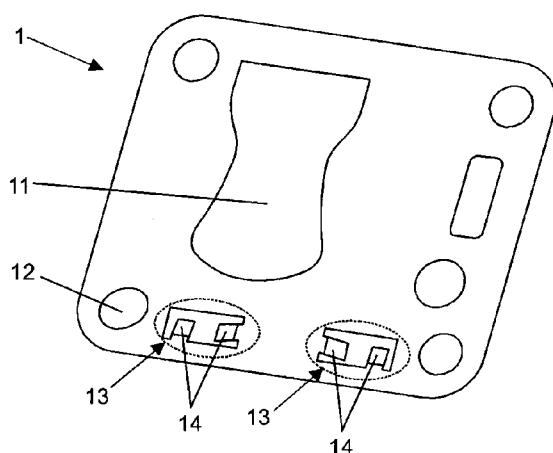


FIG. 1

(57) Abstract: The present invention refers to a valve plate assembly for feeding compressors, wherein said valve plate assembly is composed by at least one body (1, 4, 6, 7) and at least one valve plate (2, 5). In this context, at least one body (1, 4, 6, 7) is composed by at least one extension (14, 44, 64, 74); at least one valve plate (2, 5) is composed by at least one groove (23, 53); at least one extension (14, 44, 64, 74) of the body (1, 4, 6, 7) is capable of cooperative association with the at least one groove (23, 53) of the valve plate (2, 5); and at least one body (1, 4, 6, 7) is associated with at least one valve plate (2, 5) by housing at least one extension (14, 44, 64, 74) of the body (1, 4, 6, 7) in the interior of at least one groove (23, 53) of the valve plate (2, 5).

"VALVE PLATE ASSEMBLY"

Field of the Invention

The present invention refers to a valve plate assembly for feeding compressors, especially referring to the attachment of a valve body for compressors that are employed in refrigeration equipments.

Background of the Invention

As already known by the skilled in the art, compressors of refrigeration equipments are alternative or linear compressors. Such compressors includes a piston capable of exerting a linear alternative movement in the interior of a chamber that is usually defined by the compressor block.

The alternative movement of the piston is responsible for the compression of the refrigeration gas, wherein the same flows towards the internal and external compression chamber through by-pass valves, which only enables a one-way flow, orientating the same after compression and avoiding its return to the interior of the chamber, when a novel portion of gas is allowed to enter.

Said valves are commonly placed in a region near the upper end of the compression chamber (named as header), so that the entrance of the gas in the interior of the chamber is only allowed when the pressure in the interior of the same is lower than the pressure of the gas source and, also, that the gas leave the interior of the chamber only when the pressure in the interior of the same is higher than the pressure of the pressurized refrigeration line.

Consequently, in order to spend less money on manufacturing and enable the operation of the compressor under high speed (and, consequently, under high frequencies of gas compression and admission), it is common to use vane valves for this application.

Vane valves consist, basically, of a sheet (preferably a metallic one) comprising a first end attached to a valve plate and a second end that is let free to oscillate, with one of the facing sides thereof assembled in a juxtaposed position in relation to the surface of the valve plate. The region, wherein the contact of the end of the valve, that is let free to oscillate, with the valve plate occurs, comprises at least one orifice by which the refrigeration gas passes.

Thus, according to the facing side of the valve plate in which the valve is assembled, it is possible to define if the same has the function of allowing the gas flow inwards or outwards the compression chamber.

A very common inconvenience in the functioning of this type of valve addresses in the fact that said valves frequently shift from the correct position of

operation, mainly during assemblage (wherein its shift tends to not occur after the assemblage).

Regarding a suction valve, such inconvenience may result in the leak of refrigeration gas from the compression chamber, causing a reduction of the capacity and also a decrease in the efficiency of the compressor.

A prior art commonly employed solution, to overcome this inconvenience, consists of defining a recess in the valve plate, or in the compressor block, provided with the accurate profile of the valve, so as to keep the same in its ideal position, minimizing occasional faults of positioning the same.

An example of application which utilizes recesses in the valve plate can be observed in the patent document BR 0505734 and also in document US 2003/010167. These solutions including recesses in the valve plate or compressor block, although have the advantage of reducing the costs of the suction valve, present some inconveniences.

