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DISASSEMBLABLE SUCTION BOX FOR A GRIPPER

Abstract

The suction box for a gripper includes first and second parts, one of the parts being intended to be coupled to at least one contact member of the gripper, the contact member being intended to come into contact with at least one object to be seized by the gripper, and the other of the parts being intended to be in fluidic communication with a vacuum generator, the suction box being configured to selectively adopt an assembled configuration in which a mechanical connection is established between the parts or a disassembled configuration in which the mechanical connection is cancelled. In the assembled configuration and in the disassembled configuration, the first part delimits an indentation. In the assembled configuration, the indentation participates in delimiting the suction cavity of the suction box. The suction box includes a seal which, in the assembled configuration, is interposed between the first and second parts.

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Background/Summary

TECHNICAL FIELD OF THE INVENTION

[0001] The technical field of the invention relates to suction gripping, also so-called vacuum gripping, in particular the invention relates to a suction box for a gripper.

PRIOR ART

[0002] It is known to use a handling device comprising a movable member and a gripper mounted on the movable member. For example, the movable member is a lifting cylinder, a lifting tube, a hoist, an articulated arm or a lifting gantry. The gripper can grasp one or more object(s) which could then be moved by actuation of the movable member.

[0003] The gripper can grasp at least one object using a vacuum gripping technique. To this end, the gripper may comprise a suction box coupled to a vacuum generation device, also so-called a vacuum generator. The function of the vacuum generator is to create a depression allowing evacuating the air present in the suction box in order to ensure gripping of one or more object(s) using one or more contact member(s) fastened on the suction box. The contact member where each contact member is arranged so as to cooperate with at least one suction orifice of the suction box so as to hold the object to be grasped by suction relative to the gripper. Thus, this contact member or each contact member could come into contact with the object to be grasped, then a suction is generated, in particular thanks to the vacuum generator, such that the object grasped by the gripper is held with respect to the gripper even during movements of the movable member. The aforementioned contact member may be a foam or a suction cup.

[0004] In general, it is desired to limit the weight of the gripper. A reduction in the weight of the gripper allows increasing the payload of the handling device, that is to say the weight that the handling device can carry. By reducing the weight of the gripper, it is possible to use, for a definite weight of objects to be grasped successively by the handling device, a handling device that is less powerful and less expensive in components. To this end, a suction box is known comprising a first plate, a spacer and a second plate, the spacer separating the first and second plates. Each of the first and second plates is made of aluminium or stainless steel or steel or composite materials comprising carbon fibers, the spacer is made of polyurethane or of PVC foam (an acronym standing for “polyvinyl chloride” in English) lasts so as to oppose crushing thereof during gripping of the object(s). The first plate, the spacer and the second plate are fastened together by screws or rivets.

[0005] It is useful for the suction box could be dismountable in order to enable cleaning thereof when the latter is fouled. Indeed, during gripping of the object(s) by the vacuum, particles/dust can be sucked by the suction box and the latter can foul the latter thereby the possibility of a degradation of its function participating in object(s) gripping. Although the aforementioned suction box based on plates separated by a spacer and assembled by screws could be dismounted, it is nevertheless still not optimized to increase the mechanical strength of the suction box in its assembled configuration where the spacer and the first and second plates are assembled together in a dismountable manner.

OBJECT OF THE INVENTION

[0006] An object of the invention is a dismountable box having in particular a suitable mechanical strength.

[0007] To this end, the invention relates to a suction box for a gripper, said suction box comprising

a first portion and a second portion, one amongst the first and second portions being intended to be coupled to at least one contact member of the gripper, said contact member being intended to come into contact with at least one object to be grasped by the gripper, and the other one amongst the first and second portions being intended to be in fluidic communication with a vacuum generator for example of the gripper, the suction box being configured to selectively adopt: [0008] an assembled configuration in which a mechanical connection is established between the first and second portions so as to delimit respectively a first wall of the suction box and a second wall of the suction box opposite to the first wall, each of the first and second walls partially defining, in the assembled configuration, a suction cavity of the suction box; [0009] a disassembled configuration in which said mechanical connection is suppressed;
the suction box being such that: [0010] the first portion defines, in the assembled configuration and in the disassembled configuration, a recess; [0011] the recess participates in delimiting, in the assembled configuration, the suction cavity of the suction box; [0012] the suction box comprises a seal interposed, in the assembled configuration, between the first and second portions.
[0013] This suction box has the advantage of being dismountable in order to enable cleaning in case of fouling, it therefore falls within a desire to seek to limit wastes since it could be cleaned in case of loss of efficiency of the gripper that comprises it related to a fouling of the suction box. After cleaning thereof, the suction box can be used again, thereby avoiding replacement thereof. The integration of the recess into the first portion allows conferring rigidity on this first portion tending to oppose crushing of the suction box during use thereof.
[0014] The gripping box may further comprise one or more of the following features. Hence, the following features correspond to particular embodiments that could complement what has been described hereinabove in the context of the suction box.
[0015] According to one feature, the first portion is a monolithic part.
[0016] The fact that the first portion is a monolithic part has the advantage that the first portion is made as one single part/block, which then has homogeneity and rigidity that are completely suitable for guaranteeing the solidity of the first portion.
[0017] According to one feature, the first portion is obtained by machining a plate.
[0018] The fact that the first portion is obtained by machining may be determined by analysis of this first portion. Machining has various advantages like allowing adapting the shape of the suction cavity on demand and/or guaranteeing mechanical cohesion within the first portion which then does not comprise assembly by fastening, for example by bonding, different parts.
[0019] According to one feature, the first portion is formed by two parts bonded together so as to delimit the recess.
[0020] Thus, two bonded parts forming the first portion is a solution enabling the first portion to behave like a rigid block having a satisfactory mechanical strength. Furthermore, this allows selecting, during manufacture, the two parts according to a suitable thickness in order to bond them to obtain a desired rigidity of the first portion. According to one feature, the second portion is a plate, in particular with a substantially constant thickness.
[0021] Thus, the fact that the second portion is in the form of a plate allows limiting the overall weight of the suction box.
[0022] According to one feature, the second portion delimits a recess participating in delimiting, with the recess delimited by the first portion, the suction cavity of the suction box in the assembled configuration.
[0023] Thus, the recess of the second portion allows conferring rigidity on this second portion tending to oppose crushing of the suction box during use thereof.
[0024] According to one feature, the second portion is a monolithic part, for example obtained by machining a plate,
[0025] The fact that the second portion is obtained by machining may be determined by analysis of this second portion. Machining has various advantages like allowing adapting the shape of the

