

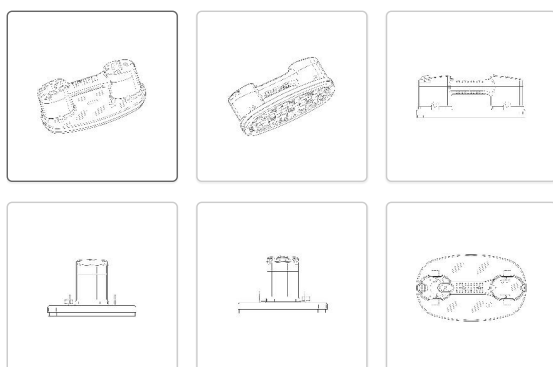
RCD file information

008482624-0001

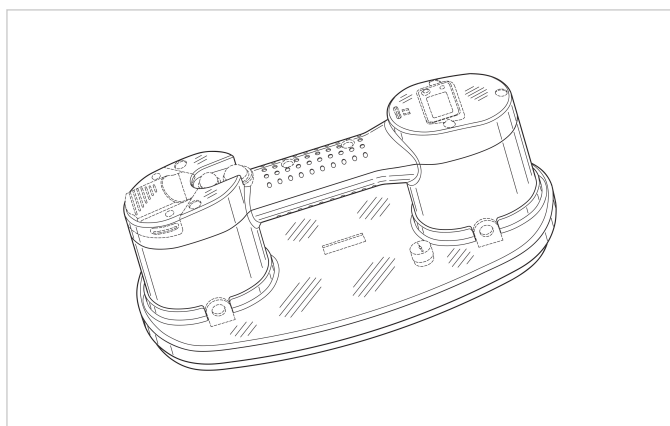
Timeline



Graphic representation



1 / 2



Design information

Design number	008482624-0001	Filing language	GERMAN
Name		Second language	ENGLISH
Filing date	01/04/2021	Reference	MU1269
Registration date	01/04/2021	Vienna Classification	
Expiry date	01/04/2026	Verbal element	
Design status	Registered and fully published (A.1.)		

Indication of the product, [\(DesignClass\)](#)

Locarno	08.08
Values	Suction lifters

English ▼

Owners

Nemo Power Tools Limited

ID	1081569	Country	HK - Hong Kong	Correspondence address	
Organisation	Nemo Power Tools Limited	State/county	n/a	Nemo Power Tools Limited 21/F, CMA Building 64 Connaught Road Central Hong Kong	Hidden. You can set your contact details to be publicly available via the User Area.
Legal status	Legal entity	Town	Hong Kong	REGIÓN ADMINISTRATIVA ESPECIAL DE HONG KONG DE LA REPÚBLICA POPULAR DE CHINA	Hidden. You can set your contact details to be publicly available via the User Area.
		Post code	n/a		
		Address	21/F, CMA Building 64 Connaught Road Central		Hidden. You can set your contact details to be publicly available via the User Area.

Representatives

WILDHACK & JELLINEK PATENTANWÄLTE

ID	10921	Country	AT - Austria	Correspondence address	
Organisation	n/a	State/county	n/a	WILDHACK & JELLINEK Patentanwälte Landstraßer Hauptstrasse 50 A-1030 Wien AUSTRIA	Hidden. You can set your contact details to be publicly available via the User Area.
Legal status	Legal person	Town	Wien		
Type	Association	Post code	1030		Hidden. You can set your contact details to be publicly available via the User Area.
		Address	Landstraßer Hauptstrasse 50		Hidden. You can set your contact details to be publicly available via the User Area.

Designers

No data

Exhibition priority

No data

Priority

Country	Filing number	Date	Status
United States	29/753,783	01/10/2020	Claimed
Showing 1 to 1 of 1 entries			

Publications

Bulletin number	Date	Section	Description
2021/152	13/08/2021	A.1	Applications published under Articles 48 and 50 CDR

Showing 1 to 1 of 1 entries

Recordals

No data

Appeals

No data

Decisions

No data

Renewals

No data

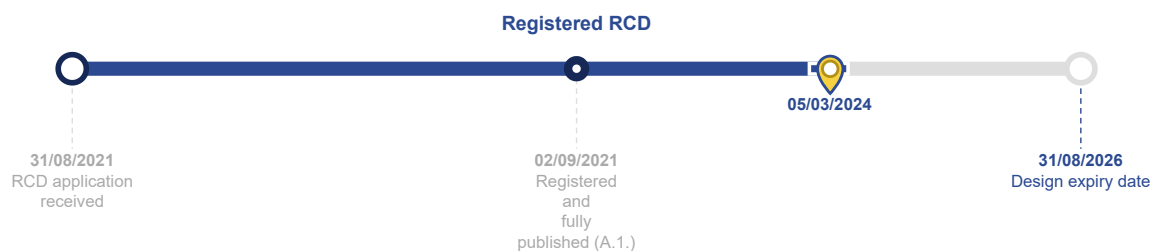
Documents

	Date	Type	Procedure	File	Portfolio	Language	Pages	Actions
	13/08/2021	certi	RCD	008482624-0001				
Showing 1 to 1 of 1 entries								

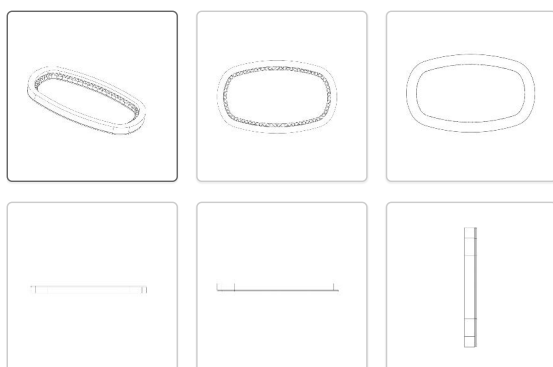
RCD file information

008668412-0001

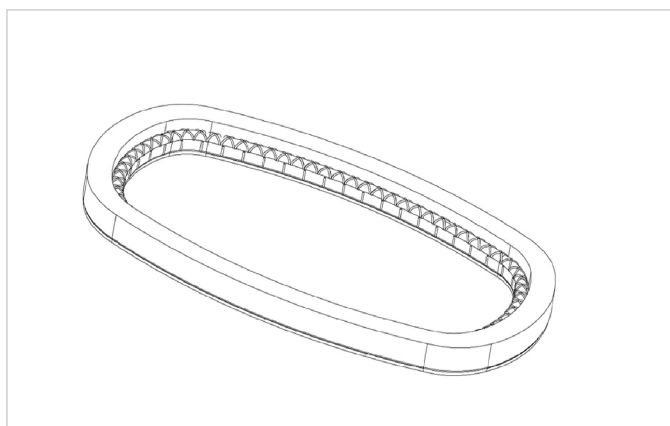
Timeline



Graphic representation



1 / 2



Design information

Design number	008668412-0001	Filing language	ENGLISH
Name		Second language	GERMAN
Filing date	31/08/2021	Reference	D-2021-087EM
Registration date	31/08/2021	Vienna Classification	
Expiry date	31/08/2026	Verbal element	
Design status	Registered and fully published (A.1.)		

Indication of the product, [\(DesignClass\)](#)

Locarno 08.05
Values Grippers

English ▾

Owners

Nemo Power Tools Limited

ID	1081569	Country	HK - Hong Kong	Correspondence address	
Organisation	Nemo Power Tools Limited	State/county	n/a	Nemo Power Tools Limited 21/F, CMA Building 64 Connaught Road Central Hong Kong	Hidden. You can set your contact details to be publicly available via the User Area.
Legal status	Legal entity	Town	Hong Kong	REGIÓN ADMINISTRATIVA ESPECIAL DE HONG KONG DE LA REPÚBLICA POPULAR DE CHINA	Hidden. You can set your contact details to be publicly available via the User Area.
		Post code	n/a		
		Address	21/F, CMA Building 64 Connaught Road Central		Hidden. You can set your contact details to be publicly available via the User Area.

Representatives

Sach & Associates

ID	86783	Country	DE - Germany	Correspondence address	
Organisation	n/a	State/county	n/a	Sach & Associates Landsberger Str. 302 D-80687 München ALEMANIA	00 49-8138 7584992
Legal status	Legal person	Town	München		00 49-81383939912
Type	Association	Post code	80687		
		Address	Landsberger Str. 302		mail@valetpatentservices.com

Designers

No data

Exhibition priority

No data

Priority

No data

Publications

Bulletin number	Date	Section	Description
2021/166	02/09/2021	A.1	Applications published under Articles 48 and 50 CDR
2023/033	17/02/2023	B.9.1	Change of name(s) and professional address(es) of the representative(s)

Showing 1 to 2 of 2 entries

Recordals

(19)



(11)

EP 3 707 092 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:

09.03.2022 Bulletin 2022/10

(21) Application number: **19725779.3**

(22) Date of filing: **05.05.2019**

(51) International Patent Classification (IPC):

B66C 1/02 (2006.01)

(52) Cooperative Patent Classification (CPC):

B66C 1/0231; B66C 1/0256; B66C 1/0287

(86) International application number:

PCT/IL2019/050502

(87) International publication number:

WO 2019/215722 (14.11.2019 Gazette 2019/46)

(54) **VACUUM GRIPPER**

VAKUUMGREIFER

PINCE À VIDE

(84) Designated Contracting States:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **08.05.2018 IL 25921618**

(43) Date of publication of application:

16.09.2020 Bulletin 2020/38

(73) Proprietor: **Nemo Power Tools Ltd.**

Central Hong Kong (CN)

(72) Inventor: **ROTEM, Nimrod**

San Francisco California 94107 (US)

(74) Representative: **Bianchetti & Minoja SRL**

**Via Plinio, 63
20129 Milano (IT)**

(56) References cited:

WO-A1-01/21357	WO-A1-2017/212163
DE-A1- 3 724 659	DE-U1-202009 004 659
GB-A- 1 036 586	US-A- 2 920 916
US-A- 3 506 297	US-A- 3 506 297
US-B1- 6 341 808	

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 3 707 092 B1

Description

TECHNOLOGICAL FIELD

[0001] The present disclosure relates to grippers for gripping object surfaces, in particular to vacuum grippers.

BACKGROUND

[0002] The following are examples of publications relevant to the background of the presently disclosed subject matter: WO2010110719, US 8096537, US 7963578, US 7712807, US 7404536, US 7222901, US 6502877, US 6244778, US 9108319, US 6296426, US 3915241, US 6413022, US 9215962, and EP 3181027.

[0003] Acknowledgement of the above references herein is not to be inferred as meaning that these are in any way relevant to the patentability of the presently disclosed subject matter.

GENERAL DESCRIPTION

[0004] According to the invention, there is provided a vacuum gripper for gripping an object surface, the vacuum gripper being a portable or hand-held vacuum gripper and comprising, prior to its being brought into contact with the object surface:

a rigid base element having a first side and a second side opposite to the first side, the second side having a central area and a periphery surrounding the central area;

a loop-shaped vacuum seal element having:

- an attachment surface, at which it is mounted at least indirectly to the periphery of the second side of the rigid base element;
- a protruding portion free of contact with the rigid base element and protruding therefrom, along an entire extension of the attachment surface, in a direction away from the first side of the base element;
- a contact surface constituting a part of the protruding portion and configured to be brought into at least a partial contact with said object surface, the vacuum seal element being elastically deformable at least at the contact surface to enable the contact surface to conform to the object surface when pressed thereagainst; and
- an inner encircling surface facing in a direction towards the central area and an outer encircling surface facing in a direction away from the inner encircling surface, both surfaces extending between the contact and the attachment surfaces;

a chamber defined by the protruding portion with said central area at the second side of the rigid base element;

an air extraction means mounted to the first side of the base element so as to be in fluid communication with said chamber through the base element, and configured to continuously extract air from the chamber to cause the contact surface to be urged towards and thereby grip the object surface when pressed thereagainst; and

at least one bracing structure protruding from the second side of the base element to a lesser extent than that of the vacuum seal element, and made of a material which is more rigid than that of the vacuum seal element; wherein the bracing structure extends along a part of the periphery which is free of contact with the vacuum seal element; and wherein said bracing structure is made of a material which is less rigid than that of the base element.

[0005] According to one aspect of the presently disclosed subject matter there is provided a vacuum gripper for gripping an object surface, the vacuum gripper comprising:

- a rigid base element having a first side and a second side opposite to the first side, the first and second sides defining therebetween a thickness of the rigid base element along its central axis, the second side having a central area and a periphery surrounding the central area and extending therefrom in a direction away from the central axis;
- a loop-shaped vacuum seal element attached at least indirectly to the periphery of the second side of the base element via an attachment surface of the vacuum seal element and having a protruding portion protruding from the second side of the base element in a direction along said axis and away from the first side of the base element, along the entire extension of the attachment surface, the protruding portion defining with said central area a chamber and comprising a contact surface configured to be brought into at least a partial contact with said object surface; and wherein the vacuum seal element is elastically deformable at least at its contact surface to enable the contact surface to conform to the object surface when pressed thereagainst; and
- an air extraction means mounted to the first side of the base element so as to be in fluid communication with said chamber through the base element, and configured to continuously extract air from the chamber to cause the contact surface to be urged towards and thereby grip the object surface when pressed thereagainst.

[0006] Due to the above features of a vacuum gripper, the contact surface of its vacuum seal element as well as the entire protruding portion thereof can have any desired radial extension and can be fully and securely supported during a gripping action. Consequently, the gripping ability of the vacuum gripper can be essentially in-

creased allowing it to be used for picking up, support, hold, place and release relatively bulky and/or heavy items such as boxes, pieces of furniture, panels and other heavy, bulky, fragile or difficult to grip items.

[0007] All additional features and aspects as well as embodiments of vacuum grippers of the presently disclosed subject matter presented below, each separately and in any combination, facilitate the above improved gripping ability of the vacuum grippers, while allowing them to have a compact and friendly design.

[0008] The periphery of the second side of the base element can be bounded by a peripheral rim radially spaced thereby from said central area and the vacuum seal element can be at least indirectly mounted to the base element via its attachment surface at an area of the periphery between the peripheral rim and the central area. The peripheral rim can constitute a lateral boundary of the gripper and the entire protruding portion or at least its substantial majority can be disposed within this lateral boundary of the gripper defined by the peripheral rim.