To manufacture said recesses, the difficult addresses in the tolerances involved in the manufacturing processes, since a variation in the thickness of the suction valves, which are usually employed in refrigeration compressors, are of the order of ± 0.005 mm. If the manufacturing processes do not meet these requirements of tolerance, several harmful consequences to the compressor performance arise, due to the increase in the void volume, leakage between the plate and valve, and the like.

Other alternatives are revealed in documents BR 9604645 and US 6,227,825, which do not utilize recesses in the valve plate or in the compressor block and which present a valve composed by two different materials. However, the attachment process between the parts increases the costs, rendering the solution, in some cases, unfeasible.

The patent application (not published yet) filed under the Filing Number 018100043731 of November 19th, 2010 – “Suction valve for refrigeration compressor and its assemblage process” – presents an alternative that do not utilizes any additional element of attachment between the valve and the body. However, this assemblage procedure for the body does not guarantee that the same will be correctly positioned in its ideal place for operation, since the positioning during assemblage is determined merely by sight and, additionally, without comprising any suitable guide element to guarantee that the position imposed in the assemblage step will be maintained during the operation of the compressor.

The unique guide elements of the body are hold-down bolts of the assembly,

which go beyond four orifices arranged on the edges of the body. Said orifices, however, have, in general, a bigger diameter than the diameter of the bolt, so as to enable that the body to be capable of passing through the orifices, without interferences with the bolts and without the need of being exactly parallel to the valve plate, streamlining the assemblage process. Thus, there is a possibility of the body move itself longitudinally or transversally, within the gap between the diameter of the orifice and the diameter of the bolt. Consequently, the use of bodies, as described in the present document, is more advantageous, representing the fail of this solution as one of the initial purposes.

It is noted, therefore, that the current prior art lacks a valve plate assembly comprising a body that employs the advantages of the reduction of costs of this solution and which are capable of being easily attached to the valve plate and, furthermore, an assembly that avoids relative movements between the body and the valve plate.

Objectives of the Invention

Thus, one of the objectives of the present invention is the provision of a valve plate assembly comprising a body that is attached by proper means to the valve plate. In this context, it is also one of the objectives of the present invention that said proper means of attachment between the body and the valve plate are capable of guaranteeing the accurate positioning of the body in relation to the valve plate, so as to avoid the movement between both during the assemblage of the compressor header.

It is another objective of the present invention the provision of a valve plate whose proper means of attachment between the body and the valve plate are simplified regarding both functional and mechanical point of view.

Still another objective of the present invention is that the proper means of attachment between the body and the valve plate do not generate addition of raw material to the manufacture of not only the body, but also to the manufacture of the valve plate.

Summary of the Invention

The objectives of the present invention are achieved by the provision of the instantly described valve plate, which comprises at least one body and at least one valve plate. The body is composed by at least one slit capable of housing at least one valve, and at least one attaching region between the body and the valve plate.

The valve plate assembly, according to the present invention, comprises at least one valve plate composed by at least one groove, at least one body composed

by at least one extension and at least one extension of the body being capable of cooperative association with at least one groove of the valve plate. In this context, at least one body is associated with at least one valve plate by housing at least one extension of the body in the interior of the at least one groove of the valve plate.

5 Preferably, the extension comprises at least one folded flap that is projected inwards the at least one groove.

Preferably, housing at least one extension of the body in the interior of at least one groove of the valve plate defines at least one support region between the extension of the body and the groove of the valve plate.

10 According to the main assemblage of the present invention, the body preferably comprises a pair of extensions, wherein said extensions are orthogonal to each other. Similarly, it is further noted that the valve plate preferably comprises a pair of grooves.

It shall be further emphasized that the extensions of the body are preferably arranged in the internal perimeter of the body. Optionally, the extensions of the body are arranged in the perimetral end of the body.

Short Description of the Drawings

The present invention will be described, in detail, with basis on the following figures.

