(12) UK Patent Application (19) GB (11) 2474793 (13) A

(43) Date of A Publication 27.04.2011

(21) Application No: 1102028.6

(22) Date of Filing: 04.10.2005

Date Lodged: 07.02.2011

(62) Divided from Application No
0520208.0 under Section 15(9) of the Patents Act 1977

(51) INT CL:
F16B 47/00 (2006.01) ***B25B 11/00*** (2006.01)
B65G 49/06 (2006.01)

(56) Documents Cited:
GB 2425724 A
WO 2005/106262 A1
JP 2000126014 A
SU 001111977 A
GB 2321274 A
JP 090206195 A
SU 001184785 A
US 5454540 A

(58) Field of Search:
INT CL **B25B, B65G, F16B**
Other: **Online: EPODOC, WPI**

(71) Applicant(s):
Belron Hungary Kft - Zug branch
(Incorporated in Switzerland)
Gotthardstrasse 20, CH-6300 Zug, Switzerland

(72) Inventor(s):
William Finck

(74) Agent and/or Address for Service:
Urquhart-Dykes & Lord LLP
UDL Intellectual Property, 7th Floor,
Churchill House, 17 Churchill Way, Cardiff,
CF10 2HH, United Kingdom

(54) Title of the Invention: **Suction device**
Abstract Title: **Suction device**

(57) A suction device 1 has a flexible sucker membrane having a peripherally extending skirt 4, and a lever 6 mounted to the sucker. The lever operates an elongate lifter element extending to the sucker skirt and operable to lift the edge of the skirt upon operation of the lever. The lifter element is preferably linked to a lifting tab (17, figure 4). The underside of the sucker membrane preferably includes a suction relieving groove (25, figure 4) having a wider end toward the periphery of the membrane and a narrower end towards the centre of the membrane.