[0009] Thus, according to another aspect of the presently disclosed subject matter there is provided a vacuum gripper for gripping an object surface, the vacuum gripper comprising, prior to its being brought into contact with the object surface:

a rigid base element having two opposite sides, the second side having a central area and a periphery surrounding the central area; the periphery having a peripheral rim defining a lateral boundary of the gripper;

a loop-shaped vacuum seal element having an attachment surface, via which it is attached at least indirectly to the periphery of the second side of the rigid base element, and a protruding portion free of contact with the base element and protruding in a direction away from the first side of the rigid base element so that at least a majority thereof is disposed within said boundary; the protruding portion comprising a contact surface configured to be brought into at least a partial contact with said object surface; the vacuum seal element being elastically deformable at least at its contact surface to enable the contact surface to conform to the object surface when pressed thereagainst;

a chamber defined the protruding portion with said central area of the second side of the base element; and

an air extraction means mounted to the first side of the base element so as to be in fluid communication with said chamber through the base element, and configured to continuously extract air from the chamber to cause the contact surface to be urged towards and thereby grip the object surface when pressed thereagainst.

[0010] In the above aspects, the protruding portion of the vacuum seal element can have an inner encircling

surface and an outer encircling surface both extending between the contact surface and the attachment surface; the inner encircling surface being oriented transversely to the contact surface and facing in the direction of said central area and the chamber and the outer encircling surface being oriented transversely to the contact surface and facing in the direction away from said central area and the chamber. In this case, the outer encircling surface can be disposed closer to the chamber than the peripheral rim of the second side of the rigid base element to the central area.

[0011] The attachment surface of the vacuum seal element and a corresponding peripheral support area of the base element can extend along at least a majority of the the periphery of second side of the base element between the central area and the peripheral rim.

[0012] The contact surface of the vacuum seal element can be substantially co-extensive with the attachment surface along the periphery of the second side of the base surface.

[0013] The vacuum seal element can have a thickness of its protruding portion between the inner and outer encircling surfaces thereof, which meets at least one of the following conditions:

- it is at least not smaller than a predetermined distance to which the protruding portion protrudes from the second side of the rigid base element;
- it is at least not smaller than a radial extension of the attachment surface (i.e. its extension in the direction along the periphery of the second side of the vacuum seal element and away from the central axis).

[0014] The thickness of the protruding portion meeting at least one of the above conditions is a thickness at least proximate and/or adjacent the contact surface. Optionally this thickness is a thickness along a majority of said predetermined distance, to which the protruding portion of the vacuum seal element protrudes from the base element. Optionally, this thickness is a thickness along the entire predetermined distance.

[0015] The vacuum gripper can have a channel at which the vacuum seal element is at least indirectly mounted to the periphery of the second side of the rigid base element, via an attachment portion of the vacuum seal element comprising the attachment surface, the channel being open in the direction along the central axis and away from the first side of the rigid base element and being configured to receive therein said attachment portion. The channel can be configured to conform to the attachment portion, i.e. to have a shape and dimensions corresponding to those of the attachment portion. In this case, the attachment portion can contact the channel not only along the attachment surface but along its entire exterior, i.e. at all its surfaces disposed within the channel. These surfaces can include the entire attachment surface and those parts of the inner and outer encircling surfaces which are disposed within the channel.

[0016] There is thus provided according to a further aspect of the presently disclosed subject matter a vacuum gripper for gripping an object surface, the vacuum gripper comprising, prior to its being brought into contact with the object surface:

a rigid base element having first and second opposite sides, the second side having a central area with a central axis passing through both sides and a periphery surrounding the central area; the periphery having a channel of a width extending radially along the second side of the element and a depth extending axially in a direction towards the first side of the element;

a loop-shaped vacuum seal element having an attachment portion received within said channel for mounting the vacuum seal element to the rigid base element and a protruding portion free of contact with the base element and protruding from said channel along its entire width in a direction away from the first side of the rigid base element; the protruding portion comprising a contact surface configured to be brought into at least a partial contact with said object surface; the vacuum seal element being elastically deformable at least at its contact surface to enable the contact surface to conform to the object surface when pressed thereagainst;

a chamber defined by the protruding portion with said central area of the second side of the base element; and

an air extraction means mounted to the first side of the base element so as to be in fluid communication with said chamber through the base element, and configured to continuously extract air from the chamber to cause the contact surface to be urged towards and thereby grip the object surface when pressed thereagainst.

[0017] The terms "rigid" and "deformable" as used herein are relative terms, such that the base element is understood to be rigid compared to the deformable vacuum seal element.

[0018] Since the vacuum seal element is elastically deformable at least at its contact surface to enable the contact surface to conform to the object surface when pressed thereagainst, it is possible for the vacuum gripper to achieve a grip on textured surfaces where the surface texture would otherwise allow air leakage.

[0019] Since the air extraction means is configured to continuously extract air from the chamber, if any air leakage does occur, an effective vacuum status can be maintained and grip on the object surface will not be lost as a result.

[0020] The vacuum seal element can comprise at least one of silicone, rubber and closed-cell foam. Such materials are capable of flexibility sufficient to conform to a textured surface to prevent or mitigate air leakage due to the non-smooth nature of textured surfaces. Of course,

it is to be understood that such materials are also suitable for use on smooth surfaces in addition to textured surfaces. Closed-cell foams do not have significantly connected cells in the foam, therefore there is no passage-way for leakage of air through the foam. Such foams can achieve high compressibility (for example, compression of up to 75% of the foam's thickness), allowing the ability to conform with the shape of an object surface. Furthermore, since the cells are closed, air is trapped inside each of the cells. Therefore the compression in the foam is stored in a manner similar to a non-linear spring. Properties of the foam, such as the cell size, thickness of the cell walls, as well as dimensions of the foam can be selected to be suitable for the weight, size and texture of objects to be lifted.

[0021] The air extraction means can comprise an impeller or a pump, each of which separately and in combination can be further referred as air extraction mechanism. The pump or impeller can be configured to be operated in a steady or variable manner. The pump or impeller is operated in such a manner as to ensure that the vacuum which allows the gripping to occur is not lost. Thus for some textured surfaces, or in some cases, steady operation can be desirable, while in others, such as with smoother surfaces, light objects which can need to be lifted, and/or where energy savings might be achieved, a variable operation can be desirable. By "variable", what is meant is fluctuation in operating power, which can also include pulsed or intermittent operation. In the present specification,

[0022] The vacuum gripper can be a portable or hand-held vacuum gripper. The air extraction means can further comprise a power source. The power source can comprise a battery pack. By enabling a hand-held or portable vacuum gripper to have its own power source, there is no need for a mains connection or other wired power connection which could otherwise constitute a trip-hazard in many circumstances. Thus the vacuum gripper can accommodate use in many environments more safely and easily.

[0023] At least one of the power source and the air extraction mechanism can be disposed on the first side of the base element. Since at least one of the power source and air extraction mechanism can be disposed on the first side of the base element, a more compact arrangement can be achieved.

[0024] The vacuum gripper can comprise a handle for holding the vacuum gripper. The handle can extend along a longitudinal direction of the rigid base element, and be mounted to its first side at locations spaced apart in the longitudinal direction. For example, the handle can have a graspable handle section extending along the length of the first side of the rigid base element and two handle mounting sections oriented transversely to the graspable section and engaging the first side of the rigid base element.

[0025] Thus, according to still further aspect of the presently disclosed subject matter, there is provided a

vacuum gripper for gripping an object surface, the vacuum gripper comprising, prior to its being brought into contact with the object surface:

- a rigid base element having a first side and a second side opposite to the first side, the second side having a central area and a periphery;
- a loop-shaped vacuum seal element having an attachment surface at which it is attached at least indirectly to said periphery of the second side of the base element and a protruding portion free of contact with the base element and protruding therefrom in a direction away from the first side of the base element; the protruding portion of the vacuum seal element comprising a contact surface configured to be brought into at least a partial contact with said object surface, the protruding portion define with the central area a chamber; the vacuum seal element being elastically deformable at least at its contact surface to enable the contact surface to conform to the object surface when pressed thereagainst;
- a handle assembly having a graspable handle section and two spaced apart handle mounting sections oriented transversely to the graspable section and integrally connected to the first side of the rigid basic element; and
- an air extraction means housed in the handle assembly at least partially within the handle mounting sections, in fluid communication with said chamber through the base element, the air extraction means being configured to continuously extract air from the chamber to cause the contact surface to be urged towards and thereby grip the object surface when pressed thereagainst.

[0026] Thus, a compact arrangement of the vacuum gripper can be achieved when different components of the air extraction means are housed within different parts of the handle assembly. The two handle mounting sections can be used for housing at least partially most of the components of the air extraction means.

[0027] In all the above aspects and embodiments, the vacuum gripper can comprise a bracing structure protruding from the second side of the base element to a lesser extent than that of the protruding portion of the vacuum seal element, and made of a material which is more rigid than that of the vacuum seal element; wherein the bracing structure extends at least along a part of the protruding portion of the vacuum seal element. Since the bracing structure protrudes from the base element to a lesser extent than that of protruding portion of the vacuum seal element, the vacuum seal element will be the first component to contact an object surface. Since the bracing structure is made of a material which is more rigid than that of the vacuum seal element, the vacuum seal element will initially deform in a manner to conform to an object surface, and subsequently, the bracing structure will provide sufficient support, stiffness and structure to

prevent over-compression of the vacuum seal element.

[0028] Thus, according to a still further aspect of the presently disclosed subject matter, there is provided a vacuum gripper for gripping an object surface, the vacuum gripper comprising:

- a rigid base element having a first side and a second side opposite to the first side, the second side having a central area and a periphery surrounding the central area;
- a loop-shaped vacuum seal element having an attachment surface at which it is attached to the periphery of the second side of the base element and a protruding portion protruding therefrom in a direction away from the first side of the base element, along an entire extension of the attachment surface, so as to define a chamber with the central area of the second side of the rigid base element; the vacuum seal element comprising a contact surface configured to be brought into at least a partial contact with said object surface and an inner and an outer encircling surface both extending between the attachment surface and the contact surface, the inner encircling surface facing in a direction towards the central area and the chamber and the outer encircling surface facing in a direction away from the central area and the chamber; the vacuum seal element being elastically deformable at least at its contact surface to enable the contact surface to conform to the object surface when pressed thereagainst and grip the object surface when air is extracted from said chamber; and
- a bracing structure attached to the periphery of the second side of the base element and protruding therefrom in a direction away from the first side of the base element to a lesser extent than that of the protruding portion of the vacuum seal element; the bracing structure is made of a material which is more rigid than that of the vacuum seal element; and wherein the bracing structure extends at least along a part of the vacuum seal element.

[0029] Said bracing structure can be made of a material which is less rigid than that of the base. Since the bracing structure is made of a material which is less rigid than that of the base element, the bracing structure will be capable of some small amount of deformation and thus will not damage the object surface. Conversely, the relatively more rigid base element will provide structural integrity to the chamber.

[0030] Said bracing structure can have a loop shape. With this arrangement, support for the entire length of the vacuum seal element can be provided. Conversely, the bracing structure can have an intermittent shape. Such a shape can allow more flexibility in the deformability of the vacuum seal structure.

[0031] The bracing structure can be disposed closer to the central area of the second side than to a peripheral

rim thereof. In this arrangement, the bracing structure can be concealed inside the chamber. Alternatively, the bracing structure can be disposed closer to the periphery of the second side than to the central area thereof. In this arrangement, the bracing structure can be visible outside of the chamber and so it will be possible to know once the maximum possible deformation and thus the maximum possible vacuum have been achieved and strongest grip has been formed between the vacuum gripper and an object surface.

[0032] The bracing structure can comprise at least one of rubber, silicone and closed-cell foam. Such materials can allow flexibility while maintaining a high structural integrity and rigidity.

[0033] In all the above aspects and embodiments, the vacuum seal element can be made at least partially of a closed-cell foam material.

[0034] Thus, according to a still further aspect of the present disclosure, there is provided a vacuum gripper for gripping an object surface, the vacuum gripper comprising:

a rigid base element having a first side and a second side opposite to the first side, the second side having a central area and a periphery surrounding the central area; and

a loop-shaped vacuum seal element comprising a closed-cell foam material and having an attachment surface at which it is attached to the periphery of the second side of the base element and a protruding portion protruding therefrom in a direction away from the first side of the base element, along an entire extension of the attachment surface, so as to define a chamber with the central area of the second side of the rigid base element; the vacuum seal element comprising a contact surface configured to be brought into at least a partial contact with said object surface and an inner and an outer encircling surface both extending between the attachment surface and the contact surface, the inner surface facing in a direction towards the central area and the chamber and the outer surface facing in a direction away from the central area and the chamber; the vacuum seal element being elastically deformable at least at its contact surface to enable the contact surface to conform to the object surface when pressed thereagainst and grip the object surface when air is extracted from said chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] In order to better understand the subject matter that is disclosed herein and to exemplify how it can be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying schematic drawings, in which:

Fig. 1 shows a bottom perspective view of a vacuum

gripper according to one example of the presently disclosed subject matter;

Fig. 2 shows a bottom perspective view of a vacuum gripper according to a second example of the presently disclosed subject matter;

Fig. 3 shows a bottom perspective view of a vacuum gripper according to a still further example of the presently disclosed subject matter;

Fig. 4 shows a top perspective view of a vacuum gripper according to a still further example of the presently disclosed subject matter;

Fig. 5 shows a cross-sectional view of the vacuum gripper shown in Fig. 4, taken along a plane A-A in Figure 4;

Fig. 6 shows a perspective view of the vacuum gripper shown in Fig. 4, being cut-away along a plane B-B in Figure 4;

Fig. 7 shows a perspective view of the vacuum gripper shown in Fig. 4, being cut-away along a plane C-C in Figure 4;

Fig. 8 shows a partial perspective view of the vacuum gripper shown in Fig. 4, being cut-away along a plane D-D in Figure 4;

Fig. 9 shows an exploded perspective view of components of a base portion of the vacuum gripper shown in Fig. 4; and

Fig. 10 shows an exploded perspective view of components of a vacuum release mechanism.

DETAILED DESCRIPTION OF EMBODIMENTS

[0036] A vacuum gripper is a device suitable for gripping an object at an object surface due to a vacuum which is created between the vacuum gripper and the object surface.