20 Figure 1 illustrates a perspective view of the preferred assemblage of the body (of the valve plate assembly);

Figure 2 illustrates a perspective view of the preferred assemblage of the valve plate (of the valve plate assembly);

25 Figure 3 illustrates a perspective view of the preferred assemblage of the valve plate assembly;

Figure 4 illustrates an extended detail of the attachment between the body and the valve plate (of the preferred embedment of the valve plate assembly);

Figure 5 illustrates a perspective view of the first optional assemblage of the body (of the valve plate assembly);

30 Figure 6 illustrates a perspective view of the first optional assemblage of the valve plate (of the valve plate assembly);

Figure 7 illustrates a perspective view of the first optional assemblage of the valve plate assembly;

35 Figure 8 illustrates a perspective view of an alternative assemblage of the body (of the valve plate assembly); and

Figure 9 illustrates a perspective view of a second alternative assemblage of

the body (of the valve plate assembly).

Detailed Description of the Invention

According to the main concept of the present invention, it is revealed a valve plate assembly composed by at least one body and at least one valve plate. Such valve plate assembly has proper means of attachment between the body and the valve plate.

Thus, the valve plate is composed by at least one groove, while the body is composed by at least one extension. The extension of the body is capable of cooperative association with the groove of the valve plate. This enables the body to be associated with the valve plate by housing an extension in the interior of the groove of the valve plate.

Therefore, proper means of attachment between the body and the valve plate, of easy assemblage and enough stiffness, is defined for maintaining the correct position of the body during the assemblage of the compressor header.

Figures 1, 2, 3, and 4 illustrate the preferred assemblage of the present invention.

According to such preferred assemblage, it is possible to verify that the valve plate assembly is fundamentally composed by one body 1 and one valve plate 2.

Said body 1 consists of a fundamentally flat, smooth, and stiff sheet, having a thickness that is substantially equal to the thickness of a valve, preferably a "vane" valve (not illustrates, but already defined by the prior art).

In this context, it is verified that the cited body 1 eliminates the need of the recess in the valve plate 2, or compressor block (not shown), to house the valve, since that, as previously mentioned, the body substantially comprises the same thickness of the valve and comprises at least one slit 11 capable of enabling to house at least one valve. Preferably, the slit 11 of the body 1 has a perimetral boundary that is substantially similar to the perimetral boundary of the vane valve (not shown).

The body 1 further comprises four orifices 12, which are equidistantly arranged in the perimetral ends thereof. Such orifices have the function of orientating the assemblage/attachment of the body 1 to the valve plate 2, besides enabling the attachment (generally, bolts [not illustrated]) between the valve plate 2 and the compressor (not illustrated) to pass across said body 1 without causing any type of interference/misalignment of the assembly. Thus, the orifices 12 of the body 1 have bigger diameters than the diameters of the means of attachment (generally, bolts [not illustrated]) between the valve plate 2 and the compressor (not shown).

The body 1 further comprises two attaching regions (virtual) 13, each one

being defined by a passing area. In the interior of the perimeter of the cited passing area, two extensions 14 are provided.

Each one of the extensions 14 comprises a kind of flap (of fundamentally rectangular perimeter) that is slightly inclined in relation to the facing sides of the body

5 1.

Each attaching region 13 includes two extensions 14, wherein said extensions 14 are preferably orthogonal to each other.

Preferably, the extensions 14 are defined in the internal perimeter of the body

1.

10 With reference to the body 1, it shall be further emphasized that the same is manufactured with metallic material by means of a stamping process or the like.

The valve plate 2 has the objective of fixing and guaranteeing the positioning of the suction and discharge valve (not shown) in relation to the functional systems of the suction and discharge of the compressor (not shown).

15 The valve plate 2, besides the suction orifice 21 and the discharge orifice 21', also comprises four orifices 22 that are equidistantly arranged in the perimetral ends thereof. Such orifices have the function of enabling the assemblage/attachment of the valve plate 2 to the compressor (not illustrated). Said assemblage/attachment is enabled by the means of attachment (generally, bolts [not shown]) that pass across

20 the cited orifices 22 (and also across orifices 12 of the body 1) and attach the cited valve plate 2 to the compressor (not illustrated).

The cited valve plate 2 further comprises two pairs of grooves 23, wherein each groove 23 comprises a fundamentally quadrangular perimeter recess defined in one of the facing sides of the valve plate 2.

25 Preferably, the grooves 23 are defined in the internal perimeter of the valve plate 2.

Still regarding the valve plate 2, it shall be noted that the same is preferably manufactured with metallic material by means of a sintering or stamping process, or the like.