suction cavity on demand and/or guaranteeing mechanical cohesion within the second portion which then does not comprise assembly by fastening, for example by bonding, different parts.
[0026] According to one feature, the second portion is formed by two parts bonded together so as to form the recess of the second portion.
[0027] Two bonded parts thus forming the second portion is a solution enabling the second portion to behave like a rigid block having a satisfactory mechanical strength. Furthermore, this allows selecting, during manufacture, the two parts according to a suitable thickness in order to bond them to obtain a desired rigidity of the second portion.
[0028] According to one feature, the first portion comprises a composite material comprising a matrix and fibers, and/or the second portion comprises a composite material comprising a matrix and fibers.
[0029] The composite material, whether that of the first portion or that of the second portion, has the advantage of offering good mechanical strength while allowing limiting, where appropriate, the weight of the first portion and/or of the second portion. In this sense, the weight of the suction box can be limited, which is advantageous in the operation of an articulated arm equipped with a gripper comprising this suction box for carrying out object(s) gripping.
[0030] According to one feature, the suction box comprises a bumper extending, in the assembled configuration, along a lateral edge of the first portion and a lateral edge of the second portion, said bumper comprising a bead compressed, in the assembled configuration, between the first and second portions.
[0031] Thus, the bumper allows forming a protection for damping the impacts that the suction box might undergo during handling thereof, for example via an articulated arm. The bead has the advantage of facilitating the assembly of the bumper to the rest of the suction box. The bumper also has the advantage in the field of people protection when the suction box is used in the context of cobotics where impacts are normed for people protection.
[0032] According to one feature, the seal is formed by the bead.
[0033] Thus, since the bumper also participates in the sealing function of the suction box, this allows limiting the number of elements to be handled during assembly and disassembly of the suction box.
[0034] According to one feature, the suction box comprises assembly members each comprising a male portion comprising a support head and a female portion comprising a support head, and, in the assembled configuration and for each assembly member, the male portion of said assembly member is fitted into the female portion of said assembly member so that the support head of the male portion of said assembly member and the support head of the female portion of said assembly member participate in the implementation of a bias of the first portion and of the second portion in the direction of one other.
[0035] Thus, the assembly members allow ensuring a suitable holding of the first and second portions with each other while enabling a suitable compression of the seal. **5**
[0036] According to one feature, the suction box comprises a third portion arranged, in the assembled configuration, between the first portion and the second portion and, in the assembled configuration: [0037] the seal is compressed between the third portion and the second portion;
[0038] the suction box comprises an additional seal compressed between the third portion and the first portion.
[0039] Thus, the third portion allows increasing the volume of the suction cavity by adjusting the separation distance between the first and second walls according to the thickness of the suction box. The porosity of an object to be grasped is a parameter which may require increasing the volume of the suction cavity in order to achieve a satisfactory gripping of the object. Thus, by enabling the presence of such a third portion, it is possible to confer good modularity on the suction box. Moreover, such a third portion could be added throughout the service life of the suction box to extend it in order to adjust it to its intended purpose, of course to the detriment of weight and

gripping speed.
[0040] According to one feature, the first portion comprises at least one rib which participates in the delimitation of the recess of the first portion.
[0041] Thus, one or more rib(s) serve as a reinforcement to oppose crushing of the suction box according to its thickness measured according to a direction transverse to substantially parallel opposite faces of the suction box respectively delimited by a surface of the first portion directed towards the outside of the suction box and by a surface of the second portion directed towards the outside of the suction box.
[0042] The invention also relates to a gripper comprising: [0043] at least one suction box as described; [0044] at least one contact member intended to come into contact with at least one object to be grasped by the gripper;
said contact member being coupled to one amongst the first or second portions of said suction box.
[0045] Thus, the maintenance of the gripper may be carried out since its suction box is dismountable.
[0046] The contact member may be a foam or a suction cup. These are two types of known contact members allowing grasping one or more object(s) of different types.
[0047] The invention also relates to a suction device for a gripper, said suction device having a plurality of suction chambers. The suction device comprises a plurality of suction boxes as described, the suction cavity of each of the suction boxes corresponding to one amongst said suction chambers and the suction device comprises a support made in one-piece locally delimiting the first portions or the second portions of the suction boxes.
[0048] Thus, this suction device has the advantage of allowing grasping different objects simultaneously each via one of the suction boxes, considering that each suction box then allows, for example, grasping only one of the objects, or the advantage of overcoming a weakness of one of the suction boxes of at least two suction boxes ensuring gripping of the same object.
[0049] The invention also relates to a method for manufacturing the suction box, the method comprising a step of forming the first portion of the suction box, a step of forming the second portion of the suction box and an assembly step to obtain the assembled configuration of the suction box, the step of forming the first portion comprising a step of machining a plate to form the recess or a step of assembling two plates, one of which is apertured to participate in the formation of the recess.
[0050] Such a manufacturing method has the advantage of being easy to implement while allowing obtaining a suction box that is easy to dismount in particular for maintenance thereof.
[0051] Other advantages and features will appear from the following detailed description.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0052] The invention will be better understood upon reading the following detailed description, given only as non-limiting example and made with reference to the appended drawings and listed hereinbelow.
[0053] FIG. **1** schematically illustrates a handling device comprising an articulated arm equipped with a gripper for handling an object.
[0054] FIG. **2** schematically illustrates, according to a perspective view, an embodiment of a gripper according to the invention.
[0055] FIG. **3** schematically illustrates, according to a perspective view, a suction box of the gripper of FIG. **2** according to an assembled configuration of this suction box.
[0056] FIG. **4** schematically illustrates, according to a perspective view, a disassembled configuration according to a particular embodiment of the suction box of FIG. **3**.

[0057] FIG. **5** schematically illustrates, according to a particular embodiment, a sectional view of the suction box of the type of FIG. **3** in its assembled configuration.
[0058] FIG. **6** illustrates the disassembled configuration of the suction box as shown in FIG. **5**.
[0059] FIG. **7** schematically illustrates, according to a particular embodiment, a sectional view of the suction box of the type of FIG. **3** in its assembled configuration.
[0060] FIG. **8** illustrates the disassembled configuration of the suction box as shown in FIG. **7**.
[0061] FIG. **9** schematically illustrates, according to a particular embodiment, a sectional view of the suction box of the type of FIG. **3** in its assembled configuration.
[0062] FIG. **10** illustrates the disassembled configuration of the suction box as shown in FIG. **9**.
[0063] FIG. **11** schematically illustrates, according to a particular embodiment, a sectional view of the suction box of the type of FIG. **3** in its assembled configuration.
[0064] FIG. **12** illustrates the disassembled configuration of the suction box as shown in FIG. **10**.
[0065] FIG. **13** schematically illustrates, according to a particular embodiment, a sectional view of the suction box of the type of FIG. **3** in its assembled configuration.
[0066] FIG. **14** illustrates the disassembled configuration of the suction box as shown in FIG. **13**.
[0067] FIG. **15** schematically illustrates, according to a particular embodiment, a sectional view of the suction box of the type of FIG. **3** in its assembled configuration.
[0068] FIG. **16** illustrates the disassembled configuration of the suction box as shown in FIG. **15**.
[0069] FIG. **17** schematically illustrates, according to a perspective view, a particular embodiment of the suction box of the type of FIG. **3** in its disassembled configuration.
[0070] FIG. **18** illustrates a schematized version, according to a sectional view, of a particular embodiment of the suction box of the type of FIG. **3** according to the principle of FIG. **17**.
[0071] FIG. **19** schematically illustrates a particular embodiment of the suction box according to a sectional view of the suction box of the type of FIG. **3**.
[0072] FIG. **20** schematically illustrates a particular embodiment of a suction device with several suction boxes.
[0073] FIG. **21** schematically illustrates, according to a perspective view, a particular embodiment of the gripper.
[0074] FIG. **22** schematically illustrates, according to a perspective view, a particular embodiment of the gripper.
[0075] FIG. **23** schematically illustrates the gripper of FIG. **22** according to an exploded view showing in particular the disassembled configuration of the suction box.
[0076] FIG. **24** schematically illustrates, according to a perspective view, a particular embodiment of the gripper equipped with suction cups.
[0077] In these figures, the same references are used to refer to the same elements or similar elements with regards to their function. The figures are not necessarily plotted to scale in order to facilitate understanding of these figures.