[0037] According to one example, as schematically shown in Figure 1, a vacuum gripper 200 comprises a rigid base element 210 having a first side 212 and a second side 214 opposite to the first side 212. The second side 214 has a central area 216 and a periphery 218 surrounding the central area 216. The periphery 218, which is seen only partially, is bounded by a peripheral rim 218a radially spaced thereby from the central area.

[0038] The vacuum gripper 200 further comprises a loop-shaped vacuum seal element 220 attached with an attachment surface 221 thereof to the periphery 218 along a peripheral support area 218b (not seen).

[0039] The loop-shaped vacuum seal element 220 further comprises a protruding portion 223 which is free of contact with the base element 210 and which protruding from the second side 214 of the base element 210 in a direction away from the first side 212 of the base element 210 to a predetermined distance D1.

[0040] The protruding portion 223 of the vacuum seal element 220 comprises a contact surface 222 configured to be brought into at least a partial contact with an object surface. The vacuum seal element 220 also comprises an inner encircling surface 224 oriented transversely to

and extending from the contact surface 222 and facing towards the central area 216 so as to define therewith a chamber 230 along the protruding portion 223. The vacuum seal element 220 also comprises an outer encircling surface 225 oriented transversely to and extending from the contact surface 222 and facing away from the central area 216 and the chamber 230, the peripheral rim 218a of the second side of the base element protruding outwardly from the outer encircling surface.

[0041] Thus, the contact surface 222 and the attachment surface 221 of the vacuum seal element both extend between the inner and outer encircling surfaces 224 and 225. As can be understood from Fig. 1, in this example the contact surface 222 is co-extensive with the attachment surface 221 along the periphery of the second side of the base element.

[0042] As further seen in Fig. 1, the predetermined distance D, to which the protruding portion 223 protrudes from the second side of the rigid base element, does not exceed a thickness T of the protruding portion between the inner and outer encircling surfaces. More particularly, the thickness T of the protruding portion is greater than the predetermined distance D1.

[0043] The vacuum seal element 220 is elastically deformable at least at its contact surface 222 to enable the contact surface 222 to conform to an object surface when pressed thereagainst. The vacuum gripper 200 further comprises an air extraction means 240 mounted to the first side 212 of the base element 210 so as to be in fluid communication with the chamber 230 through the base element 210. The air extraction means 240 is configured to continuously extract air from the chamber to cause the contact surface 222 to be urged towards and thereby grip an object surface when pressed thereagainst.

[0044] According to a further example, as shown in Figure 2, a vacuum gripper 300 comprises a rigid base element 310 having a first side 312 and a second side 314 opposite to the first side 312. The second side 314 has a central area 316 and a periphery 318 surrounding the central area 316 and bounded by a peripheral rim 318a.

[0045] The vacuum gripper 300 further comprises a loop-shaped vacuum seal element 320 attached to the periphery of the second side 314 of the base element 310 with an attachment surface 321 thereof along a peripheral support area 318b (not seen).

[0046] The loop-shaped vacuum seal element 320 comprises a protruding portion 323 free of contact with the base element 310 protruding from the second side 314 of the base element 310 in a direction away from the first side 312 of the base element 310 to a predetermined distance D1. The protruding portion 323 of the vacuum seal element 320 comprises a contact surface 322 configured to be brought into at least a partial contact with an object surface. The vacuum seal element 320 also comprises an inner encircling surface 324 oriented transversely to and extending from the contact surface 322 and at least partially facing towards the central area 316 so as to define therewith a chamber 330 along the pro-

truding portion 323. The vacuum seal element 320 also comprises an outer encircling surface 325 oriented transversely to and extending from the contact surface 322 and facing away from the central area 316 and the chamber 330, the peripheral rim 318a of the second side of the base element protruding outwardly from the outer encircling surface. Thus, the contact surface 322 and the attachment surface 321 of the vacuum seal element both extend between the inner and outer encircling surfaces 324 and 325. As can be understood from Fig. 2, the contact surface 322 is co-extensive with the attachment surface 321 along the periphery of the second side of the base element.

[0047] As further seen in Fig. 2, the predetermined distance D1, to which the protruding portion 323 protrudes from the second side of the rigid base element, does not exceed a thickness T of the protruding portion between the inner and outer encircling surfaces. More particularly, the thickness T of the protruding portion is greater than the predetermined distance D1.

[0048] The vacuum seal element 320 is elastically deformable at least at its contact surface 322 to enable the contact surface 322 to conform to an object surface when pressed thereagainst. The vacuum gripper 300 further comprises a bracing structure 350 attached to the peripheral support area 318b (not seen) of the second side 314 of the base element 310 and protruding therefrom in a direction away from the first side 312 of the base element to a lesser extent than that of the vacuum seal element 320. The bracing structure 350 is made of a material which is more rigid than that of the vacuum seal element 320. The bracing structure 350 extends at least along a part of the vacuum seal element 320.

[0049] According to a still further example, as shown in Figure 3, a vacuum gripper 400 comprises a rigid base element 410 having a first side 412 and a second side 414 opposite to the first side 412. The second side 414 has a central area 416 and a periphery 418 surrounding the central area 416 and bounded by a peripheral rim 418a radially spaced thereby from the central area.

[0050] The vacuum gripper 400 further comprises a loop-shaped vacuum seal element 420 attached to the peripheral support area 418b of the second side 414 of the base element 410 with an attachment surface 421 thereof at a peripheral support area 418b (not seen).

[0051] As can be seen in Figure 3, the loop-shaped vacuum seal element 420 is attached to the second side 414 of the base element 410. The loop-shaped vacuum seal element 420 comprises a protruding portion 423 free of contact with the base element protruding from the second side 414 of the base element 410 in a direction away from the first side 412 of the base element 410 to a predetermined distance D1. The protruding portion 423 of the vacuum seal element 420 comprises a contact surface 422 configured to be brought into at least a partial contact with an object surface. The vacuum seal element 420 also comprises an inner encircling surface 424 oriented transversely to and extending from the contact sur-

face 422 and at least partially facing towards the central area 416 so as to define therewith a chamber 430 along the protruding portion 423. The vacuum seal element 420 also comprises an outer encircling surface 425 oriented transversely to and extending from the contact surface 422 and facing away from the central area 416 and the chamber 430, the peripheral rim 418a of the second side of the base element protruding outwardly from the outer encircling surface. Thus, the contact surface 422 and the attachment surface 421 of the vacuum seal element both extend between the inner and outer encircling surfaces 424 and 425. As can be understood from Fig. 3, the contact surface 422 is co-extensive with the attachment surface 421 along the periphery of the second side of the base element.

[0052] As further seen in Fig. 3, the predetermined distance D1, to which the protruding portion 323 protrudes from the second side of the rigid base element, does not exceed a thickness T of the protruding portion between the inner and outer encircling surfaces. More particularly, the thickness T of the protruding portion is greater than the predetermined distance D1.

[0053] The vacuum seal element 420 is elastically deformable at least at its contact surface 422 to enable the contact surface 422 to conform to an object surface when pressed thereagainst. The vacuum seal 420 element comprises a closed-cell foam material.

[0054] An exemplary closed-cell foam material can be formed, for example, from Styrene, 1,3-butadiene polymer, also known as: Benzene, ethenyl-, polymer with 1,3-butadiene; Butadiene-styrene latex; Butadiene-styrene resin; Poly(styrene-co-butadiene), 5% styrene; Styrene, 1,3-butadiene polymer; Styrene- Butadiene copolymer; Styrene-butadiene copolymers; and having the following properties:

CAS (Chemical Abstract Service) Registry Number: 9003-55-8

Molecular Formula: $C_{12}H_{14}$

Molecular Weight: 158.243

Density: 1.04 g/mL at 25 °C

Solubility: solvents with solubility parameters between 7.7 and 9.4: soluble

Form: slab/chunk

Stability: Stable. Combustible. Incompatible with strong oxidizing agents.

Breaking strength (MPa): 24.5 ~ 26.5

Elongation at break (%): 800 ~ 1000

Rebound rate (%): 50 - 80

Compression ratio 100°C 70h (%): 2-40

Maximum use temperature (c): 150

Embrittlement temperature (c): -35 - -42

Expansion ratio (%): gasoline 10 - 45; benzene 100 - 300 ; acetone 15 - 50; ethanol 5-20.

[0055] Such a material may be formed or manufactured into a closed-cell foam using the manufacturing method of SBR foaming, and the production method of

finished products can be by die-cutting.

[0056] Any other suitable materials can be used instead or additionally, i.e. materials having properties with comparable properties such as one or more of, but not limited to, Breaking strength, Elongation at break, Compression ratio, Rebound rate and Hermeticity.

[0057] In each of the above examples, the first and second sides of the rigid base element define therebetween a thickness of the rigid base element along its central axis.

[0058] In each of the above examples, the loop-shaped vacuum seal element is so mounted to second side of the rigid base element that as can be seen in Figures 1, 2 and 3, they can be considered as having the following features:

- the protruding portion of the vacuum seal element is disposed within a lateral boundary defined by the peripheral rim of the second side of the rigid base element;
- the protruding portion is disposed closer to the chamber than the peripheral rim of the second side of the rigid element to the central area;
- the contact surface of the protruding portion and the attachment surface of the attachment surface are substantially co-extensive in the radial direction.

[0059] Each of the above examples can additionally include any of the features from others of these examples, and can additionally or alternatively include any of the features described below in relation to a further example of the presently disclosed subject matter. For example, the second and third examples can also include air extractor means as set out in the first example, and the air extractor means can be a pump or impeller, and can operate in a steady or variable manner.

[0060] Alternatively or additionally, each of the first and third examples can include a bracing structure as set out in the second example. Further, in any of the examples, the bracing structure can be made of a material which is less rigid than that of the base element, can have a loop shape, can be disposed either closer to the central area of the second side than to the peripheral rim thereof, or closer to the peripheral rim of the second side than to the central area thereof, and/or can comprise at least one of rubber, silicone and closed-cell foam.

[0061] Alternatively or additionally, the vacuum seal element of the vacuum gripper of each of the first and second examples can comprise a closed-cell foam material. Alternatively or additionally, it can comprise a silicon and/or rubber material.

[0062] Alternatively or additionally, any of the first to third examples be a portable or hand-held vacuum gripper, the air extraction means can further comprise a power source, which can comprise a battery pack, at least one of the power source and the pump or impeller can be disposed on the first side of the base element, the vacuum gripper can comprise a handle for holding the

vacuum gripper, and/or at least one of the power source and the pump or impeller can be at least partially housed in the handle.

[0063] In the vacuum grippers 200, 300 and 400, their vacuum seal elements can be attached to the peripheral area of the second side of their rigid base elements directly or indirectly in any suitable manner.

[0064] Figure 4 shows a still further example of a vacuum gripper, a vacuum gripper 100. The vacuum gripper 100 comprises a handle portion 110, a power supply portion 120 (see also Figure 5), a pump portion 130 (see also Figure 5) and a base portion 140. The handle portion 110 has a first end 111a and a second end 111b, by which the handle portion 110 is connected or mounted to the base portion 140.

[0065] The base portion 140 as seen in Figure 4 comprises a rigid base element 141 having a first side 141a and a second side 141b opposite to the first side, and a vacuum seal element 145 held thereby.

[0066] The first side of 141a of the base element 141 is the same as a first side 140a of the base portion 140. The handle portion, power supply portion and pump portion are disposed on the first side 141a of the rigid base element 141, and can be mounted thereto either directly or via each other. For example, the power supply portion and the pump portion can be mounted to the first side 141a of the base element 141 via the handle portion 110. Such mounting avoids disconnection of components due to any vibrations caused when a pump of the pump portion is in operation.

[0067] Handle portion 110 can be a single piece or can comprise multiple pieces. If the handle portion comprises multiple pieces, it can be hollow and so it can be possible to house various components within the handle. Such housings can be joined by screws, bolts, adhesives or snap-fitting arrangements, for example.

[0068] The handle can be connected along a single surface or at multiple surfaces to the base portion. The handle can have a wider palm-gripping portion and a narrower finger-gripping portion to allow easy grasping of the handle. Alternatively, the handle can comprise a hole or aperture when connected to the base portion, to allow a hand to grasp around the handle easily. The handle can take an elongate shape for easy grasping. For ease of grasping, the handle can be provided with a textured surfaces, in the form of protrusions and/or recesses, for improved friction with a user's hand.

[0069] As shown specifically in the vacuum gripper 100, as seen in Figure 6, the handle portion 110 comprises an upper housing 112 and a lower housing 114, which are joined together by at least one screw or bolt 116. The upper and lower housings 112, 114 are arranged in this example to form an elongate shape, easily capable of being gripped by a user's hand.

[0070] In order to provide improved grip in the hand of user, the surface of the upper and lower housings 112, 114 are provided with a multiple recesses 118 (see Figure 6) arranged in rows and columns.

[0071] The power supply portion and the pump portion can be provided separately from the handle portion or can be provided within the handle portion. For example, arrangements are envisioned, whereby the power supply portion and the pump portion are arranged at the same or opposite ends of the handle portion, or one or both are not at either end but rather in the middle of the handle portion. Alternatively, one or both of the power supply portion and the pump portion can be provided within an end of the handle portion, and extending further into the handle portion away from that end.

[0072] In the vacuum gripper as shown in Figure 5, the power supply portion 120 is arranged at and within the first end 111a of the handle portion 110 and the pump portion 130 is arranged within the second end 111b of the handle portion 110, which is the opposite end of the handle portion 110 from the first end 111a. The pump portion 130 extends further from the second end 111b into the handle portion 110.

[0073] The power supply portion is for supplying power to the pump portion, and can be a battery pack. The power supply portion can be electrically connected to the pump portion through the handle, or outside of the handle, for example, along the first surface of the base portion to which the handle is mounted. In the former case, the electrical connection has greater structural integrity as it can be protected from environmental damage.

[0074] As shown in more detail in Figures 5 and 7, the power supply portion 120 comprises a battery or battery pack 122, arranged to supply power to the pump portion 130 of the vacuum gripper 100. The battery pack 122 is electrically connected through the handle portion 110, to the pump portion 130, in order to supply power to the pump portion 130.

[0075] Various operating controls can be provided to control the power supplied by the power supply portion to the pump portion. For example various buttons, sliders, control dials for adjusting the power strength, triggers or other devices can be provided. The power operating control can be arranged to remain at the "on" position until a user turns it to "off". This enables the user to retain full functionality of their hands for safely lifting the vacuum gripper. Alternatively, as a safety mechanism, power knob 124 may only be "on" as long as it is depressed by a user, and changes to "off" when released. Such an arrangement ensures safety and power savings when the vacuum gripper is left unattended, and power savings when in use in a situation where no further air extraction is required.