30 Thus, it is noted that the extensions 14 of the body 1 and the grooves of the valve plate 2 have analogous dimensions and geometries. The inclination of the extensions 14 of the body 1 has also a "depth" analogous to the depth of the grooves 23.

Thus, it is verified that the extensions 14 of the body 1 are capable of

35 cooperative association with the grooves 23 of the valve plate 2. Consequently, the attachment between the body 1 and the valve plate 2 is enabled by housing at least

one extension 14 of the body 1 in at least one of the grooves 23 of the valve plate 2.

The cooperative association between the extensions 14 of the body 1 and the grooves 23 of the valve plate 2 is illustrated (in extended detail) in figure 5.

As detailed in such figure, the act of housing at least one extension 14 of the body 1 in at least one of the grooves 23 of the valve plate 2 defines at least one (but preferably two) support region 2, which is fundamentally shaped by the physical contact between the extensions 14 and the groove 23 walls. Thus, it shall be emphasized that the support region 3 occurs with no mechanical interference between the extensions 14 and the groove 23 walls; in other words, the physical contact between the extensions 14 and the groove 23 walls does not cause the physical deformation of any of these elements (differently from what occurs with the object disclosed in document US 6,293,774, wherein it can be noted the physical deformation and/or mechanical interference of at least one portion of the valve when fixed to the valve plate).

The support regions 3 enable the positioning and support of the body 1 on the valve plate 2, inhibiting the movement of the body 1 in longitudinal and/or transversal direction in relation to said valve plate 2.

Therefore, the main objective of the present invention (disclose a valve plate assembly comprising a body assembled on the valve plate by proper means of attachment) is completely achieved.

Figures 5 and 6 illustrate a first optional assemblage of the present invention. Such optional assemblage is fundamentally similar to the above-mentioned preferred assemblage, considering only a few modifications.

Thus, a first optional assemblage provides a valve plate assembly fundamentally composed by one body 4 and one valve plate 5.

Said body 4 is fundamentally similar to body 1 of the preferred embodiment of the present invention. Therefore, the cited body 4 also consists of a fundamentally flat, smooth, and stiff sheet (having a thickness that is substantially equal to the thickness of a valve, preferably of a "vane" valve) composed by a slit 41 (similar to the slit 11 of body 1), four orifices 42 (similar to orifices 12 of body 1) and two attaching regions 43 (similar to the areas 13 of body 1).

With reference to the instant optional assemblage, each attaching region 43 comprises one extension 44, which comprises a type of flap (of fundamentally rectangular perimeter) that is slightly inclined in relation to the facing sides of the body 4. Each extension 44 is fundamentally analogous to an extension 14 of the body 1.

Preferably, the extensions 44 are defined in a specific point of the perimetral

end of body 4.

Valve plate 5 is also fundamentally similar to valve plate 2 of the preferred embodiment of the present invention. Therefore, the cited valve plate 5 also comprises a body, such as a fundamentally flat, smooth, and stiff sheet, which has the objective of fixing and positioning the vane valve in relation to the functional systems of the compressor suction and discharge (not shown). Thus, the valve plate 5 is composed by a suction orifice 51 and a discharge orifice 51' (similar to orifices 21 and 21' of the valve plate 2) and four orifices 52 (similar to the four orifices 22 of the valve plate 2).

Valve plate 5, instead of presenting structures similar to the grooves 23 of the valve plate 2, presents two perimetral grooves 53. Each perimetral groove 23 comprises a fundamentally quadrangular perimeter slit defined in a section of the perimetral end of the valve plate 5.

Similar to the attachment in the preferred assemblage of the present invention (attachment between the body 1 and the valve plate 2), the attachment between the body 4 and the valve plate 5 is also defined by housing the extensions 44 of the body 4 in the perimetral grooves 53 of the valve plate 5. This attachment/housing can be better observed in figure 7.

Thus, it can be affirmed that the "functional concept" of the preferred assemblage (body 1 and valve plate 2) is similar to the "functional concept" of the first optional assemblage (body 4 and valve plate 5); in other words, said assemblages provide proper means of attachment to the body and its corresponding valve plate.

Figure 8 illustrates a second optional assemblage of the body, which is named herein as body 6.