DETAILED DESCRIPTION

[0078] By “substantially parallel”, it should be understood parallel or parallel within a **10** degrees margin.
[0079] By “substantially constant thickness”, it should be understood a thickness that is constant or that varies by more or less 10% around a reference value of this thickness.
[0080] By “comprised between two values”, it should be understood that these two values form the bounds of a corresponding range for which the two values are included.
[0081] In particular, by “sealing”, reference is made to airtightness.
[0082] An orthonormal reference frame XYZ is defined, this reference frame is represented by the axes X, Y and Z in FIG. **3**. The “below” concept is defined according to the axis Z.
[0083] Gripping at least one object **2000**, as shown for example in FIG. **1**, by a gripper **1000** allows grasping said at least one object **2000** in order to handle and/or move it. Next, what applies to gripping of the object **2000** can be applied, where appropriate, to the simultaneous gripping of

several objects **2000** by the same gripper **1000**. To ensure gripping, the gripper **1000** may comprise a suction box **100** coupled to at least one contact member **1001** belonging to the gripper **1000**. The contact member **1001** is intended to come into contact with the object **2000** to be grasped by the gripper **1000**. Furthermore, during use of the gripper **1000**, the suction box **100**, and in particular its interior, is in fluidic communication with a vacuum generator **1002** (shown for example in FIGS. **1**, **2**, **21**, **22** and **23**).

[0084] Conventionally, the vacuum generator **1002** may be configured to suck the interior of the suction box **100** in order to create a depression allowing evacuating the air present in the suction box **100** and therefore creating a depression at orifices **101** (shown in particular in FIGS. **4** to **19** and **23**) comprised in the suction box **100** in order to ensure, using the contact member(s) **1001**, gripping of the object **2000**. These orifices **101** are open-through and each connects the outside of the suction box **100** to the interior of the suction box **100**.

[0085] The gripper **1000** may comprise this vacuum generator **1002**. In this case, the vacuum generator **1002** may be mounted on the suction box **100** and may comprise a Venturi cartridge participating in ensuring the suction function of the vacuum generator **1002**.

[0086] Alternatively, the vacuum generator **1002** may be remote from the gripper **1000** to which it does not therefore belong. The vacuum generator **1002** is then considered to be remote and may be connected to the gripper **1000** by means of a hose allowing sucking the content of the suction box **100**. It is then the hose which enables the fluidic communication of the vacuum generator **1002** with the suction box **100** during use of the gripper **1000**. In this case, the vacuum generator **1002** may comprise a turbine or a vacuum pump allowing sucking the air contained in the suction box **100**.

[0087] Thus, the suction box **100** may be coupled to the vacuum generator **1002** by direct mounting of the vacuum generator **1002** on the suction box **100** or via the hose connecting the suction box **100** to the vacuum generator **1002**.

[0088] The aforementioned hose may be replaced by any other system allowing connecting the vacuum generator **1002** to the suction box **100**.

[0089] In the principle of FIG. **1**, a handling device **10** may comprise the gripper **1000** for example mounted on a movable member **11**, such as an articulated arm, which comprises the handling device **10**. In the case where the vacuum generator **1002** is remote from the gripper **1000** (a case that is not shown), it is then the handling device **10** which comprises the vacuum generator **1002**.

[0090] The invention relates to the suction box **100** for the gripper **1000** with reference to FIGS. **1** to **24** which show different embodiments of the suction box **100**. The suction box **100** comprises a first portion **102** and a second portion **103**. One amongst the first portion **102** and the second portion **103** is intended to be coupled (for example by mounting or gluing) to the at least one contact member **1001** of the gripper **1000** (hereinafter, which applies to the contact member **1001** could be applied to several contact members **1001** that the gripper **1000** may comprise), said contact member **1001** being intended to come into contact with said at least one object **2000** to be grasped by the gripper **1000**, and the other one amongst the first portion **102** and the second portion **103** is intended to be in fluidic communication with the vacuum generator **1002** that the gripper **1000** may comprise or remote from the gripper **1000** as mentioned hereinabove.

[0091] By “said other one amongst the first portion **102** and the second portion **103** is intended to be in fluidic communication with the vacuum generator **1002**”, it should herein be understood that said other one amongst the first portion **102** and the second portion **103** is configured to enable the passage, towards the vacuum generator **1002**, of a fluid (in the present case in particular air) present inside the suction box **100**. In other words, said other one amongst the first portion **102** and the second portion **103** is configured to enable a fluidic communication between the interior of the suction box **100** and the vacuum generator **1002**, for example, whether by direct mounting of the vacuum generator **1002** on the suction box **100** or by using the aforementioned hose then connecting for example said other one amongst the first portion **102** and the second portion **103** to