[0076] As shown in Figures 4, 5 and 6, the battery pack 122 is further electrically connected to a power knob 124 arranged at the first end 111a of the handle portion 110a. The power knob 124 can be actuated by a user to operate, i.e. turn on and off and vary the power supply to, the pump portion 130. In this case, the power knob 124 is a press-release button, i.e. requires being held down and depressed in order to supply power to the pump portion 130. There is also an ON/OFF button 126 (see Figure 4)

at the second end 111b of the handle portion 110, which in the "off" state can allow the battery to be charged, and in the "on" state allows power supply to the pump portion.

[0077] The pump portion can comprise a pump, impeller or other air extraction mechanism/device, and as described above can be disposed partly in the handle. The pump is fixedly mounted to the base portion, either directly or via the handle. Such a fixed arrangement provides structural integrity. The pump can comprise a filtering arrangement, such as a filter and filter holder for filtering air passing through the pump to avoid ingress of particulates which could damage the pump, or impair its operation.

[0078] As shown in Figures 5 and 8, the pump portion 130 comprises a pump 132 disposed partly in the second end 111b of the handle portion 110, and partly continuing into the handle portion 110, extending partly through the handle portion 110 in a direction towards the first end 111a. The pump 132 is a vacuum pump, i.e. arranged to extract air as will be described further below. The end of the pump 132 disposed towards the first end 111a of the handle portion 110 is electrically connected to, and powered by, the battery pack 122 of the power supply portion 120. An opposite end of the pump 132 is disposed in the second end 111b of the handle portion 110, separated from the base portion 140 by means of a filter holder 134 arranged to contain a filter 136. The filter 136 is arranged to prevent ingress of particles to the pump 132 during pump operation as air is drawn into and through the pump 132 via the filter 136.

[0079] The filter holder 134 and filter 136 are fluidly connected in a sealed manner to a hole 146 passing through the base element 141 from the first side 141a of the base element 141 to the second side 141b of the base element 141.

[0080] As can be seen in Figures 5-8, the first and second sides of the rigid base element define therebetween a thickness of the rigid base element along its central axis, and the second side 141b of the base element has a central area 160 and a periphery 180 surrounding the central area 160 and bounded by a peripheral rim 180a radially spaced thereby from the central area.

[0081] The vacuum seal element 145 is attached at an attachment portion 145a thereof to a peripheral support area 180b constituting a part of the periphery 180 of the second side of the base element 141, and the attachment portion 145a has an attachment surface 145f in contact with peripheral support area.

[0082] The vacuum seal element 145 further comprises a protruding portion 145b free of contact with the base element and protruding therefrom in a direction away from the first side 141a to a predetermined distance D1. The protruding portion is co-extensive with the attachment portion 145a along the peripheral support area 180b. The surface of the protruding portion 145b of the vacuum seal element 145 which is distal from the second side 141b is a contact surface 145c for contacting an object surface.

[0083] The vacuum seal element 145 further comprises an inner encircling surface 145d oriented transversely to and extending from the contact surface 145c and partially facing towards the central area 160 so as to define therewith a chamber 170 along the protruding portion 423. The vacuum seal element 145 also comprises an outer encircling surface 145e oriented transversely to and extending from the contact surface 145c and facing away from the central area 160 and the chamber 170, the peripheral rim 18a of the second side of the base element protruding outwardly from the outer encircling surface. Thus, the contact surface 145c and the attachment surface 145f of the vacuum seal element both extend between the inner and outer encircling surfaces 145d and 145e, and the contact surface 145c is co-extensive with the attachment surface 145f along the peripheral support area 180b of the second side of the base element.

[0084] As seen, the predetermined distance D1, to which the protruding portion 145a protrudes from the second side of the rigid base element, does not exceed a thickness T of the protruding portion between the inner and outer encircling surfaces. More particularly, the thickness T of the protruding portion is greater than the predetermined distance D1.

[0085] The vacuum seal element is disposed closer to a peripheral rim 180a of the second side 141b than the central area 160 of the second side 141b, and has a loop shape. By loop shape, what is meant is that the vacuum seal element sealingly encircles the chamber 170. The loop-shape can be an annulus, i.e. circular, or can comprise any other shaped circuitous structure, i.e. a closed boundary, e.g. an elliptical shape.

[0086] In each of the above examples, the loop-shaped vacuum seal element is so mounted to second side of the rigid base element that as can be seen in Figures 1, 2 and 3, they can be considered as having the following features:

- the protruding portion of the vacuum seal element is disposed within a lateral boundary defined by the peripheral rim of the second side of the rigid base element;
- the protruding portion is disposed closer to the chamber than the peripheral rim of the second side of the rigid element to the central area;
- the contact surface of the protruding portion and the attachment surface of the attachment surface are substantially co-extensive in the radial direction.

[0087] The vacuum seal element 145 with its attachment portion 145a mounted to the of the peripheral support area 180b of the second side 141b of the rigid base element can be considered as constituting with this area (and any other elements used for such mounting as described in detail below) a vacuum seal assembly, and as can be seen in Figures 5-8, this assembly has each of the following features:

- the protruding portion of the vacuum seal element is disposed within a lateral boundary of the assembly defined by the peripheral rim of the second side of the rigid base element (this boundary is shown in dotted line and designated as 180c in Fig. 5); and
- the assembly comprises a channel 180d (Fig. 5) receiving the attachment portion 145b and conforming thereto in shape, i.e. the channel has a width corresponding to the thickness of the attachment portion and a depth of the channel corresponding to a height of the attachment portion along its inner and outer encircling surfaces (these width and depth are designated in Fig. 5 as W and D2 respectively); in this particular example the width exceeds the depth.

[0088] The base portion 140 can comprise further structural components e.g. at the second side of the rigid element, such as a seal structure element for giving support to the vacuum seal element 145, a leakage seal element for ensuring a seal between the base element 141 and the seal structure element, and a bracing structure for providing structural integrity to the vacuum seal element 145.

[0089] In the particular example as shown in the exploded view of Figure 9, and as visible in the cross sections shown in Figures 7 and 8, the base portion 140 is of generally elliptical shape and comprises, apart from the rigid base element 141 and the vacuum seal element 145, also a leakage seal element 142, a seal structure element 143, and a bracing structure 144. The rigid base element 141 provides a supportive structure, and the ends 111a, 111b of the handle portion 110 are attached to the first side 141a of the base element 141 in the manner described above. Additionally, at least some of the components of the power supply portion 120 and the pump portion 130 can be securely fixed to the base element 141, to avoid disconnection of components due to any vibrations caused when the pump 132 is in operation.

[0090] The base element can be formed by injection molding or casting, and can comprise a polymer, plastic or a metal. The base element can be provided at its underside with a number of ribs to provide more strength and structure to the base element which will be put under high loads when a vacuum is formed adjacent thereto, as will be described in more detail below. The base element can also comprise a number of holes passing therethrough in order to allow passage of bolts or other fixing members which can provide a secure mounting connections between the base element and the ends of the handle portion, the pump portion and/or the power supply portion. The arrangement of ribs will vary depending on the particular arrangement of components, connections, and the dimensions of each structural member.

[0091] As shown in the example, as depicted in Figure 9, various ribs 147 are shown on the second side 141b of the base element 141 and various holes are shown as passing through the base element from the second side 141b to the first side 141a.

[0092] Various other structural arrangements can be provided to retain and/or support the various components of the base portion. For example, various clips, channels or tracks can be provided on the second side of the base element to securely hold the vacuum seal element and any or all other components of the base portion in place.

[0093] As shown in Figure 9 in this particular example, the base element 141 comprises an elliptical track 148 at its second side 141b, open in a direction away from the first side 141a, having track sides for supporting the various components of the seal. The leakage seal element 142 is disposed entirely within the track 148, between (and adjacent to) the base element 141 and the seal structure element 143, creating a fluid-impervious seal between the base element 141 and the seal structure element 143.

[0094] The seal structure element 143 comprises an elliptical looped structure having a T-shaped radial cross-section. The top of the "T-shape" contacts and lies parallel to the leakage seal element 142, while the leg of the "T-shape" extends transverse to the leakage seal element 142. Thus two channels, each having an elliptical loop shape, are formed within the track 148. Each channel is bounded by one of the track sides and one respective side of the leg of the "T-shape". The two channels are open in a direction away from the second side 141b and are concentric, i.e. there is an inner channel and an outer channel. The bracing structure 144 is fixed in the inner channel and the vacuum seal element 145 is fixed in the outer channel.

[0095] The bracing structure is arranged to prevent over-compression or over-deformation of the vacuum seal element. Thus, for example, the bracing structure can be stiffer or more rigid than the vacuum seal element. In other words, the bracing structure comprises a material which is relatively much more stiff or rigid, and less easily deformable than the vacuum seal element. Exemplary materials for the bracing structure include, but are not limited to, silicone, rubber, and/or a relatively stiff closed-cell foam, while exemplary materials for the vacuum seal element include, but are not limited to, silicone, rubber and/or closed-cell foams. It is to be understood that where similar materials are chosen for each of the bracing structure and the vacuum seal element, a stiffer, more rigid form of the material should be provided for the former and a more deformable, less rigid form of the material should be provided for the latter.

[0096] The bracing structure protrudes from the second side of the base element to a lesser extent than the vacuum seal element. The bracing structure can comprise a loop-shape arranged either concentrically within or concentrically outside the vacuum seal element. Alternatively, the bracing structure can comprise one or more extended intermittent supportive elements, such as curved or straight portions extending along the vacuum seal element, or even multiple support pillars spaced along, i.e. extending along, the vacuum seal element, to enable support to be provided at multiple points around

and along the loop-shaped vacuum seal element.

[0097] In the specific example shown in Figure 8 for example, the bracing structure 144 protrudes by a smaller amount out of the channel than the outer vacuum seal element 145. Therefore, if the contact surface of the vacuum seal element 144 is brought into contact with an object surface, for example a textured panel to be lifted, the vacuum seal element 145 will contact the object surface, and the bracing structure 144 will be spaced apart, i.e. offset, from the object surface. In this manner, the chamber defined by the encircling surface and the second side 141b of the base element 141 becomes enclosed as it is additionally bounded by the object surface.

[0098] Upon activation of, i.e. supply of power to, the pump 132 (when the vacuum gripper 100 is switched on by actuating (depressing) the power knob 124 and turning "on" the ON/OFF button 126), air is drawn from chamber via the hole 146 passing through the base element 141, through the filter 136, through the pump 132 and out of the vacuum gripper 100. If the contact surface of the vacuum seal element 144 has been brought into contact with an object surface, the chamber will be enclosed. Consequently, when the pump 132 is activated, the air pressure in the enclosed chamber reduces relative to the ambient air pressure outside of the chamber, so that the vacuum gripper 100 and the object surface are urged closer together.

[0099] As this urging force increases with decreasing pressure in the enclosed chamber, the contact surface of the vacuum seal element 145 will begin to deform and compress in such a manner as to bring the vacuum gripper 100 and the object surface closer together, and cause the contact surface of the vacuum seal element 145 to adapt its shape to more closely conform with the texture of the object surface.

[0100] As the vacuum gripper 100 and the object surface come closer together and are brought into closer conformity with one another, a better seal is created, reducing undesirable ingress of air, via gaps between the vacuum seal element 145 and the object surface, into the enclosed chamber. This creates a more effective vacuum and therefore stronger urging of the vacuum gripper 100 and the object surface towards one another.

[0101] Over-compression of the vacuum seal element 145 can be problematic, as it can damage the vacuum seal element 145 by moving from elastic deformation to plastic deformation. Consequently, this could lead to reduced effectiveness of the vacuum seal element 145 and thus less effective grip.

[0102] The bracing structure 144 helps to prevent over-compression of the vacuum seal element 145 as follows. As the vacuum gripper 100 and the object surface come closer together, the offset or space between the bracing structure 144 and the object surface, due to the relative protrusion distances of the bracing structure 144 and the contact surface of the vacuum seal element 145 from the second side 141b of the base element 141, is reduced. At a certain compression threshold, at least some of the

vacuum seal element 145 or the contact surface thereof will have been compressed to effectively protrude by the same amount as the bracing structure, and so the bracing structure 144 will contact the object surface. Since the bracing structure 144 is less easily deformable than the vacuum seal element 145, the bracing structure will resist and withstand further urging forces caused by the vacuum and thus prevent further significant compression, i.e. over-compression, of the vacuum seal element 145.

[0103] An alternative to the above is an arrangement comprising use of only a vacuum seal element, having a material and shape chosen such as to be deformable but to resist over-deformation, allowing the vacuum gripper 100 to conform with the external surface, while avoiding over-compression due to innate material stiffness.

[0104] In each case, since the vacuum gripper 100 has a vacuum seal element with a contact surface capable of conforming to an object surface, an effective vacuum can easily be formed and so a smaller, i.e. more energy efficient pump can be used. For example, a pump can have a working voltage of 9-14 V DC, a vacuum degree of 80 kPa, a rated flow of 20 L/min, a rated power of 16 W, and a rated voltage of 12 V DC. Since the pump is smaller and consumes less energy, a smaller power supply is required. Thus both the pump portion 130 and the power supply portion 120 can be small and light, increasing the portability and ease of use of the vacuum gripper, particularly when using the vacuum gripper to support and lift objects which are themselves heavy.

[0105] Furthermore, energy efficiency can also be improved by operating the pump in a variable manner, for example by reducing the power supplied to the pump to a level sufficient to maintain the vacuum grip on an object, without unnecessarily reducing the pressure in the chamber to a stronger vacuum. In this way, power savings can be achieved, as the vacuum gripper is more adaptable to different gripping situations.

[0106] The vacuum gripper can be used on a variety of surfaces, including smooth and textured surfaces. This is because the deformability of the contact surface of the vacuum seal element 145 of the vacuum gripper 100 allows conformity of the vacuum gripper 100 with the surface of an object to be carried, thereby ensuring a sufficient vacuum can be achieved, even when the external surface can be textured, i.e. it is not a smooth surface.

[0107] By vacuum, what is meant is that an ultimate pressure in the enclosed chamber is substantially below atmospheric pressure. For example, having a pressure in the range of 50-80 kPa.