Body 6, which is susceptible of attachment to the valve plate 2 of the preferred assemblage of the present invention (or to a similar valve plate that comprises at least one perimetral slit similar to the perimetral groove 23), is fundamentally similar to body 1. Therefore, body 6 also consists of a fundamentally flat, smooth, and stiff sheet having a thickness that is substantially equal to the thickness of a valve, preferably of a "vane" valve (not shown, but already defined by prior art documents).

In this context, body 6 comprises only one slit 61 (similar to the slit 11 of body 1), and preferably two attaching regions 63 (similar to regions 13 of body 1), each one comprising two extensions 64 (similar to extensions 14 of body 1).

Similar to the attachment in the first optional assemblage of the present invention (attachment between the body 1 and the valve plate 2), the attachment

between the body 6 and the valve plate 2 is also defined by housing the extensions 64 of the body 6 in the perimetral grooves 23 of the valve plate 2.

Therefore, it is noted that the only difference between bodies 1 and 6 is that body 6 has no equidistantly arranged orifices in the perimetral ends of the body. Thus, it can be affirmed that the “functional concept” of the preferred assemblage (body 1 and valve plate 2) is similar to the “functional concept” of the second optional assemblage (body 6 and valve plate 2); in other words, said assemblages provide proper means of attachment to the body and its corresponding valve plate.

Figure 9 illustrates a third optional assemblage of body, which is named herein as body 7.

Body 7, which is susceptible of attachment to the valve plate 5 of the first assemblage of the present invention (or to a similar valve plate that comprises at least one perimetral slit similar to the perimetral groove 53), is fundamentally similar to body 4. Therefore, body 7 also consists of a fundamentally flat, smooth, and stiff sheet having a thickness that is substantially equal to the thickness of a valve, preferably of a “vane” valve (not shown, but already defined by prior art documents).

In this context, body 7 comprises only one slit 71 (similar to the slit 41 of body 4), and preferably two attaching regions 73 (similar to regions 43 of body 4), each one comprising two extensions 74 (similar to extensions 44 of body 4).

Similar to the attachment in the first optional assemblage of the present invention (attachment between the body 4 and the valve plate 5), the attachment between the body 7 and the valve plate 5 is also defined by housing the extensions 74 of the body 7 in the perimetral grooves 23 of the valve plate 5.

Therefore, it is noted that the only difference between bodies 4 and 7 is that body 7 has no equidistantly arranged orifices in the perimetral ends of the body. Thus, it can be affirmed that the “functional concept” of the first optional assemblage (body 4 and valve plate 5) is similar to the “functional concept” of the fourth optional assemblage; in other words, said assemblages provide proper means of attachment to the body and its corresponding valve plate.

It shall be further disclosed that, optionally, the assemblage process of the bodies 1, 4, 6 and valve plates 2, 5 may also utilize the previous application of a viscous liquid to at least one of the facing sides of the valve plate, in accordance with the patent application (not published yet) filed under the Filing Number 018100043731 of November 19th, 2010 – “Suction valve for refrigeration compressor and its assemblage process” – which was applied by the same Applicant of the present invention.

Upon describing examples of the embodiments of the present invention, it is evident that the scope of the same encompasses other possible modifications (including configurative modifications in the bodies and valve plates), which are only limited by the contents of the set of claims, therein included possible equivalent

5 means.

SET OF CLAIMS

1. A valve plate assembly, comprising at least one body (1, 4, 6, 7) and at least one valve plate (2, 5); said valve plate assembly being **characterized** in that it comprises:

- 5 at least one body (1, 4, 6, 7) having at least one extension (14, 44, 64, 74);
 at least one valve plate (2, 5) having at least one groove (23, 53);
 at least one extension (14, 44, 64, 74) of the body (1, 4, 6, 7) being capable
of cooperative association with at least one groove (23, 53) of the valve plate (2, 5);
and
10 at least one body (1, 4, 6, 7) being associated with at least one valve plate (2,
5) by housing at least one extension (14, 44, 64, 74) of the body (1, 4, 6, 7) in the
interior of at least one groove (23, 53) of the valve plate (2, 5).

2. A valve plate assembly, in accordance with Claim 1, **characterized** in that
each extension (14, 44, 64, 74) of the body (1, 4, 6, 7) comprises at least one folded
15 flap that is projected inwards the at least one groove (23, 53) of the valve plate (2, 5).