the vacuum generator **1002**.
[0092] In particular, FIG. **3** shows, viewed from the outside, the suction box **100** which could then have different structural embodiments as one could deduce from FIGS. **4** to **19**. For example, FIGS. **5** to **16**, **18** and **19** show sectional views of these different embodiments, each sectional view being according to a sectional plane of the suction box **100** of the type of FIG. **3** parallel to the plane defined by the axes Z and Y.
[0093] For example, in FIGS. **4** to **11**, the first portion **102** is shown below the second portion **103** and is coupled (FIG. **2**) or is intended to be coupled (FIGS. **4** to **12** and **17** to **19**) to the contact member **1001** or to several contact members **1001** meaning that the first portion **102** comprises the orifices **101**.
[0094] For example, in FIGS. **13** to **16**, the second portion **103** is shown below the first portion **102** and is coupled (FIG. **2**) or is intended to be coupled (FIGS. **13** to **16**) to the contact member **1001** or to a plurality of contact members **1001** meaning that the second portion **103** comprises the orifices **101**.
[0095] Thus, in general, said one amongst the first and second portions **102**, **103** intended to be coupled to the contact member **1001** may comprise the orifices **101** enabling the passage of air between the outside of the suction box **100** and the interior of the suction box **100**; in particular, this air passage may be generated during use of the gripper **1000** forcibly by the vacuum generator **1002** which sucks the interior of the suction box **100**, in particular via the aforementioned fluidic communication.
[0096] In particular, this suction box **100** is intended to be dismountable. To this end, said suction box **100** is configured to selectively adopt: [0097] an assembled configuration in which a mechanical connection is established between the first portion **102** and the second portion **103**, as illustrated for example in FIGS. **1**, **2**, **3**, **5**, **7**, **9**, **11**, **13**, **15**, **18**, **20**, **21** and **22**, so as to respectively delimit a first wall **104** of the suction box **100** and a second wall **105** of the suction box **100** opposite to the first wall **104**, each of the first wall **104** and of the second wall **105** partially delimiting, in the assembled configuration, a suction cavity **106** of the suction box **100** (this suction cavity **106** corresponding in particular to the interior of the aforementioned suction box **100**);
[0098] a disassembled configuration in which said mechanical connection is suppressed, as illustrated, for example, in FIGS. **4**, **6**, **8**, **10**, **12**, **14**, **16**, **17** and **23**.
[0099] The first portion **102** delimits, in the assembled configuration and in the disassembled configuration, a recess **107**. The recess **107** participates in delimiting, in the assembled configuration, the suction cavity **106** of the suction box **100**. The suction box **100** comprises a seal **108** interposed, in the assembled configuration, between the first portion **102** and the second portion **103**. Of course, the seal **108** participates, in the assembled configuration, in ensuring sealing of the suction cavity **106** between the first portion **102** and the second portion **103**. In particular, the first wall **104** forms an inner surface, delimited by the first portion **102**, of the suction cavity **106** and the second wall **105** forms an inner surface, delimited by the second portion **103**, of the suction cavity **106**.
[0100] Such a suction box **100** has the advantage of being dismountable in order to enable cleaning thereof in case of fouling, it is therefore in line with a desire of seeking to limit wastes since it can be cleaned in case of loss of efficiency of the gripper **1000** related to a fouling of the suction box **100**. After cleaning thereof, the suction box **100** can be used again, thereby avoiding replacement thereof.
[0101] The integration of the recess **107** into the first portion **102** allows conferring rigidity on this first portion **102** tending to oppose crushing of the suction box **100** during use thereof, that is to say during gripping of an object **2000** by the gripper **1000** using the vacuum generator **1002**. The addition of rigidity is ensured whether the recess **107** is on the side intended to be coupled to the contact member **1001** like in the case, for example, of FIGS. **4** to **12**, **18**, **19** and **23**, or on the opposite on the side intended to be coupled to the contact member **1001**, where appropriate, on the

side intended to cooperate with a vacuum generator **1002** as shown in FIGS. **13** to **16**.
[0102] Moreover, another advantage is that, where appropriate, this suction box **100** allows limiting the number of parts to be handled and to align during assembly of the suction box **100** or to be handled during disassembly of the suction box **100** in particular when the latter does not comprise an intermediate element, hereinafter corresponding to an independent third portion **117**, in particular as shown in FIGS. **17** and **18**, participating in delimiting the structure of the suction box **100** (and therefore the thickness of its suction cavity **106** according to the axis Z) between the first and second portions **102**, **103** as will be seen later on. Thus, although dismountable, the suction box **100** could remain relatively thin, which allows limiting the volume of the suction cavity **106** and conferring a satisfactory gripping speed on the gripper **1000**.
[0103] In general, during the operation of the gripper **1000**, a depression at the level of the contact member **1001** can be generated by the vacuum generator **1002** which enables the establishment of an air flow passing through the suction box **100** by entering into the suction cavity **100** through the orifices **101** and then coming out of the suction box **100** through an opening **120** comprised in the suction box **100**, this opening **120** being formed in the first or second portion **102**, **103** opposite to said one amongst the first and second portions **102**, **103** intended to be coupled to the contact member **1001** comprising the orifices **101**. Thus, the opening **120** enables the aforementioned fluidic communication. Hence, the opening **120** is configured to participate in establishing the fluidic communication between the suction cavity **106** and the vacuum generator **1002**.
[0104] Where appropriate, in order to facilitate mounting of the vacuum generator **1002** on the suction box **100** and to couple it to the opening **120** of the suction box **100**, the suction box **100** may comprise assembly means **121** like inserts with threaded hollow bodies for receiving each of a screw **1002***a* participating in fastening of the vacuum generator **1002** to the suction box **100**. In FIGS. **3**, **4**, **17** and **23**, one could see four assembly means **121** around the opening **120** for the corresponding box **100**. In particular, the means **121** extend throughout the suction box **100**.
[0105] In the assembled configuration, a lateral peripheral edge is at least partially delimited by the first and second portions **102**, **103**. In other words, the first and second portions **102**, **103** participate in delimiting the lateral peripheral edge.
[0106] The seal **108** allows participating in sealing of the suction box **100** more particularly at the level of the lateral peripheral edge. In other words, the seal **108** allows avoiding pressure drops, in particular in air, laterally to the suction box **100** during the operation of the gripper **1000**, that is to say when the vacuum generator **1002** is active to generate suction via the suction box **100** in order to grasp an object **2000**.
[0107] The seal **108** may be made of EPDM (this acronym being well-known for designating ethylene-propylene-diene monomer) or of silicone and the seal **108** may, for example, be in the form of a foam. This is quite particularly suitable to ensure the desired sealing function.
[0108] The seal **108** can at least partially adopt a closed loop shape, intended to ensure the desired sealing of the suction box **100**, and therefore of its suction cavity **106**, at the level of the lateral peripheral edge formed when the suction box **100** is in its assembled configuration.
[0109] For example, in the assembled configuration, the seal **108** may be compressed between the first portion **102** and the second portion **103**. The seal **108** could then be in contact, on the one hand, with the first portion **102** and, on the other hand, with the second portion **103**.
[0110] The seal **108** may be fastened, for example by bonding with a suitable adhesive such as a double-sided adhesive, to one amongst the first and second portions **102**, **103** (although this is not limiting, in the illustrated examples, the seal **108** is in particular bonded to the first portion **102** in FIGS. **13** to **16**, and is in particular bonded to the second portion **103** in FIGS. **4** to **12** and **17**); as a result, in the disassembled configuration, the seal **108** remains secured to said one amongst the first and second portions **102**, **103** to which it is fastened. This has the advantage of limiting the number of parts to be handled during the phase of assembling and/or disassembling the suction box **100**.
[0111] In particular, when the seal **108** is glued/fastened by gluing to one amongst the first and

second portions **102**, **103**, this seal **108** may be, in the assembled configuration, in simple contact with the other one amongst the first and second portions **102**, **103**, whereby, in the disassembled configuration, the seal **108** remains fastened by gluing to one amongst the first and second portions **102**, **103** and remote from the other one amongst the first and second portions **102**, **103**. This corresponds in particular to what is illustrated in FIGS. **5** to **16**.

[0112] As a result of what has been described before, the presence of the recess **107** of the first portion **102** allows conferring a satisfactory mechanical strength on the suction box **100** while allowing participating in laterally delimiting the suction cavity **106** of the suction box **100**. Henceforth, there are different means to enable the presence of this recess **107**: [0113] the first portion **102** may be a monolithic part (for example in the form of a plate with a variable thickness) as illustrated for example in FIG. **7**, **8**, **11**, **12**, **15**, **16**, to this end, the first portion **102** may be obtained by machining a plate, what a person skilled in the art could easily observe; [0114] the first portion **102** may be formed by two parts **102***a*, **102***b* bonded together so as to delimit the recess **107** as illustrated for example in FIGS. **4**, **5**, **6**, **9**, **10**, **13**, **14**, **17**, **18**, **19**.