[0108] The vacuum gripper 100 can be used to pick up, support, hold, place and release items such as boxes, pieces of furniture, panels and other heavy, bulky, fragile or difficult to grip items. When the user desires to release the item from the grip of the vacuum gripper, a simple release mechanism can be provided which causes a gap in one of the surfaces of the enclosed chamber, allowing ingress of air, causing loss of vacuum, loss of grip and separation of the vacuum gripper 100 and the external

surface of the item.

[0109] In the example shown in Figures 4 and more specifically in Figures 5 and 10, the mechanical release is provided in the form of release mechanism 150, having release button 152 provided at the first end 111a of the handle portion 110. Release button 152 is connected via a shaft 153 to a blocking component 158 located at the second side 141b of the base element 141 via a hole in the base element 141. A surface of the blocking component 158 which faces the second side 141b of the base element 141 comprises an annular channel into which an O-ring or other sealing component is placed. The O-ring or sealing component has a larger diameter than, and surrounds, the outer circumference of the hole in the base element 141 through which the shaft 153 passes. A compression spring 154 urges at one end against a circlip 155 on the shaft 153 and at the other against the upper surface of the main base element 141, i.e. against the upper surface 140a of the base portion 140. This causes the blocking component 158 to be biased and pulled upwards and compress the O-ring or sealing component between the blocking element 158 and the second side 141b of the base element 141. This creates an effective airtight seal against air leakage into the enclosed chamber when a vacuum is in place.

[0110] In the event that the user wishes to release the gripped item, the user can first release the press-release power knob 124 and/or turning "off" the ON/OFF button 126 to turn off the supply of power to the pump portion 130. This will enable easier release once an attempt to separate the item from the vacuum gripper 100 is made. The user can then depress the release button 152. This urges the shaft 153 downwards against the biasing force of the spring 153 and pushes the blocking element 158 and the O-ring or sealing component away from the underside of the main base element 141, to allow ingress of air into the enclosed chamber. The pressure in the enclosed chamber increases to atmospheric pressure and the vacuum gripper 100 can simply be lifted away and removed from the external surface of the item.

[0111] Since both the power button 126 and the release button 152 are conveniently placed next to each other at the first end 111a of the handle portion 110, a user can simply and easily use a single digit, e.g. a thumb or forefinger, to press each button in succession to release the vacuum gripper 100 from the external surface of the item.

[0112] Although the above described examples are in relation to a hand-held vacuum gripper, it is also envisaged that a vacuum gripper can be connected to the end of a robotic arm. In such embodiments, the vacuum gripper may not have a handle portion as described above, and the pump portion can be arranged on the first side of the base element, either directly mounted thereon or mounted at a distance, for example within the robotic arm. The power supply portion may be in the form of stored power, i.e. may be a battery, and/or may be a mains connection via wires or other conductive compo-

nents passing along and/or through the robot arm.

[0113] In such robotic arms, there may not be an on-off knob on the vacuum gripper, but rather, power supply to the vacuum gripper can be remotely controlled by a human or computer operator.

[0114] The strength of the vacuum provided by the vacuum gripper can be sufficient to enable lifting of an object to which the vacuum gripper is attached.

Claims

1. A vacuum gripper (200) for gripping an object surface, the vacuum gripper being a

portable or hand-held vacuum gripper and comprising, prior to its being brought into contact with the object surface:

a rigid base element (210) having a first side and a second side opposite to the first side, the second side having a central area and a periphery surrounding the central area; a loop-shaped vacuum seal element (220) having:

- an attachment surface, (221) at which it is mounted at least indirectly to the periphery of the second side of the rigid base element;
- a protruding portion free of contact with the rigid base element and protruding therefrom, along an entire extension of the attachment surface, in a direction away from the first side of the base element;
- a contact surface (222)

constituting a part of the protruding portion and configured to be brought into at least a partial contact with said object surface, the vacuum seal element being elastically deformable at least at the contact surface to enable the contact surface to conform to the object surface when pressed thereagainst; and

- an inner encircling surface facing in a direction towards the central area and an outer encircling surface facing in a direction away from the inner encircling surface, both surfaces extending between the contact and the attachment surfaces;

a chamber defined by the protruding portion with said central area at the second side of the rigid base element;

an air extraction means (132) mounted to the first side of the base element so as to be in fluid communication with said chamber through the base element, and configured to continuously extract air from the chamber to cause the contact

- surface to be urged towards and thereby grip the object surface when pressed thereagainst; and **characterised in that** it comprises at least one bracing structure (144) protruding from the second side of the base element to a lesser extent than that of the vacuum seal element, and made of a material which is more rigid than that of the vacuum seal element; wherein the bracing structure extends along a part of the periphery which is free of contact with the vacuum seal element; and wherein said bracing structure is made of a material which is less rigid than that of the base element.
2. A vacuum seal element according to Claim 1, wherein said periphery of the second side of the rigid base element is bounded by a peripheral rim and comprises a peripheral support area at which the attachment surface of the vacuum seal element is attached to the periphery of the second side of the rigid base element.
 3. A vacuum gripper according to Claim 2, wherein the peripheral support area constitutes a majority of the periphery of the second side of the rigid base element.
 4. A vacuum gripper according to Claim 2 or 3, wherein at least a majority of the protruding portion of the vacuum seal element is disposed within a lateral boundary defined by the peripheral rim.
 5. A vacuum gripper according to any one of the preceding claims, wherein the vacuum seal element is mounted to the second side of the vacuum seal element via a channel receiving an attachment portion of the vacuum seal element comprising its attachment surface, the protruding portion protruding from the channel along the entire extension of the attachment portion.
 6. A vacuum gripper according to Claim 5, wherein the channel has a width corresponding to the thickness of the attachment portion between the corresponding parts of the inner and outer encircling surfaces disposed within the channel and a depth corresponding to a height of the attachment portion along said parts the inner and outer encircling surfaces, the protruding portion protruding from said channel along its entire width.
 7. A vacuum gripper according to Claim 5 or 6, wherein the channel meets one of the following conditions:
 - the width of the channel does not exceed the thickness of the protruding portion; or
 - the contact surface is co-extensive with the channel along the entire width thereof;
- where the periphery of the second side of the vacuum seal element is bounded by a peripheral rim, the peripheral rim constitutes one wall of the channel.
8. A vacuum gripper according to any one of the preceding claims, further comprising a handle for holding the vacuum gripper at the first side of the base element, connected to the first side of the rigid base element at at least two spaced apart locations.
 9. A vacuum gripper according to Claim 8, wherein the handle comprises two handle mounting sections integrally connected to the first side of the rigid base element at said spaced apart locations and a graspable handle section extending therebetween.
 10. A vacuum gripper according to Claim 9, wherein the air extraction means comprises a power source, which is mounted at least partially within one of the handle mounting sections.
 11. A vacuum gripper according to Claim 9 or 10, wherein the air extraction means comprises an air extraction mechanism such as an impeller or a pump, which is mounted within the handle, optionally within one of the handle mounting sections.
 12. A vacuum gripper according to Claim 11, wherein both the power source and the air extraction mechanism are at least partially housed in the two handle mounting portions, optionally in two different handle mounting portions.
 13. A vacuum gripper according to Claim 1, wherein said bracing structure has a loop shape.
- ### Patentansprüche
1. Vakuumgreifer (200) zum Greifen einer Objektfläche, wobei der Vakuumgreifer ein tragbarer oder handgehaltener Vakuumgreifer ist und, bevor er in Kontakt mit der Objektfläche gebracht wird, umfasst:
 - ein festes Basiselement (210) mit einer ersten Seite und einer der ersten Seite gegenüberliegenden zweiten Seite, wobei die zweite Seite einen zentralen Bereich und einen den zentralen Bereich umgebenden Umfang aufweist;
 - ein schleifenförmiges Vakuumdichtelement (220) mit:
 - einer Befestigungsfläche (221), an der es zumindest indirekt an dem Umfang der zweiten Seite des festen Basiselements angebracht ist;
 - einen vorstehenden Abschnitt, der keinen

Kontakt mit dem festen Basiselement hat und davon entlang einer gesamten Ausdehnung der Befestigungsfläche in einer Richtung weg von der ersten Seite des Basiselements vorsteht;

- eine Kontaktfläche (222), die einen Teil des vorstehenden Abschnitts bildet und ausgestaltet ist, um in zumindest teilweisen Kontakt mit der Objektfläche gebracht zu werden, wobei das Vakuumdichtelement zumindest an der Kontaktfläche elastisch verformbar ist, um der Kontaktfläche zu ermöglichen, sich an die Objektfläche anzupassen, wenn sie gegen diese gedrückt wird; und

- eine innere umlaufende Fläche, die in Richtung des zentralen Bereichs weist, und eine äußere umlaufende Fläche, die in eine Richtung weg von der inneren umlaufenden Fläche weist, wobei sich beide Flächen zwischen den Kontakt- und den Befestigungsflächen erstrecken;

eine Kammer, die durch den vorstehenden Abschnitt mit dem zentralen Bereich an der zweiten Seite des festen Basiselements definiert ist;

ein Luftabsaugmittel (132), das an der ersten Seite des Basiselements angebracht ist, um in Fluidverbindung mit der Kammer durch das Basiselement zu stehen, und ausgestaltet ist, um kontinuierlich Luft aus der Kammer abzusaugen, um zu bewirken, dass die Kontaktfläche in Richtung der Objektfläche gedrückt wird und diese dadurch greift, wenn sie gegen sie gedrückt wird; und

dadurch gekennzeichnet, dass er mindestens eine Versteifungsstruktur (144) umfasst, die von der zweiten Seite des Basiselements in einem geringeren Ausmaß als das Vakuumdichtelement vorsteht und aus einem Material gefertigt ist, das fester ist als das des Vakuumdichtelements; wobei sich die Versteifungsstruktur entlang eines Teils des Umfangs erstreckt, der keinen Kontakt mit dem Vakuumdichtelement hat; und wobei die Versteifungsstruktur aus einem Material gefertigt ist, das weniger fest als das des Basiselements ist.

2. Vakuumdichtelement nach Anspruch 1, wobei der Umfang der zweiten Seite des festen Basiselements durch einen Umfangsrand begrenzt ist und einen Umfangshaltebereich umfasst, an dem die Befestigungsfläche des Vakuumdichtelements an dem Umfang der zweiten Seite des festen Basiselements angebracht ist.
3. Vakuumgreifer nach Anspruch 2, wobei der Umfangshaltebereich einen Großteil des Umfangs der

zweiten Seite des festen Basiselements bildet.

4. Vakuumgreifer nach Anspruch 2 oder 3, wobei zumindest ein Großteil des vorstehenden Abschnitts des Vakuumdichtelements innerhalb einer durch den Umfangsrand definierten seitlichen Begrenzung angeordnet ist.
5. Vakuumgreifer nach einem der vorhergehenden Ansprüche, wobei das Vakuumdichtelement an der zweiten Seite des Vakuumdichtelements über einen Kanal befestigt ist, der einen Befestigungsabschnitt des Vakuumdichtelements aufnimmt, der seine Befestigungsfläche umfasst, wobei der vorstehende Abschnitt entlang der gesamten Ausdehnung des Befestigungsabschnitts aus dem Kanal vorsteht.
6. Vakuumgreifer nach Anspruch 5, wobei der Kanal eine Breite aufweist, die der Dicke des Befestigungsabschnitts zwischen den entsprechenden Teilen der inneren und äußeren umlaufenden Flächen, die innerhalb des Kanals angeordnet sind, entspricht, und eine Tiefe, die einer Höhe des Befestigungsabschnitts entlang der Teile der inneren und äußeren umlaufenden Flächen entspricht, wobei der vorstehende Abschnitt entlang seiner gesamten Breite aus dem Kanal vorsteht.
7. Vakuumgreifer nach Anspruch 5 oder 6, wobei der Kanal eine der folgenden Bedingungen erfüllt:
 - die Breite des Kanals übertrifft nicht die Dicke des vorstehenden Abschnitts; oder
 - die Kontaktfläche ist koextensiv mit dem Kanal entlang der gesamten Breite davon;
 - wo der Umfang der zweiten Seite des Vakuumdichtelements durch einen Umfangsrand begrenzt ist, bildet der Umfangsrand eine Wand des Kanals.
8. Vakuumgreifer nach einem der vorhergehenden Ansprüche, ferner umfassend einen Griff zum Halten des Vakuumgreifers an der ersten Seite des Basiselements, der mit der ersten Seite des festen Basiselements an mindestens zwei voneinander beabstandeten Stellen verbunden ist.
9. Vakuumgreifer nach Anspruch 8, wobei der Griff zwei Griffbefestigungsabschnitte, die integriert mit der ersten Seite des festen Basiselements an den beabstandeten Stellen verbunden sind, und einen greifbaren Griffabschnitt, der sich dazwischen erstreckt, umfasst.
10. Vakuumgreifer nach Anspruch 9, wobei das Luftabsaugmittel eine Energiequelle umfasst, die zumindest teilweise innerhalb von einem der Griffbefestigungsabschnitte angebracht ist.