3. A valve plate assembly, in accordance with Claim 1 or 2, **characterized** in
that housing at least one extension (14, 44, 64, 74) of the body (1, 4, 6, 7) in the
interior of at least one groove (23, 53) of the valve plate (2, 5) creates at least one
support region (3) between the extension (14, 44, 64, 74) of the body (1, 4, 6, 7) and
20 a wall defined by a groove of the valve plate (2, 5).

4. A valve plate assembly, in accordance with Claim 1, **characterized** in that
said body (1, 4, 6, 7) preferably comprises a pair of extensions (14, 44, 64, 74).

5. A valve plate assembly, in accordance with Claim 4, **characterized** in that
said extensions (14, 44, 64, 74) are orthogonal to each other.

25 6. A valve plate assembly, in accordance with Claim 1, **characterized** in that
said valve plate (2, 5) preferably comprises a pair of grooves (23, 53).

7. A valve plate assembly, in accordance with any of Claims 1 to 6,
characterized in that said extensions (14, 64) of the body (1, 6) are arranged in the
internal perimeter of the body (1, 6).

30 8. A valve plate assembly, in accordance with any of Claims 1 to 6,
characterized in that said extensions (44, 74) of the body (4, 7) are arranged in the
perimetral end of the body (4, 7).

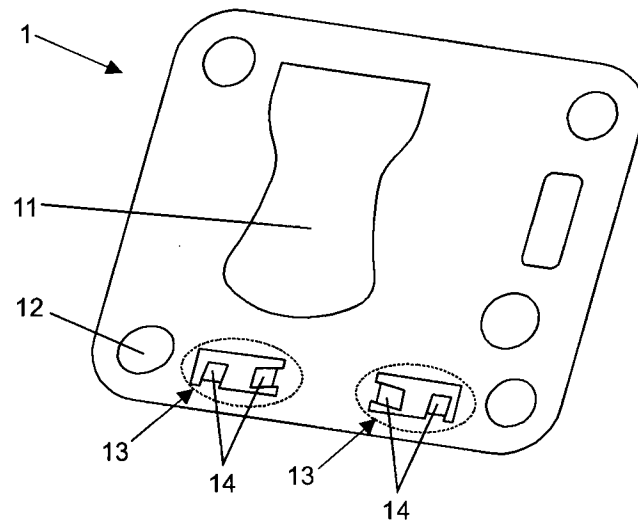


FIG. 1

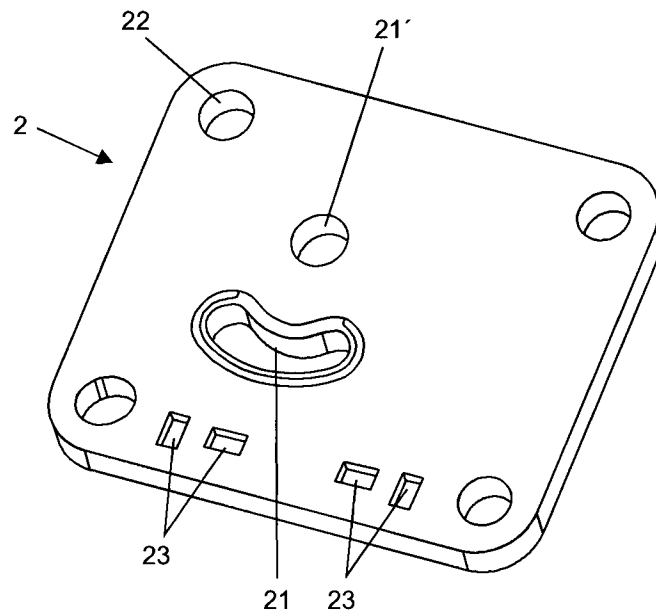


FIG. 2

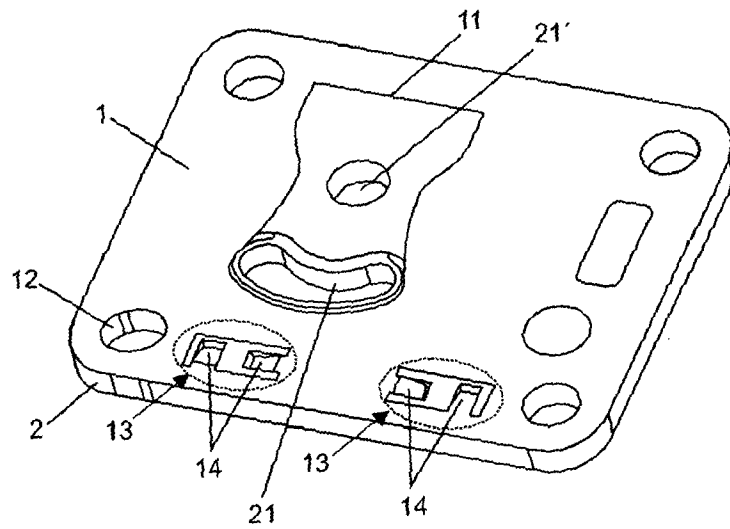


FIG. 3

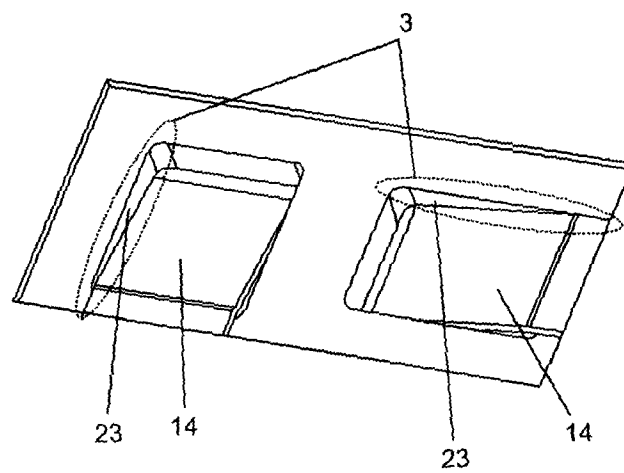


FIG. 4

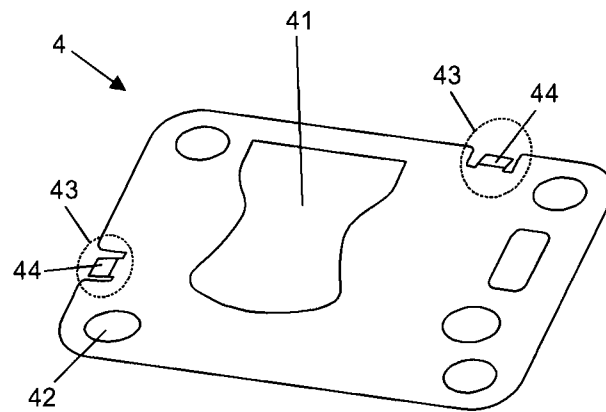


FIG. 5

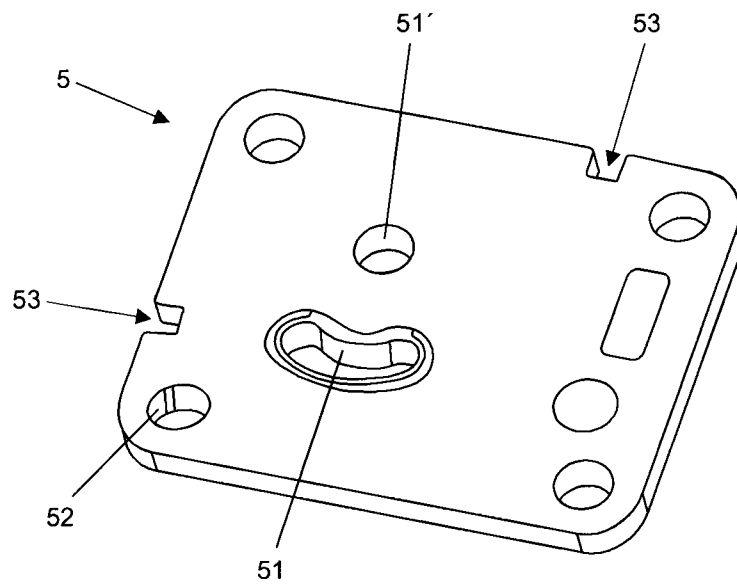


FIG. 6

4 / 5

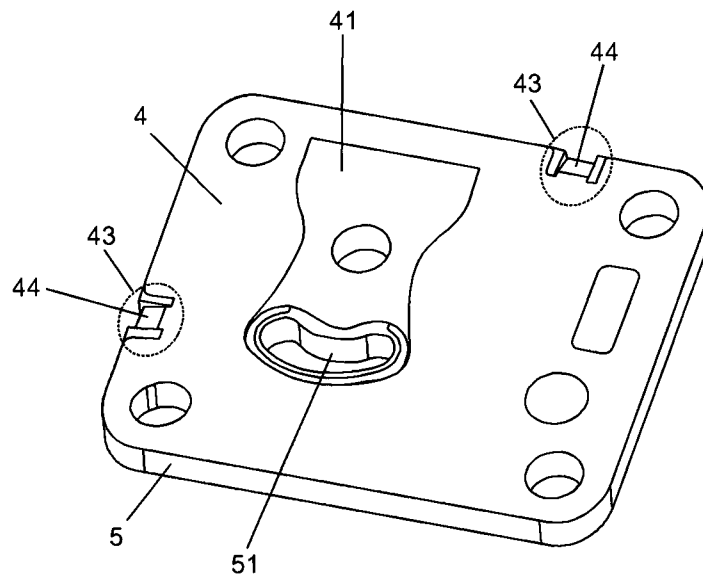