[0115] The two parts **102***a*, **102***b* bonded together may be bonded by a two-component epoxy glue. A person skilled in the art will be able to use epoxy two-component glues well known per se, like for example LOCTITE® EA 9461 or ARALDITE® 2015-1.

[0116] The mentioned machining of the plate from which the first portion **102** may be derived may be carried out using a milling cutter.

[0117] The first portion **102** formed by two parts **102***a*, **102***b* may be obtained by bonding together a first plate with a second plate (thereby forming the two parts **102***a*, **102***b*, respectively) cut in a suitable manner, for example, using a milling cutter to remove portions thereof so that cutting of the second plate allows, with the cooperation of the first plate, obtaining the recess **107** following bonding.

[0118] In general, the recess **107** of the first portion **102** may result from the fact that the periphery of the face of the first portion **102** delimiting the first wall **104** has a loop-shaped elevation obtained by milling of the plate or by one of the two parts **102***a*, **102***b*. This elevation participates with the first wall **104** in delimiting, in the assembled configuration, the suction cavity **106**.

[0119] The second portion **103** may be a plate, as shown, for example, in FIGS. **9** to **16**. This plate which then forms the second portion **103** preferably has a substantially constant thickness.

[0120] According to one embodiment, the second portion **103** may delimit an recess **109** participating in delimiting, with the recess **107** delimited by the first portion **102**, the suction cavity **106** of the suction box **100** in the assembled configuration, as shown, for example, in FIGS. **5**, **6**, **7**, **8**, **18** and **19**.

[0121] The second portion **103** may be a monolithic part (for example in the form of a plate with a variable thickness) as shown, for example, in FIGS. **7** and **8**, and may for example be obtained by machining a plate. Alternatively, the second portion **103** may be formed by two parts **103***a*, **103***b* (FIGS. **5**, **6**, **18** and **19**) bonded together so as to form the recess **109** of the second portion **103**.

[0122] The two parts **103***a*, **103***b* of the second portion **103** may be bonded together by a two-component epoxy glue. A person skilled in the art will be able to use epoxy two-component glues well known per se, like for example LOCTITE® EA 9461 or ARALDITE® 2015-1.

[0123] The mentioned machining of the plate from which the second portion **103** may be derived may be carried out using a milling cutter.

[0124] The second portion **103** formed by two parts **103***a*, **103***b* may be obtained by bonding together a first plate with a second plate (thereby respectively forming the two parts **103***a*, **103***b*) cut in a suitable manner, for example, using a milling cutter in order to remove portions thereof so that cutting of the second plate allows, with the cooperation of the first plate, obtaining the recess **109** following bonding.

[0125] In particular, bonding two parts, whether to form the first portion **102** or the second portion **103**, will be preferred because this will generally be faster than machining a complete plate to the

desired shape and because this allows limiting the loss of material (the cut-out portions can be reused for other applications).
[0126] Machining is advantageous in the context of a gripper **1000** with a small-sized suction box **100** in order to reduce the manufacturing time in comparison with bonding different parts; this being of course true only if the ratio between the time of machining of a plate and the time of forming two suitable parts and then bonding them is strictly less than **1**. Another advantage of machining is that it is possible to reduce the overall weight of the first portion **102** and, where appropriate, of the second portion **103**, meaning that there is no need to provide for suitable dimensions of bonding surfaces to address a need for efficient bonding between two parts.
[0127] In general, the recess **109** of the second portion **103** may result from the fact that the periphery of the face of the second portion **103** delimiting the second wall **105** has a loop-shaped elevation obtained by milling or by one of the two parts **103***a*, **103***b*. This elevation participates with the second wall **105** in delimiting, in the assembled configuration, the suction cavity **106**.
[0128] Preferably, the first portion **102** comprises a composite material comprising a matrix and fibers, in particular carbon fibers or Kevlar® fibers. This has the advantage of reinforcing the rigidity of the first portion **102**.
[0129] Preferably, the second portion **103** comprises a composite material comprising a matrix and fibers, in particular carbon fibers or Kevlar® fibers. This has the advantage of reinforcing the rigidity of the second portion **103**.
[0130] In particular, and that being so in a manner applicable to the composite material of the first portion **102** and/or of the second portion **103**, the matrix may be made of an epoxy resin, of course in a hardened state.
[0131] The composite material may be the same for the first portion **102** and for the second portion **103**, or the composite material of the first portion **102** may be different from the composite material of the second portion **103**.
[0132] In the case where a monolithic part forms the first portion **102** or the second portion **103**, the latter is then preferably made of the corresponding composite material.
[0133] If the first portion **102**, or the second portion **103**, is formed of two parts bonded together, each of these two parts may be made of a composite material as mentioned before.
[0134] As regards the aforementioned fibers, whether for the first portion **102** or for the second portion **103**, each fiber may be selected from among: a carbon fiber, a glass fiber and an aramid fiber (for example Kevlar®). In other words, within each of the first and second portions **102**, **103**, the fibers may be made of the same material or of different materials. Such fibers have the advantage of ensuring a satisfactory rigidity of the suction box **100** while allowing limiting its weight. An advantage of carbon and/or glass and/or aramid fibers in the corresponding composite material is that this portion may have a greater deformation before alteration than if it was made of aluminum or steel.
[0135] The composite material may comprise a twill weave 3K formed by its fibers. In particular, it may consist of a twill carbon weave 3K.
[0136] According to a particular embodiment that could in particular be implemented for all or part of the different embodiments of the suction box **100**, and for example as illustrated in FIGS. **2** to **18**, **22** and **23**, the suction box **100** may comprise a bumper **110** extending, in the assembled configuration, along a lateral edge **111** of the first portion **102** and a lateral edge **112** of the second portion **103**, said bumper **110** comprising a compressed bead **113**, in the assembled configuration, between the first and second portions **102**, **103**.
[0137] The bumper **110** may be made of EPDM or silicone and the bumper **110** may, for example, be in the form of a foam. EPDM or silicone each has the advantage of having a satisfactory flexibility, and more preferably still more flexibility in their foam form, to absorb and limit the consequences of an impact via the bumper **110**.
[0138] Each of the lateral edge **111** of the first portion **102** and the lateral edge **112** of the second