11. Vakuumgreifer nach Anspruch 9 oder 10, wobei das Luftabsaugmittel einen Luftabsaugmechanismus, wie z. B. einen Impeller oder eine Pumpe, umfasst, der innerhalb des Griiffs, optional innerhalb von einem der Griffbefestigungsabschnitte, befestigt ist. 5
12. Vakuumgreifer nach Anspruch 11, wobei sowohl die Energiequelle als auch der Luftabsaugmechanismus zumindest teilweise in den beiden Griffbefestigungsabschnitten, optional in zwei verschiedenen Griffbefestigungsabschnitten, untergebracht sind. 10
13. Vakuumgreifer nach Anspruch 1, wobei die Versteifungsstruktur eine Schlaufenform aufweist. 15

Revendications

1. Pince à vide (200) pour pincer une surface d'objet, la pince à vide étant une pince à vide portable ou à main et comprenant, avant qu'elle ne soit amenée en contact avec la surface d'objet : 20
- un élément de base rigide (210) qui comporte un premier côté et un second côté opposé au premier côté, le second côté comportant une zone centrale et une périphérie qui entoure la zone centrale ; 25
- un élément de scellement sous vide en forme de boucle (220) qui comporte : 30
- une surface de liaison (221) au niveau de laquelle il est monté au moins indirectement sur la périphérie du second côté de l'élément de base rigide ; 35
 - une partie faisant saillie qui est exempte de contact avec l'élément de base rigide et qui fait saillie depuis, le long de la totalité d'une extension de la surface de liaison, dans une direction d'éloignement par rapport au premier côté de l'élément de base ; 40
 - une surface de contact (222) qui constitue une partie de la partie faisant saillie et qui est configurée pour être amenée au moins en contact partiel avec ladite surface d'objet, l'élément de scellement sous vide pouvant être déformé élastiquement au moins au niveau de la surface de contact pour permettre que la surface de contact se conforme à la surface d'objet lorsqu'elle est pressée contre ; et 45
 - une surface d'encerclement interne qui est orientée dans une direction vers la zone centrale et une surface d'encerclement externe qui est orientée dans une direction d'éloignement par rapport à la surface d'encerclement interne, les deux surfaces étant étendues entre les surfaces de contact et 50

de liaison ;

une chambre qui est définie par la partie faisant saillie avec ladite zone centrale au niveau du second côté de l'élément de base rigide ; et un moyen d'extraction d'air (132) qui est monté sur le premier côté de l'élément de base de manière à être en communication fluïdique avec ladite chambre au travers de l'élément de base, et qui est configuré pour extraire en continu de l'air à partir de la chambre pour provoquer la poussée de la surface de contact en direction de la surface d'objet et par voie de conséquence, le pincement de cette dernière lorsqu'il est pressé contre ; et

caractérisée en ce qu'elle comprend au moins une structure de renforcement (144) qui fait saillie depuis le second côté de l'élément de base selon une étendue moindre que celle de l'élément de scellement sous vide et qui est réalisée en un matériau qui est davantage rigide que celui de l'élément de scellement sous vide, dans laquelle la structure de renforcement est étendue le long d'une partie de la périphérie qui est exempte de contact avec l'élément de scellement sous vide ; et dans laquelle ladite structure de renforcement est réalisée en un matériau qui est moins rigide que celui de l'élément de base.

2. Élément de scellement sous vide selon la revendication 1, dans lequel ladite périphérie du second côté de l'élément de base rigide est délimitée par un rebord périphérique et comprend une zone de support périphérique au niveau de laquelle la surface de liaison de l'élément de scellement sous vide est liée à la périphérie du second côté de l'élément de base rigide. 35
3. Pince à vide selon la revendication 2, dans laquelle la zone de support périphérique constitue une majeure partie de la périphérie du second côté de l'élément de base rigide. 40
4. Pince à vide selon la revendication 2 ou 3, dans laquelle au moins une majeure partie de la partie faisant saillie de l'élément de scellement sous vide est disposée à l'intérieur d'une frontière latérale qui est définie par le rebord périphérique. 45
5. Pince à vide selon l'une quelconque des revendications précédentes, dans laquelle l'élément de scellement sous vide est monté sur le second côté de l'élément de scellement sous vide via un canal qui reçoit une partie de liaison de l'élément de scellement sous vide qui comprend sa surface de liaison, la partie faisant saillie faisant saillie depuis le canal le long de la totalité de la dimension de la partie de liaison. 50

6. Pince à vide selon la revendication 5, dans laquelle le canal présente une largeur qui correspond à l'épaisseur de la partie de liaison entre les parties se correspondant des surfaces d'encerclement interne et externe qui sont disposées à l'intérieur du canal et une profondeur qui correspond à une hauteur de la partie de liaison le long desdites parties des surfaces d'encerclement interne et externe, la partie faisant saillie faisant saillie depuis ledit canal le long de la totalité de sa largeur. 5 10
7. Pince à vide selon la revendication 5 ou 6, dans laquelle le canal satisfait l'une des conditions qui suivent : 15
- la largeur du canal n'excède pas l'épaisseur de la partie faisant saillie ; ou
 - la surface de contact présente la même étendue que le canal le long de la totalité de sa largeur ; 20
 - dans laquelle la périphérie du second côté de l'élément de scellement sous vide est délimitée par un rebord périphérique, et le rebord périphérique constitue une paroi du canal. 25
8. Pince à vide selon l'une quelconque des revendications précédentes, comprenant en outre une poignée pour maintenir la pince à vide au niveau du premier côté de l'élément de base, laquelle est connectée au premier côté de l'élément de base rigide au niveau d'au moins deux localisations espacées. 30
9. Pince à vide selon la revendication 8, dans laquelle la poignée comprend deux sections de montage de poignée qui sont connectées d'un seul tenant au premier côté de l'élément de base rigide au niveau desdites deux localisations espacées et une section de poignée pouvant être saisie qui est étendue entre. 35
10. Pince à vide selon la revendication 9, dans laquelle le moyen d'extraction d'air comprend une source de puissance, laquelle est montée au moins partiellement à l'intérieur de l'une des sections de montage de poignée. 40 45
11. Pince à vide selon la revendication 9 ou 10, dans laquelle le moyen d'extraction d'air comprend un mécanisme d'extraction d'air tel qu'un moyen d'agitation ou d'une pompe, lequel est monté à l'intérieur de la poignée, en option à l'intérieur de l'une des sections de montage de poignée. 50
12. Pince à vide selon la revendication 11, dans laquelle la source de puissance et le mécanisme d'extraction d'air sont tous deux au moins partiellement logés dans les deux parties de montage de poignée, en option dans deux parties de montage de poignée différentes. 55
13. Pince à vide selon la revendication 1, dans laquelle ladite structure de renforcement présente une forme de boucle.