FIG. 7

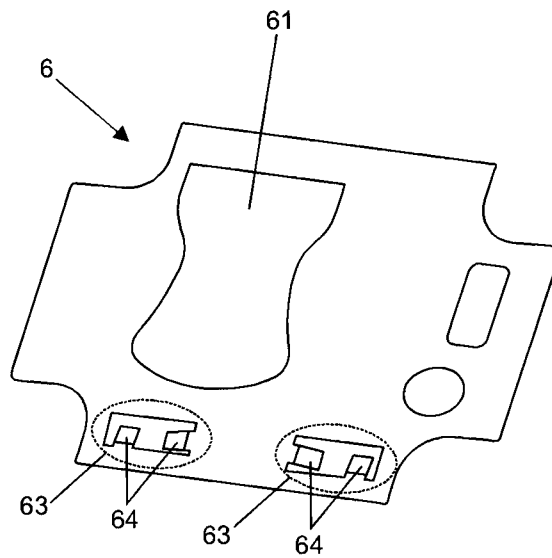


FIG. 8

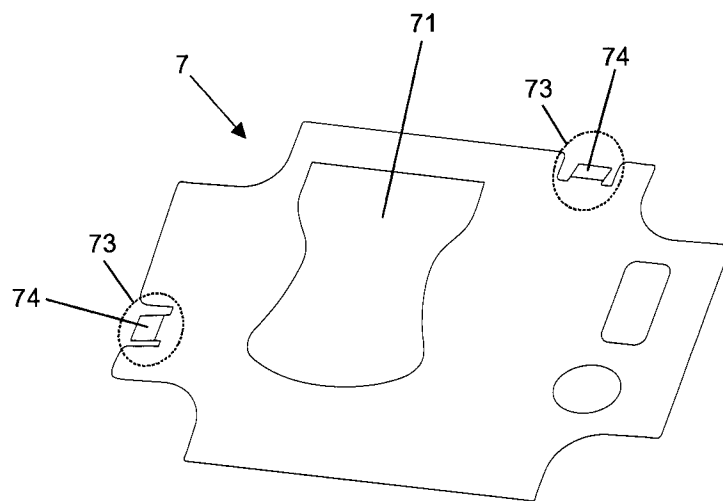


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2012/000242

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04B39/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/010167 A1 (BIANCHI VITTORIO [IT]) 16 January 2003 (2003-01-16) cited in the application claim 1; figure 2 -----	1-8
X	US 6 227 825 B1 (VAY MARTIN [BR]) 8 May 2001 (2001-05-08) cited in the application column 5, line 58 - column 7, line 18 -----	1-8
X	US 6 293 774 B1 (BRABEK WALTER [AT]) 25 September 2001 (2001-09-25) cited in the application column 2, line 55 - column 3, line 23 -----	1-8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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