portion **103** participates in delimiting the aforementioned lateral peripheral edge.
[0139] In the assembled configuration, as shown for example in FIGS. **5**, **7**, **9**, **11**, the bead **113** may be pinched/compressed between the seal **108**, in particular then fastened to the second portion **103**, and the first portion **102** thereby holding of the bumper **110** with respect to the rest of the suction box **100**.
[0140] Alternatively, as shown, for example, in FIG. **13** and FIG. **15**, in the assembled configuration, the bead **113** may be pinched/compressed between the seal **108**, in particular then fastened to the first portion **102**, and the second portion **103**, whereby holding of the bumper **110** with respect to the rest of the suction box **100**.
[0141] The bumper **110** may also be such that the bead **113** actually forms the seal **108** as shown, for example, in FIG. **19**. This allows limiting the overall number of elements necessary to manufacture the suction box **100**. Of course, this principle could be applied to the different described embodiments.
[0142] Alternatively, the bumper **110** may be deprived of beads **113** and be bonded, for example via a double-sided adhesive, to one amongst the first and second portions **102**, **103**. According to still another alternative, the first and/or second portions **102**, **103** may, in the assembled configuration, be such that they define a housing, for example obtained by suitable machining of the first and/or second portions **102**, **103**, in which a portion of the bumper **110** is fitted in order to enable holding of the bumper **110** with respect to the rest of the suction box **100**.
[0143] We have talked before bout the mechanical connection which allows holding the suction box **100** in its assembled configuration. In fact, by “mechanical connection”, it should be understood any connection allowing holding the suction box **100** in its assembled configuration. The mechanical connection is reversible since it could be eliminated to obtain the disassembled configuration of the suction box **100**. In the assembled configuration, the mechanical connection can hold the first portion **102** with respect to the second portion **103** so as to form a consistent whole and oppose a relative movement between the first portion **102** and the second portion **103**. On the contrary, the elimination of the mechanical connection enables the independent handling of the first portion **102** and of the second portion **103**, for example by moving them away from each other, whereby it is possible to easily access the interior of the suction box **100** and therefore the suction cavity **106**, for example to clean the suction cavity **106**.
[0144] Hence, there is a need to have an effective mechanical connection that is simple to implement, for example to facilitate the maintenance of the suction box **100**. To this end, the suction box **100** may comprise assembly members **114** each comprising a male portion **115** comprising a support head **115***a* and a female portion **116** comprising a support head **116***a*. In the assembled configuration and for each assembly member **114**, the male portion **115** of said assembly member **114** is fitted into the female portion **116** of said assembly member **114** so that the support head **115***a* of the male portion **115** of said assembly member **114** and the support head **116***a* of the female portion **116** of said assembly member **114** participate in the implementation of a bias of the first portion **102** and of the second portion **103** towards one another, in particular whereby the assembly member participates in the compression of the seal **108**. Besides ensuring the desired holding of the first portion **102** with respect to the second portion **103**, this also allows compressing the seal **108** in a manner suitable for ensuring the lateral sealing (i.e. parallel to the plane given by the axes X and Y in FIG. **3**) of the suction box **100** in order to avoid pressure drops at the level of the lateral peripheral edge during gripping of object(s) **2000**. In particular, the assembly members **114** extend throughout the suction box **100** and in particular through the first portion **102** and the second portion **103**.
[0145] In particular, the female portion **116** may be in the form of an insert fastened to the first portion **102**, or to the second portion **103**, which then also comprises the orifices **101**; in this case, the female portions **106** are preferably flush with the external surface of the suction box **100** (i.e. the female portions **116** do not project at the surface of one face of the suction box **100** where the

member **1001** will be/is mounted in contact to facilitate mounting thereof). In this case, the support head **116***a*, also so-called the collar, of each female portion **116** may be accommodated entirely in the considered first portion **102** or second portion **103** and may be, or not, bonded thereto.
[0146] For example, the or each assembly member **114** may be such that its female portion **116** comprises an elongate body which extends from the support head **116***a* of said female portion **116**, this elongate body of said female portion **116** being provided with a threaded hole to receive by screwing a tapped elongate body of the male portion **115** of said assembly member **114**, the tapped elongate body extending from the support head **115***a* of said male portion **115**.
[0147] The assembly members **114** may be distributed at the periphery of the suction box **100**, this periphery being in particular that one according to a plane parallel to the axes X and Y of FIG. **3**, so as to enable, in the assembled configuration, a suitable compression, in particular a homogeneous compression, of the seal **108** in order to avoid air leaks by the lateral peripheral edge.
[0148] For example, FIG. **3** shows the use of fourteen assembly members **114**, which could of course be adapted according to the dimensions of the suction box **100**.
[0149] According to a particular embodiment, the suction box **100** may comprise a third portion **117** arranged, in the assembled configuration, between the first portion **102** and the second portion **103**. Thus, in the assembled configuration, the seal **108** may be compressed between the third portion **117** and the second portion **103** and more particularly between an edge **117***a* of the third portion **117** and the second portion **103**. Moreover, in the assembled configuration, the suction box **100** comprises in this case an additional seal **108***a* compressed between the third portion **117** and the first portion **102** and more particularly between the edge **117***a* of the third portion **117** and the first portion **102**. This additional seal **108** then also participates, in the assembled configuration, in sealing the suction cavity **106** between the first portion **102** and the second portion **103**. In the assembled configuration, the third portion **117** allows increasing the volume of the suction cavity **106** in comparison with the volume of this suction cavity **106** if the suction box **100** was, in its assembled configuration, without the third portion **117**. As a result, the suction box **100** is thicker, allowing for a larger volume of the suction cavity **106** enabling better object(s) gripping **2000**, in particular porous to air, since by increasing the volume of the gripping cavity **106**, the gripper **1000** can have a better power, although this is achieved to the detriment of the speed at which the object(s) **2000** can be grasped (i.e. loss of responsiveness of the gripper **1000**).
[0150] Thus, the suction box **100** as described has the advantage of being modular meaning that the third portion **117** can be easily added where necessary to adjust the separation distance between the first and second portions **102**, **103**, for example like a spacer. Also, a plurality of third portions **117** may be stacked where necessary between the first and second portions **102**, **103** to allow for a better adjustment of the volume of the suction cavity **106**, one or more additional seal(s) should then be provided for in order to ensure, in the assembled configuration, sealing of the suction cavity **106** between the first portion **102** and the second portion **103**.
[0151] In the disassembled configuration, unlike the assembled configuration, the first, second and third portions **102**, **103**, **117** can be handled independently and are therefore separated from one another.
[0152] In particular, the third portion **117** may be a plate cut across its thickness so that it comprises a loop-shaped edge participating in delimiting, in the assembled configuration, the suction cavity **106** and the lateral peripheral edge. In other words, the third portion **117** may be an apertured plate.
[0153] In the case where the third portion **117** is present, the seal **108** may be fastened, for example by bonding, in particular using a double-sided adhesive, to the second portion **103** (FIG. **17**) and in particular on a face of the second portion **103** opposite the third portion **117** in the assembled configuration (FIG. **18**); then, in the assembled configuration, the seal **108** is in contact with the third portion **117**. Of course, alternatively, the seal **108** may be fastened, for example by bonding, in particular using a double-sided adhesive, to the third portion **117** on a face of the third portion **117** opposite the second portion **103** in the assembled configuration; then, in the assembled

configuration, the seal **108** is in contact with the second portion **103**. Still alternatively, the seal **108** may simply be in contact with the second portion **103** and the third portion **117** in the assembled configuration; then, in the disassembled configuration, the seal **108** may be handled independently with respect to the second and third portions **103**, **117**. The additional seal **108***a* may be fastened, for example by bonding in particular using a double-sided adhesive, to the third portion **117** (FIG. **17**) and in particular on a face of the third portion **117** opposite the first portion **102** in the assembled configuration (FIG. **18**); then, in the assembled configuration, the additional seal **108***a* is in contact with the first portion **102**. Of course, alternatively, the additional seal **108***a* may be fastened, for example by bonding in particular using a double-sided adhesive, to the first portion **102** on a face of the first portion **102** opposite the third portion **117** in the assembled configuration; then, in the assembled configuration, the additional seal **108***a* is in contact with the third portion **117**. Still alternatively, the additional seal **108***a* may simply be in contact with the first portion **102** and the third portion **117** in the assembled configuration; then, in the disassembled configuration, the additional seal **108***a* can be handled independently with respect to the first and third portions **102**, **117**.