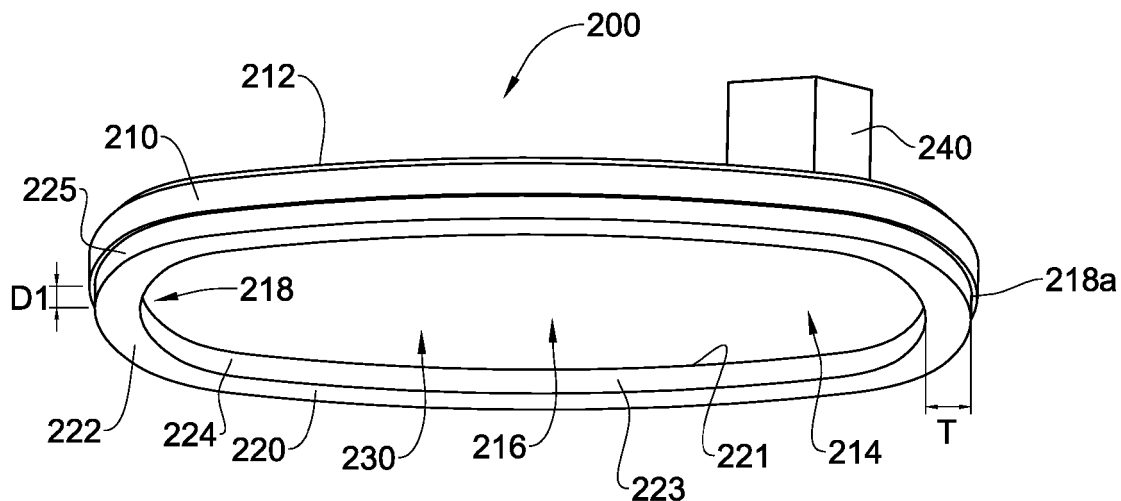


FIGURE 1

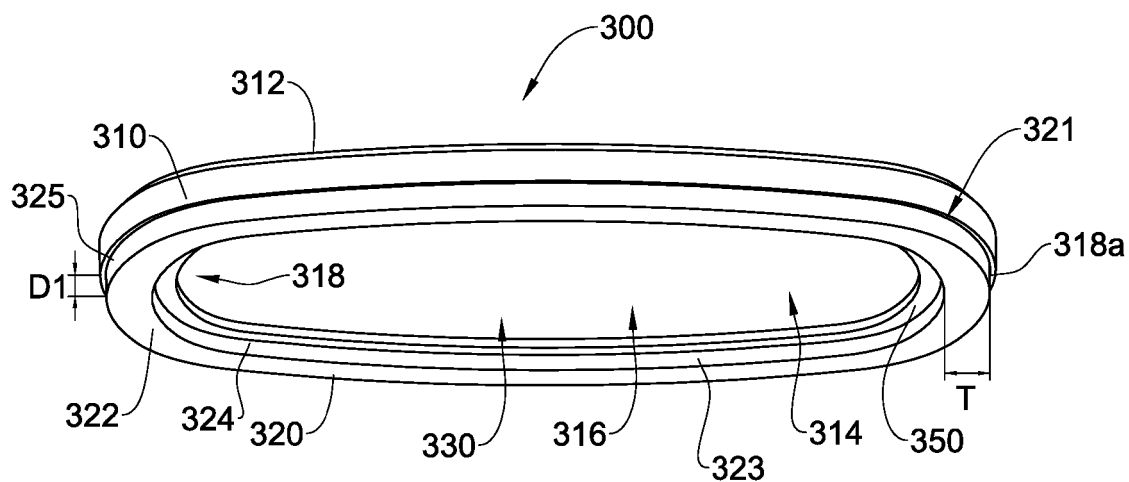


FIGURE 2

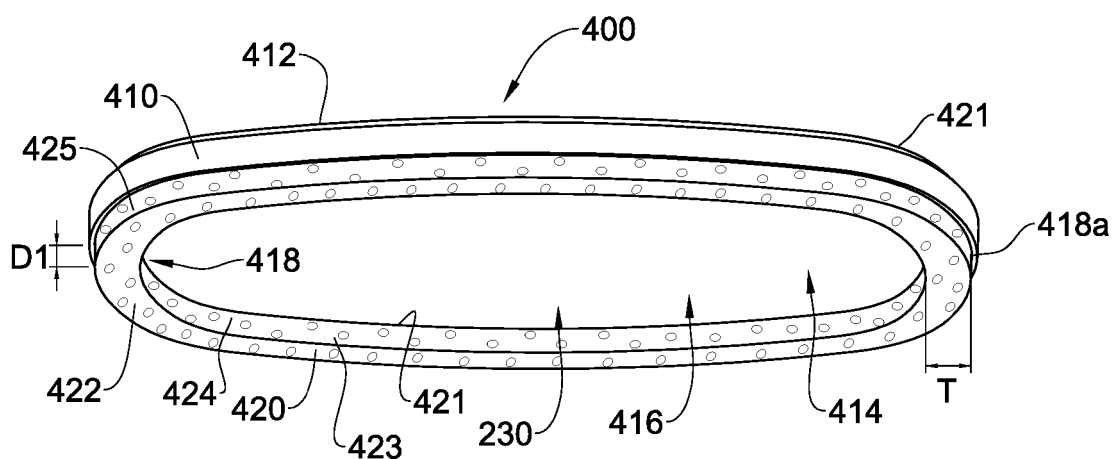


FIGURE 3

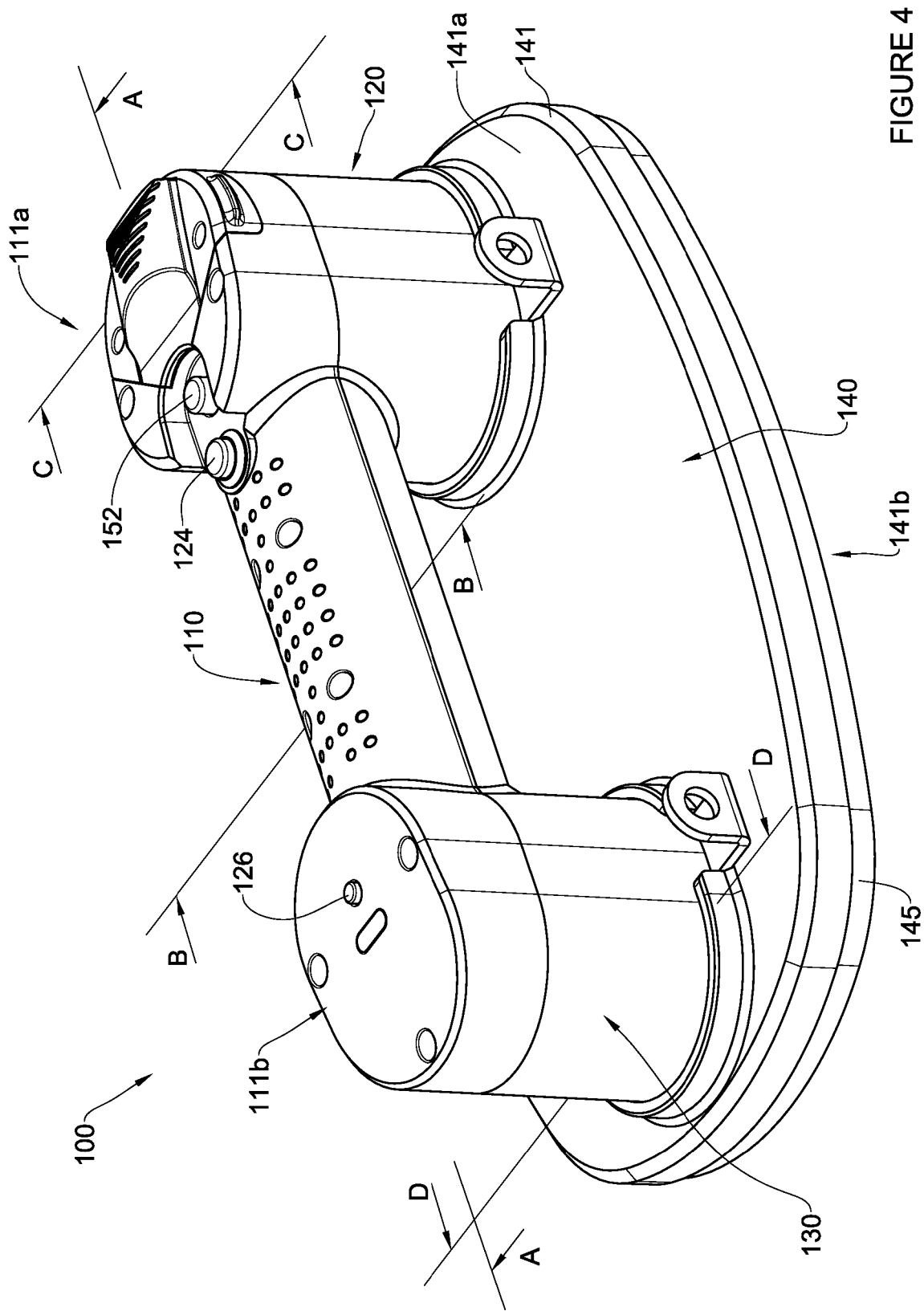


FIGURE 4

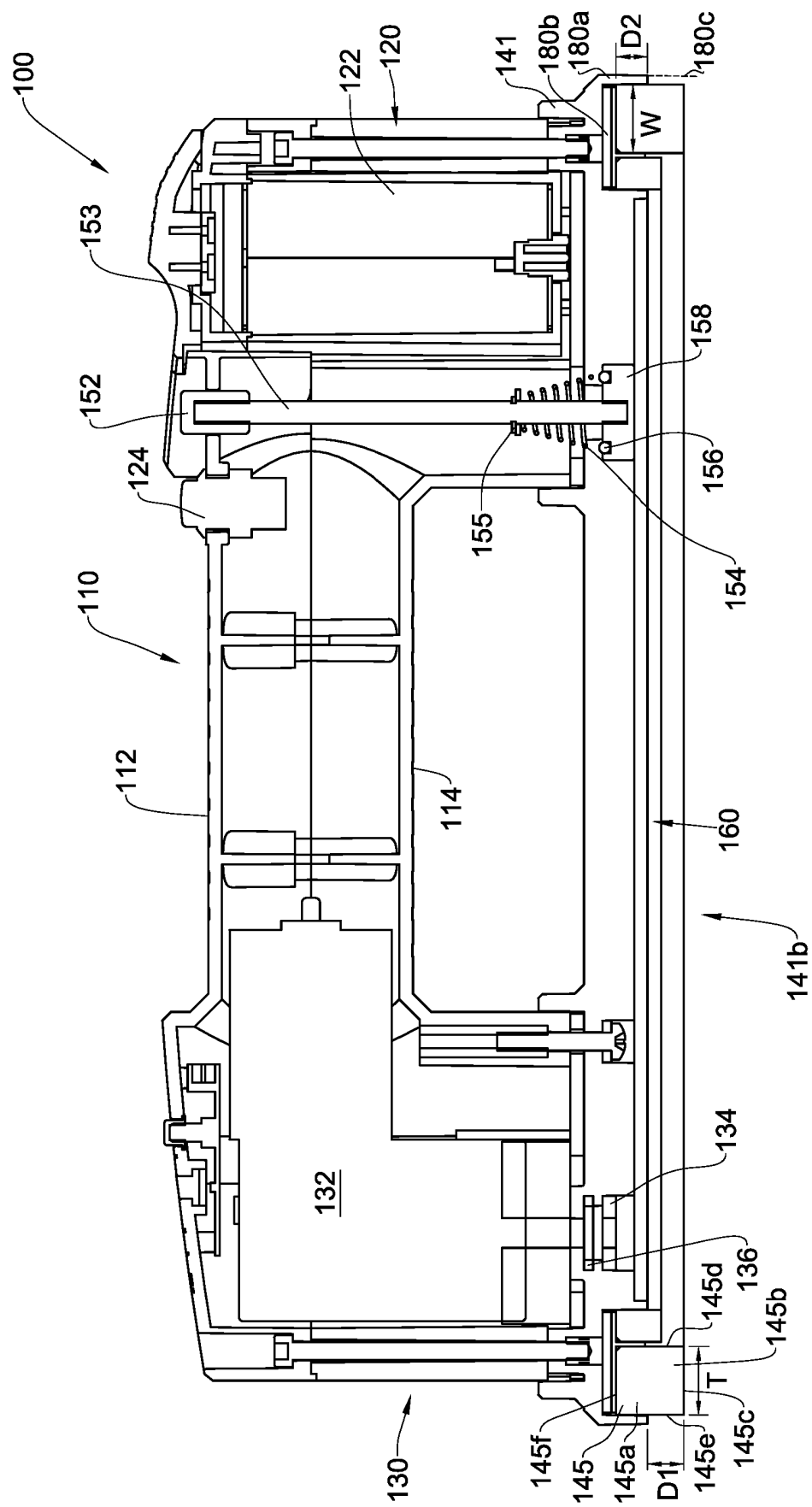


FIGURE 5

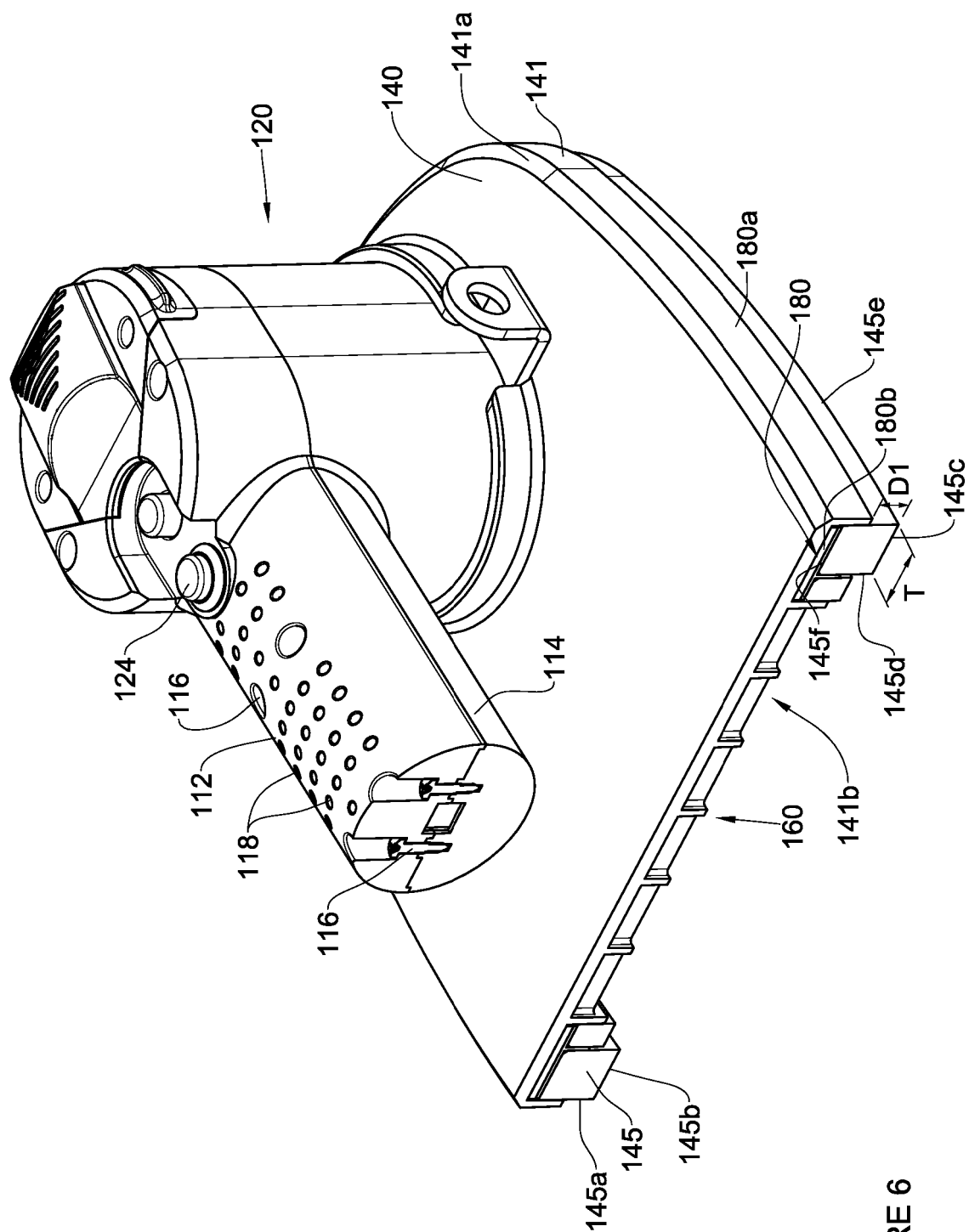


FIGURE 6

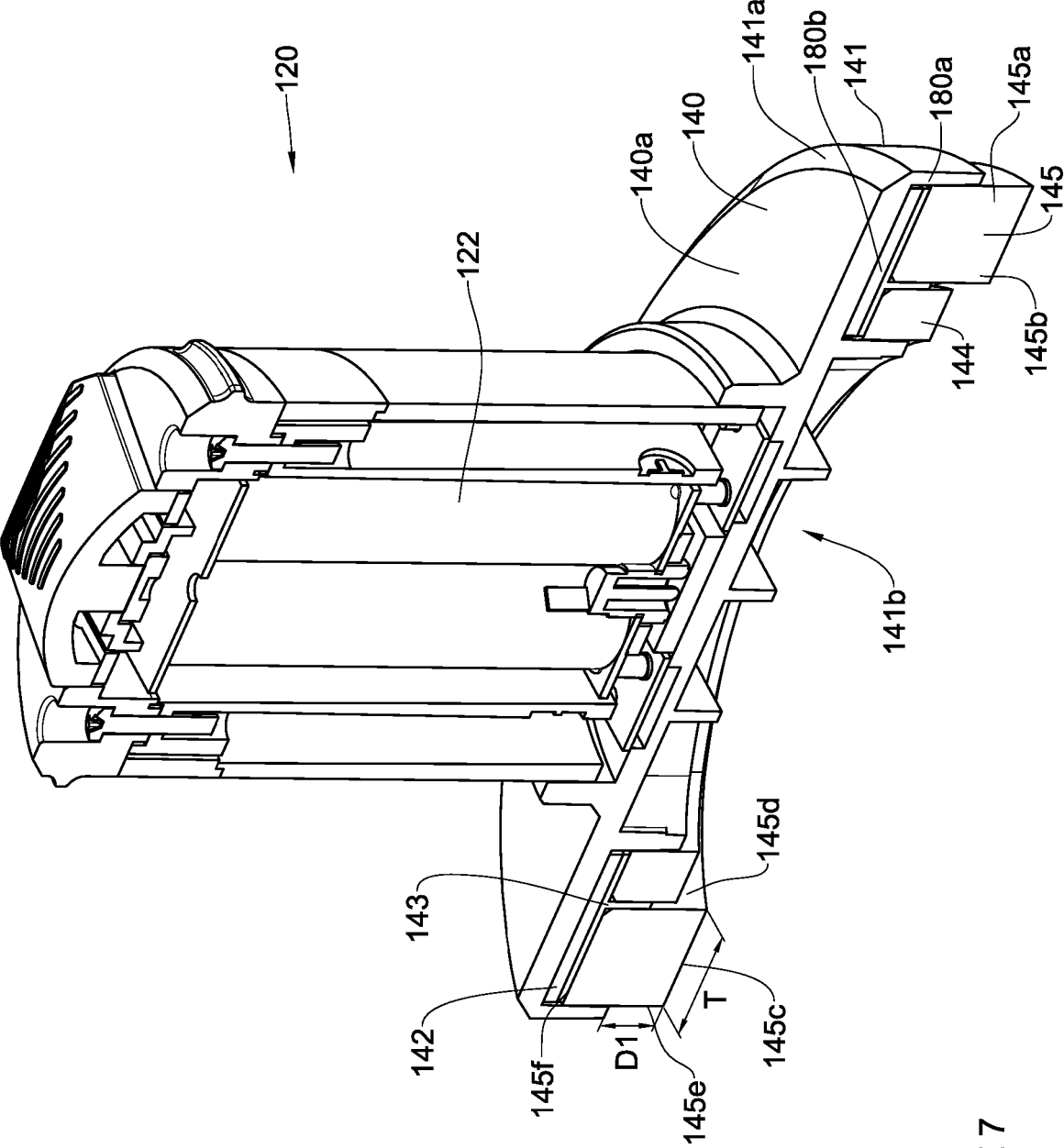


FIGURE 7

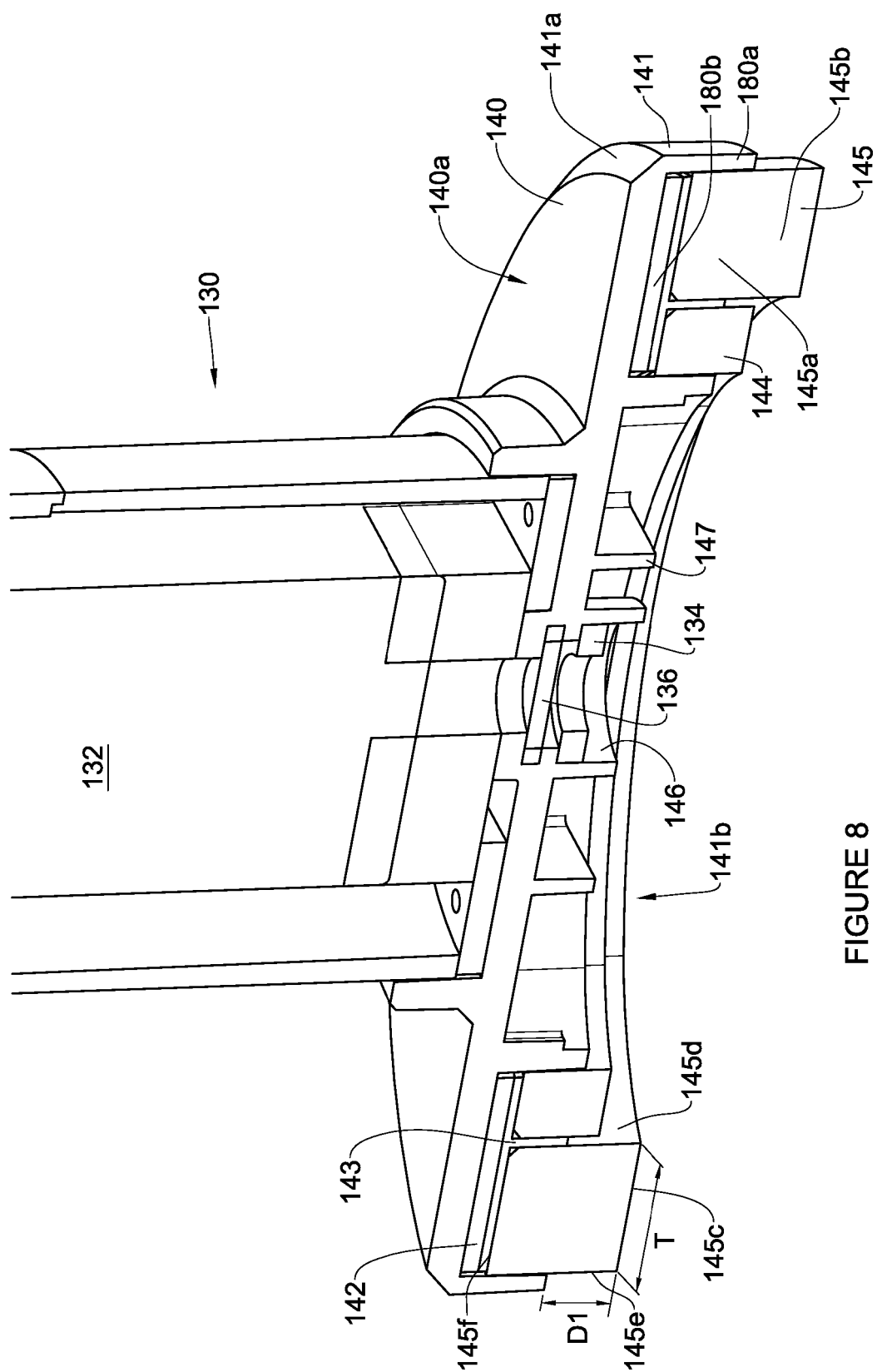


FIGURE 8

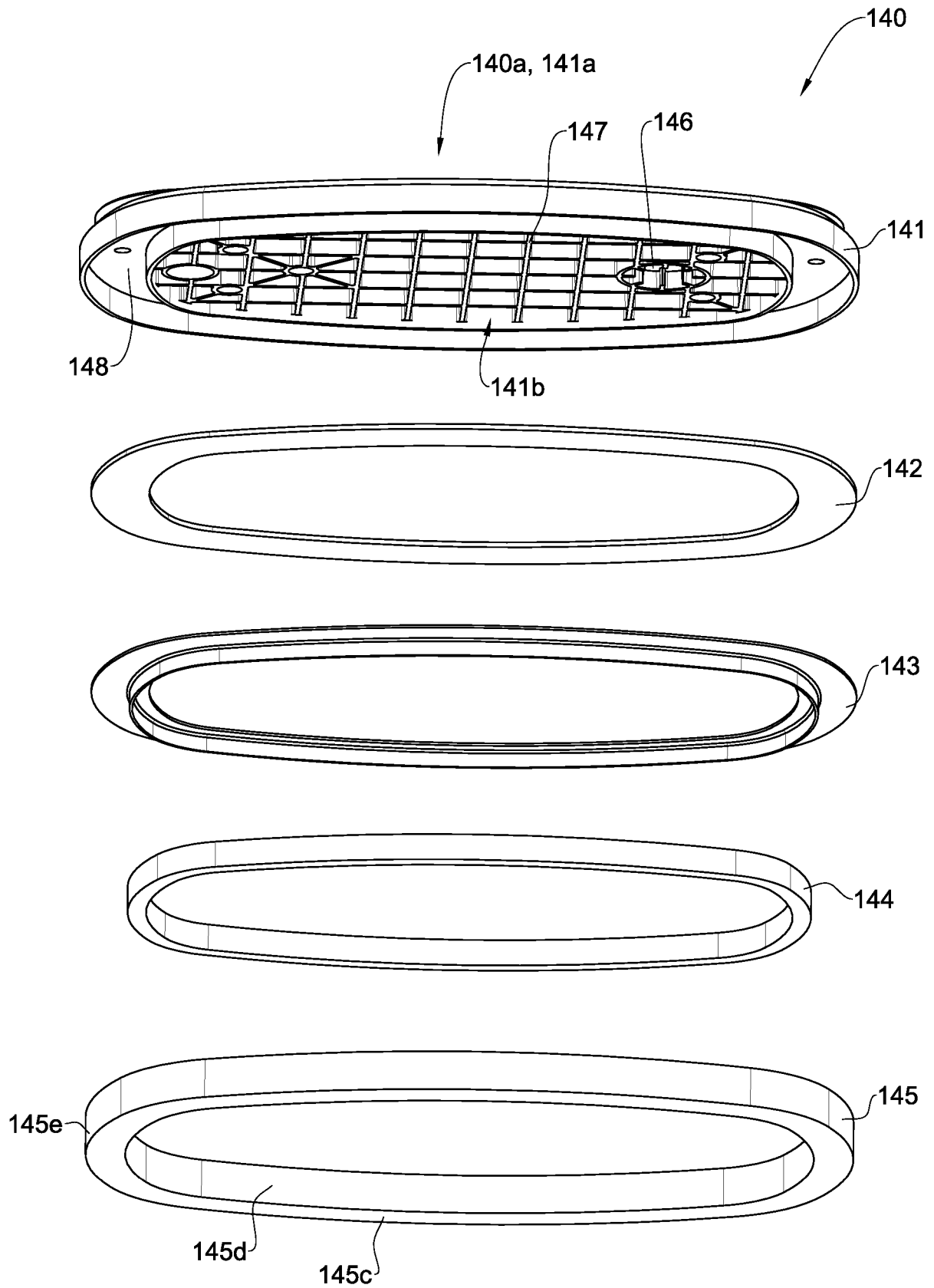


FIGURE 9

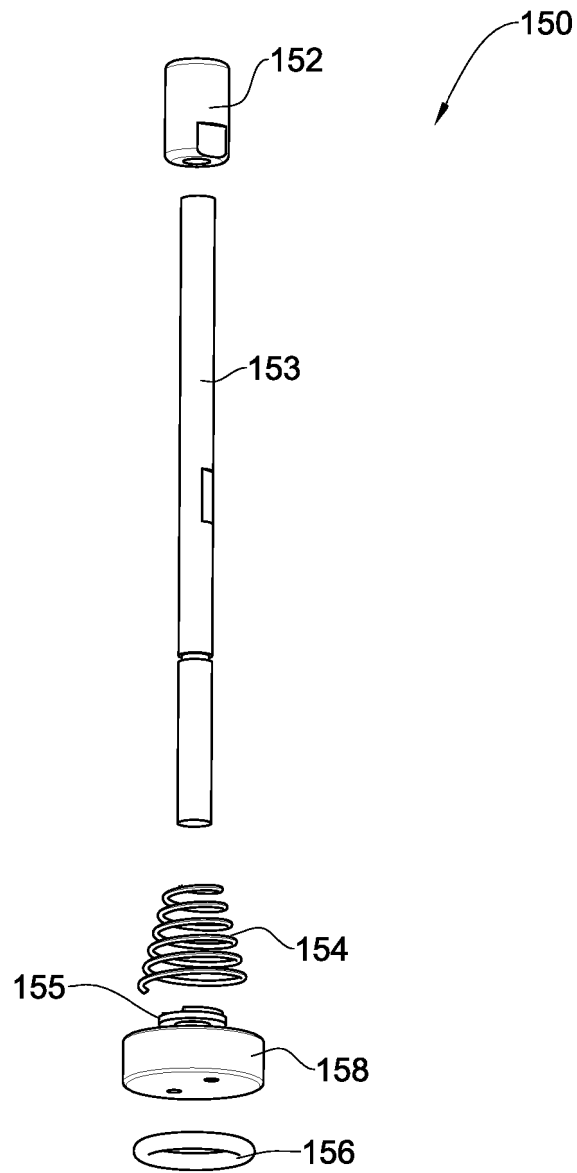


FIGURE 10

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2010110719 A [0002]
- US 8096537 B [0002]
- US 7963578 B [0002]
- US 7712807 B [0002]
- US 7404536 B [0002]
- US 7222901 B [0002]
- US 6502877 B [0002]
- US 6244778 B [0002]
- US 9108319 B [0002]
- US 6296426 B [0002]
- US 3915241 A [0002]
- US 6413022 B [0002]
- US 9215962 B [0002]
- EP 3181027 A [0002]

Non-patent literature cited in the description

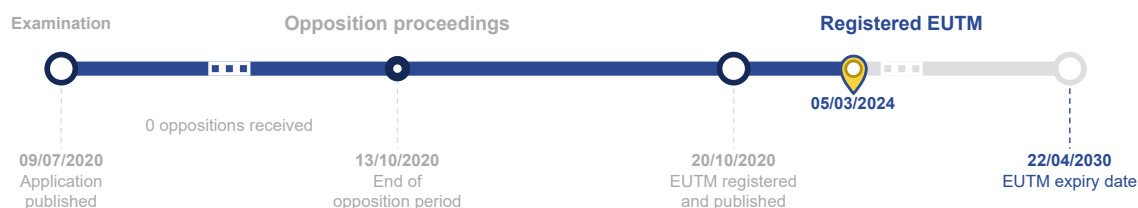
- *CHEMICAL ABSTRACTS*, 9003-55-8 [0054]

EUTM file information

GRABO

018228224

Timeline



Trade mark information

Name	GRABO	Filing date	22/04/2020
Filing number	018228224	Registration date	17/10/2020
Basis	EUTM	Expiry date	22/04/2030
Date of receipt	22/04/2020	Designation date	
Type	Word	Filing language	English
Nature	Individual	Second language	German
Nice classes	7, 9 (Nice Classification)	Application reference	16929GC/esr
Vienna Classification		Trade mark status	Registered
		Acquired distinctiveness	No

Goods and services

English (en) ▼

7 Reciprocating saws; cutting machines; angle grinders; grinding wheels (parts of machines); cutters (machines); bread cutting machines; lifting apparatus for paving stones, brick, concrete, marble, porcelain tiles, rubber, semi-processed plastics; packaging machines; vending machines; garbage disposal machines; air condensers; agricultural machine tools, other than hand-operated; excavators; food processors (electric); vacuum cleaners; motors and engines (except for land vehicles); anti-pollution devices for motors and engines; loaders (machines); electric door openers; welding equipment; incubator for eggs; agricultural sprayer; machines and machine tools for vacuum-assisted lifting; couplings and transmission belts for machines, except those for land vehicles; mixers (machines); industrial power tool used for handling of materials, namely, vacuum assisted hand-held lifting tools for industrial use; power tools, namely, vacuum assisted hand-held lifting tools used to hold and position work pieces for manufacturing and construction applications; vacuum lifters for use in handling glass, sheet metal, windows, doors, hardwood products, lumber, beams, plastic sheets, ceramic tile, rough concrete, drywall and rough slate; vacuum assisted hand-held lifting tools and auxiliary straps used to lift, move and transport household appliances, furniture, boxes and entertainment systems.

9 Lithium-ion batteries; battery chargers; battery charging apparatus; scientific, navigation, signalling, checking (supervision), life-saving (rescue) and teaching apparatus and instruments; apparatus and instruments for conducting, switching, transforming, accumulating, regulating or controlling electricity; cash registers, calculating devices; calculators; fire extinguishing equipment; printers for use with computers; scanner; computer mouse; keyboard; connector (data processing equipment); USB flash drive; covers for tablet computers; computer cases; protective films adapted for computer screens; computer power supply; smartglasses; smartwatches; smart bracelets; humanoid robots with artificial intelligence; mobile phone case; batteries for mobile phones; covers for smartphones; cases for smartphones; protective