[0154] The third portion **117** may comprise a composite material as described hereinabove. However, the third portion **117** may be made of another material, like, for example, a compact foam so as to oppose crushing thereof in the context of use of the suction box **100**. The third portion **117** may be made of a fiber-based resin or may be obtained in **3**D printing (also known as additive manufacturing) of any material suited to its function. The use of a foam as a third portion **117** could be possible if the rigidity of the suction box **100** ensured at least by the first portion **102** provided with its recess **107** and, where appropriate, by the second portion **103**, in particular provided with its recess **109**, is enough.

[0155] The additional seal **108***a* may be made of silicone EPDM and the additional seal **108***a* may, for example, be in the form of a foam. This is quite particularly suitable to ensure the desired sealing function.

[0156] The first portion **102** may comprise one or more rib(s) **118** (cf. for example FIGS. **4** to **19** and **23**) which participate in the delimitation of the recess **107** of the first portion **102** and therefore to the shape of the suction cavity **106**.

[0157] The second portion **103** may comprise one or more rib(s) **119** which participate in the delimitation of the recess **109** of the second portion **103** and therefore to the shape of the suction cavity **106**.

[0158] The aforementioned rib(s) **118**, **119** participate(s) in improving the overall rigidity of the suction box **100** by improving the rigidity of the first portion **102** and/or of the second portion **103**.

[0159] Next, we talk about several ribs **118** that the first portion **102** could comprise; what applies for several ribs **118** of the first portion **102** could also be applied to one single rib **118** in the case where the first portion **102** comprises only this single rib **118**. Where appropriate, we also talk hereinafter about several ribs **119** that the second portion **103** could comprise; what applies for several ribs **119** of the second portion **103** could also be applied to one single rib **119** in the case where the second portion **103** comprises only this single rib **119**.

[0160] In particular, the ribs **118**, **119** extend at the level of a bottom of the corresponding recess **107**, **109**, and therefore involve a decrease in the volume of the suction cavity **106** in the assembled configuration while allowing improving rigidity.

[0161] For example, the seal **108** may have a shape such that it is compressed, in the assembled configuration: [0162] between an edge of a face of the first portion **102** and an edge of a face of the second portion **103**, said edges adopting in particular the shape of a closed loop and said faces facing each other; and [0163] between the ribs **118** of the first portion **102** and the second portion **103**;

thereby improving the overall rigidity of the suction box **100** since the ribs **118** and the seal **108** oppose crushing of the suction box **100** according to its thickness measurable according to the axis

Z.
[0164] This compression of the seal **108** between the ribs **118** of the first portion **102** and the second portion **103** could be ensured when the second portion **103** is in the form of a plate, in particular with a substantially constant thickness, for example as illustrated in FIGS. **9**, **11**, **13** and **15**.
[0165] In the case where the second portion **103** comprises the ribs **119**, the compression of the seal **108** between the ribs **118** of the first portion **102** and the second portion **103** may be done more particularly between the ribs **118** of the first portion **102** and the ribs **119** of the second portion **103**. In other words, the seal **108** may have a shape such that it is compressed, in the assembled configuration: [0166] between the edge of the face of the first portion **102** and the edge of the face of the second portion **103**, said edges adopting in particular the shape of a closed loop and said faces facing each other; and. [0167] between the ribs **118** of the first portion **102** and the ribs **119** of the second portion **103**, for example as illustrated in FIGS. **5** and **7**;
thereby improving the overall rigidity of the suction box **100** since the ribs **118**, **119** and the seal **108** oppose crushing of the suction box **100** according to its thickness measurable according to the axis Z.
[0168] Besides the reinforcing function that the ribs **118**, **119** confer, these allow refining the corresponding first portion **102** or the corresponding second portion **103** at the level of the bottom of the corresponding recess **107**, **109**. Thus, for example when the first portion **102** or the second portion **103** is formed by bonding two parts, the part forming the bottom of the corresponding recess **107**, **106** may be a plate with a relatively thin thickness, for example comprised between 0.5 mm and 5 mm.
[0169] In the case where the third part **117** is present as shown in FIGS. **17** and **18**, the third part **117** may comprise portions **117***b*, each interposed between a rib **118** of the first portion **102** and the second portion **103**, and more particularly interposed between a rib **118** of the first portion **102** and a rib **119** of the second portion **103**, so that for each portion **117***b* of the third part **117**: [0170] said portion **117***b* participates in the compression of the seal **108** between the second portion **103** and said portion **117***b*, and, where appropriate, between one of the ribs **119** of the second portion **103** and said portion **117***b;* [0171] said portion **117***b* participates in the compression of the additional seal **108***a* between said portion **117***b* and one of the ribs **118** of the first portion **102**.
[0172] This allows effectively opposing crushing of the suction box **100** according to its thickness. In particular, the portions **117***b* extend from the edge **117***a* of the third portion **117** to participate in delimiting the volume of the cavity **106** in the assembled configuration.
[0173] The invention also relates to a suction device **130** for the gripper **1000**, said suction device **130** comprises a plurality of suction chambers. The suction device **100** comprises a plurality of suction boxes **100** as described, the suction cavity **106** of each of the suction boxes **100** corresponding to (i.e. forming) one amongst said suction chambers. The suction device **130** comprises a support **131** made in one-piece locally delimiting the first portions **102** or the second portions **13** of the suction boxes **100**. For example, this allows having several independent suction cavities **106**, for example to grasp different objects **2000**. In particular, each suction box **100** could then be placed in fluidic communication with a vacuum generator **1002** that is specific thereto (i.e. each vacuum generator **1002** could then be coupled/associated with only one of the suction boxes **100**).
[0174] In particular, FIG. **20** shows the suction device **130** for which the support **131** locally delimits three second portions **103** each assembled to a corresponding first portion **102**, the first portions **102** could be disassembled independently. For example, this allows facilitating maintenance by enabling opening of one suction cavity **106** at a time to clean it. The number of three second portions **103** herein is indicative, in particular more generally at least two are needed.
[0175] In particular, FIGS. **22** and **23** illustrate a particular embodiment of the suction device **130** within a gripper **1000** thereby the presence of the support **131** locally delimiting two second

portions **103** schematically separated by a dotted line A**1** and an element **132** made in one-piece locally delimiting two first portions **102** sharing a common partition **133** intended to participate in separating two suction cavities **106** when the support **131** and the element **132** are assembled with a seal **134** being interposed therebetween. The result of this is that the line A**1** also schematizes the separation between two suction boxes **100** of the suction device **130**. The seal **134** locally forms the seal **108** of one amongst the suction boxes **100** and the seal **108** of the other one amongst the suction boxes **100**. In the example of FIGS. **22** and **23**, the contact member **1001** is a foam common to the two suction boxes **100**, for example encircled by the same bumper **110**.

[0176] The invention also relates to the gripper **1000**, the embodiments of which are illustrated in FIGS. **1**, **2**, **21**, **22**, **23**. The gripper **1000** generally comprises: [0177] at least one suction box **100** as described, FIGS. **1** and **2** show the gripper **1000** with one single suction box **100** whereas FIGS. **21**, **22**, **23** show the gripper **1000** with two suction boxes **100**; [0178] at least one contact member **1001** intended to come into contact with at least one object **200** to be grasped by the gripper **1000**.

[0179] Said contact member **1001** is coupled/arranged, for example by gluing or mounting, to one amongst the first or second portions **102**, **103** of said suction box **100**. Said one amongst the first or second portions **102**, **103** may comprise at least one suction orifice **101**, and in particular several suction orifices **101**, for sucking air at the level of the contact member **1001** towards the suction cavity **106** of said suction box **100**.

[0180] In particular, FIG. **21** shows the gripper **1000** comprising two distinct boxes **100** each: [0181] coupled to a contact member **1001** arranged at its first portion **102**; [0182] in fluidic communication with a vacuum generator **1002** which is specific thereto and fastened to its second portion **103**.

[0183] The two suction boxes **100** are secured to each other using a connecting element **1003** comprised in the gripper **1000**, this connecting element **1003** (for example formed by a bar) being fastened to the two vacuum generators **1002**, for example using four screws **1004** for each vacuum generator **1002**, these four screws could correspond to the screws **1002***a* mentioned hereinbefore, then they also serve to fasten said vacuum generator **1002** to the corresponding suction box **100**.

[0184] The contact member **1001** may be a foam as shown, for example, in FIGS. **1**, **2**, **21**, **22**, **23** or a suction cup as shown for example in FIG. **24** where each orifice **101** may be in fluidic communication with a corresponding suction cup.

[0185] In the case where the contact member **1001** is a foam, this foam may be fastened, for example by bonding using a double-sided adhesive, to the first portion **102** or to the second portion **103** which then comprises the orifices **101** so that each orifice **101** opens into a corresponding open-through hole of the foam, each open-through hole of the foam could be: in the continuity of one single orifice **101**, and with a maximum lateral dimension (in particular considered parallel to the plane XY) strictly larger than the maximum lateral dimension (in particular considered parallel to the plane XY) of said orifice **101**.

[0186] As a result of what has been described hereinbefore, the invention also relates to a method for manufacturing the suction box **100**. The manufacturing method comprises a step of forming the first portion **102** of the suction box **100**, a step of forming the second portion **103** of the suction box and an assembly step to obtain the assembled configuration of the suction box **100**. The step of forming the first portion **102** comprises a step of machining, for example using a milling cutter, a plate to form the recess **107** or a step of assembling two plates, one of which is apertured, for example by cutting using a milling cutter, to participate in the formation of the recess **107**.

[0187] Besides the advantages set out hereinbefore, the suction box **100** as described has the advantage of allowing streamlining the manufacture of the latter.

[0188] Indeed, it is then possible to store the different elements/parts/portions that form it and all it remains is to carry out the assembly on order: the stocks and the delivery delays are then optimized. Moreover, kits may be commercialized allowing assembling the suction box **100** and possibly the gripper **1000**.

[0189] In particular, the suction box **100** finds industrial application in the field of robotic gripping of object(s) **2000**, in particular in production lines where the objects **2000** should be handled while enabling easy maintenance of the suction box **100**.

Claims

1. A suction box for a gripper, said suction box comprising a first portion and a second portion, one amongst the first and second portions being intended to be coupled to at least one contact member of the , said contact member being intended to come into contact with at least one object to be grasped by the gripper, and the other one amongst the first and second portions being intended to be in fluidic communication with a vacuum generator, the suction box being configured to selectively adopt: an assembled configuration in which a mechanical connection is established between the first and second portions so as to delimit respectively a first wall of the suction box and a second wall of the suction box opposite to the first wall, each of the first and second walls partially defining, in the assembled configuration, a suction cavity of the suction box; a disassembled configuration in which said mechanical connection is suppressed; wherein: the first portion defines, in the assembled configuration and in the disassembled configuration, a recess; the recess participates in delimiting, in the assembled configuration, the suction cavity of the suction box; the suction box comprises a seal interposed, in the assembled configuration, between the first and second portions.
2. The suction box according to claim 1, wherein the first portion is a monolithic part.
3. The suction box according to claim 2, wherein the first portion is obtained by machining a plate.
4. The suction box according to claim 1, wherein the first portion is formed by two parts bonded together so as to delimit the recess.
5. The suction box according to claim 1, wherein the second portion is a plate.
6. The suction box according to claim 1, wherein the second portion delimits a recess participating in delimiting, with the recess delimited by the first portion, the suction cavity of the suction box in the assembled configuration.
7. The suction box according to claim 6, wherein the second portion is a monolithic part, or is formed by two parts bonded together so as to form the recess of the second portion.
8. The suction box according to claim 1, wherein the first portion comprises a composite material comprising a matrix and fibers, and/or the second portion comprises a composite material comprising a matrix and fibers.
9. The suction box according to claim 1, wherein it comprises a bumper extending, in the assembled configuration, along a lateral edge of the first portion and a lateral edge of the second portion, said bumper comprising a bead compressed, in the assembled configuration, between the first and second portions.
10. The suction box according to claim 9, wherein the seal is formed by the bead.
11. The suction box according to claim 1, wherein it comprises assembly members each comprising a male portion comprising a support head and a female portion comprising a support head, and in that, in the assembled configuration and for each assembly member, the male portion of said assembly member is fitted into the female portion of said assembly member so that the support head of the male portion of said assembly member and the support head of the female portion of said assembly member participate in the implementation of a bias of the first portion and of the second portion in the direction of one other.
12. The suction box according to claim 1, wherein it comprises a third portion arranged, in the assembled configuration, between the first portion and the second portion and in that, in the assembled configuration: the seal is compressed between the third portion and the second portion; the suction box comprises an additional seal compressed between the third portion and the first portion.

13. The suction box according to claim 1, wherein the first portion comprises at least one rib which participates in the delimitation of the recess.

14. A suction device for a gripper, said suction device comprises a plurality of suction chambers and a plurality of suction boxes each according to claim 1, the suction cavity of each of the suction boxes corresponding to one amongst said suction chambers and the suction device comprises a support made in one-piece locally delimiting the first portions or the second portions of the suction boxes.

15. A gripper, wherein it comprises: at least one suction box according to claim 1; at least one contact member intended to come into contact with at least one object to be grasped by the gripper; said contact member being coupled to one amongst the first or second portions of said suction box.

16. The gripper according to claim 15, wherein the contact member is a foam or a suction cup.

17. A method for manufacturing a suction box according to claim 1, wherein it comprises a step of forming the first portion of the suction box, a step of forming the second portion of the suction box and an assembly step to obtain the assembled configuration of the suction box, the step of forming the first portion comprising a step of machining a plate to form the recess or a step of assembling two plates, one of which is apertured to participate in the formation of the recess.