films adapted for mobile phones; data cable for mobile phones; wearable activity trackers; speakers; speakers for communication equipment for short-range transmission of digital sound and data and support point-to-point and multipoint applications; virtual reality headsets devices; counters; counterfeit money detectors; automatic ticket machines; voting machines; fax machines; scales; measuring instruments; signal lights; navigation instruments; routers; cameras; video cameras; semiconductors; resistors; power switches; wires; cables; fluorescent screens; optical fibers; remote control devices; electric anti-theft devices; battery chargers for travel; power bank; electronic chip; antenna; video telephones; television; loudspeakers; microphones; telephone handsets; telephones; internal communication devices; DVD players; complete set of wireless telephones; mobile phone straps; headphones; safety apparatus; alarms; electric locks; electric doorbells; electronic anti-theft devices; eyeglasses; 3D spectacles.

Description

No data

Owners

Nemo Power Tools Limited

ID	1081569	Country	HK - Hong Kong	Correspondence address	
Organisation	Nemo Power Tools Limited	State/county	n/a	Nemo Power Tools Limited 21/F, CMA Building 64 Connaught Road Central Hong Kong	Hidden. You can set your contact details to be publicly available via the User Area.
Legal status	Legal entity	Town	Hong Kong	REGION ADMINISTRATIVA ESPECIAL DE HONG KONG DE LA REPUBLICA POPULAR DE CHINA	Hidden. You can set your contact details to be publicly available via the User Area.
		Post code	n/a		
		Address	21/F, CMA Building 64 Connaught Road Central		Hidden. You can set your contact details to be publicly available via the User Area.

Representatives

BOMHARD IP, S.L.

ID	72210	Country	ES - Spain	Correspondence address	
Organisation	n/a	State/county	n/a	Bomhard IP, S.L. C/Bilbao, 1, 5º	965129470
Legal status	Legal person	Town	Alicante	E-03001 Alicante	965129475
Type	Association	Post code	03001	ESPAÑA	
		Address	C/Bilbao, 1, 5º		mail@bomhardip.com

Correspondence

	From	Procedure	Filing number	Subject	Date	Actions
		EUTM	018228224	L304 – Cover letter for registration certificate	21/10/2020	
		EUTM	018228224	Certificate	20/10/2020	
		EUTM	018228224	L167 - Confirmation of a restriction of the list of goods or services in a European Union trade mark application	18/08/2020	
		EUTM	018228224	Letter to the EUIPO	17/08/2020	
		EUTM	018228224	L167 - Confirmation of a restriction of the list of goods or services in a European Union trade mark application	29/06/2020	
		EUTM	018228224	Letter to the EUIPO	17/06/2020	

	From	Procedure	Filing number	Subject	Date	Actions
		EUTM	018228224	L110 - Notice of grounds for refusal of application for a European Union trade mark	08/05/2020	
		EUTM	018228224	L101F - Receipt of an application for a European Union trade mark (EUTM) and notification that a provisional filing date has been accorded	22/04/2020	
		EUTM	018228224	Application form and attachment	22/04/2020	
Showing 1 to 9 of 9 entries						

IR transformation

No data

Seniority

No data

Exhibition priority

No data

Priority

No data

Publications

Bulletin number	Date	Section	Description
2020/128	09/07/2020	A.1	Applications published under Article 44 EUTMR
2020/200	20/10/2020	B.2	Registrations with amendments since the application was published
Showing 1 to 2 of 2 entries			

Cancellation

No data

Recordals

No data

Oppositions

No data

Appeals

No data

Decisions

No data

Renewals

No data

Trade mark relations

No data

InternationalApplications

No data