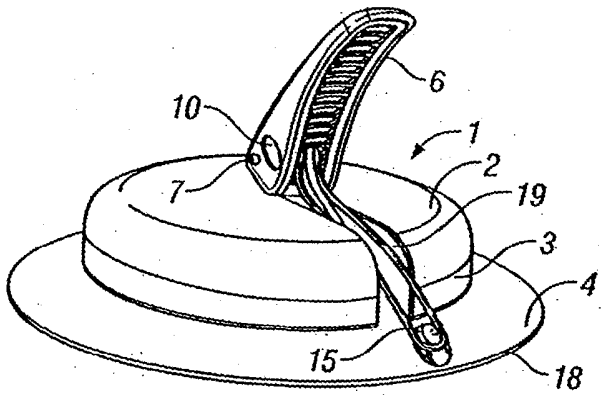

FIG. 1

GB 2474793 A

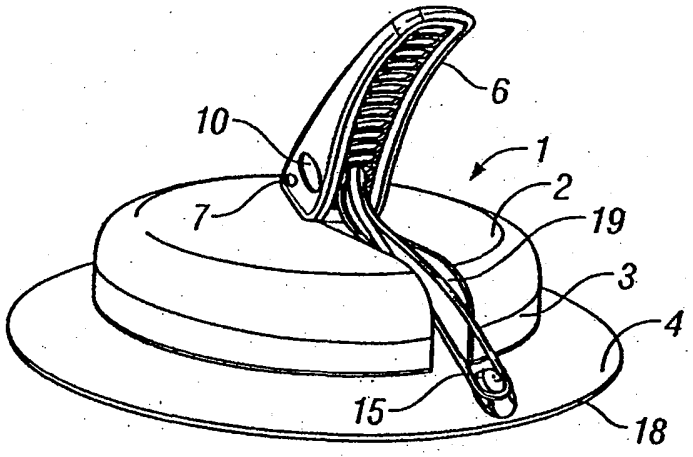

FIG. 1

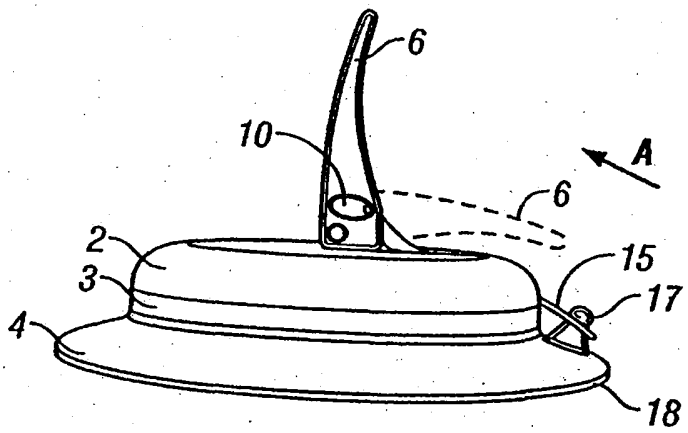

FIG. 2

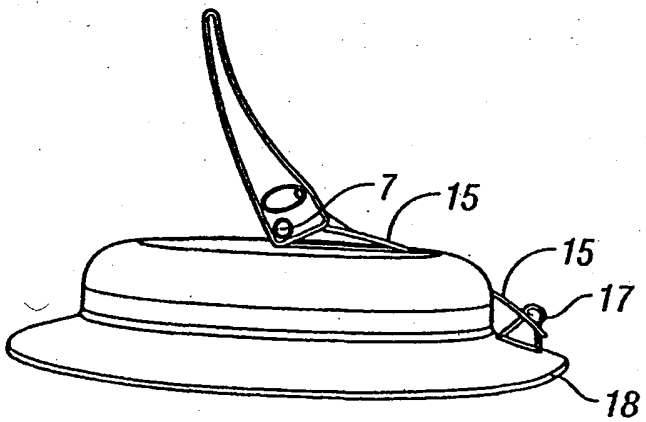

FIG. 3

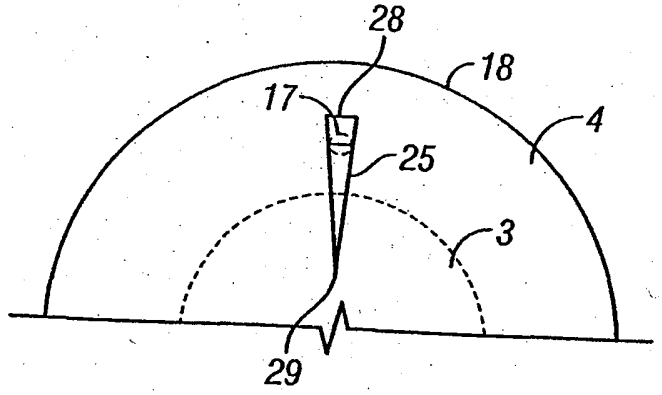

FIG. 4

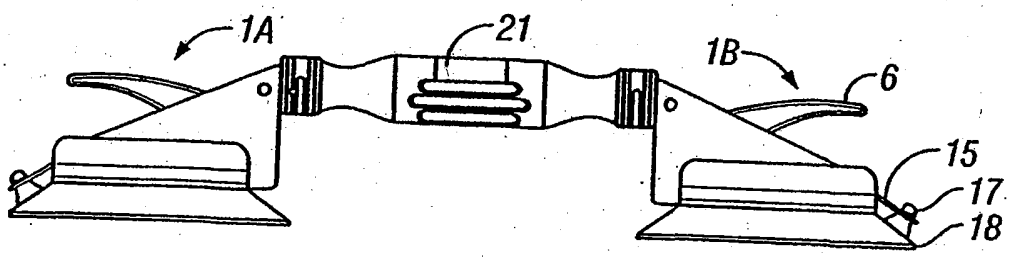

FIG. 5

Suction Device

The present invention relates to a suction device, and in particular to a suction device including a flexible suction skirt.

Suction devices are known having sucker membrane including a flexible sucker skirt extending from a flexible sucker body. Typically a mounting is provided to locate the sucker body and support a lever actuator arrangement which is manually operable to energise or de-energise the sucker. An exemplary suction device is disclosed, for example, in DE 20103755, in which a lever having a cam is movable to urge a cam follower pin to push down the concave dish of the flexible sucker body, so energising or de-energising the suction device. The suction device of DE 20103755 is provided with a lifting tab proximate the radially outer edge of the flexible sucker skirt, and a suction relieving groove on the underside of the flexible sucker membrane. The suction relieving groove aids in releasing the suction device when the lifting tab is lifted.

An improved arrangement has now been devised.

According to a first aspect, the present invention provides a suction device comprising:

a flexible sucker membrane having a peripherally extending skirt;

an actuator arranged to act to reconfigure the sucker between a suction enhanced configuration and a suction relief configuration;

wherein the actuator is also operable to lift an outer edge of the peripherally extending skirt.

It is preferred that the a suction device includes a mounting for mounting the sucker and the actuator.

Beneficially, the actuator comprises a lever, the lever preferably including a cam arrangement to act on the sucker to reconfigure the sucker between the suction enhanced configuration and the suction reduced configuration. Desirably a cam follower is arranged to act to reconfigure the sucker.

In a preferred embodiment, the lever is movable in a first pivotal direction from a neutral position in order to reconfigure the sucker between the suction enhanced configuration and the suction reduced configuration, the lever being movable in an opposed pivotal direction from the neutral position in order to lift the outer edge of the peripherally extending skirt.

It is preferred that the actuator is connected to an edge lifter linkage extending to a distal portion of the peripherally extending skirt. The edge lifter linkage is desirably guided to be movable in a guide arrangement. In a preferred embodiment, the guide arrangement comprises a guide channel formed in a mounting for the sucker and lever.

According to an alternative aspect, the invention provides a suction device comprising:

a flexible sucker having a peripherally extending skirt;

a lever mounted to the sucker;

the lever operating an elongate lifter element extending to the sucker skirt, the lifter element operable to lift the edge of the skirt upon operation of the lever.

Beneficially, a lifting tab is provided for the skirt, the elongate lifter element being linked to the lifting tab. The elongate lifter element is preferably flexible.

It is preferred that the underside of the sucker membrane includes a suction relieving groove having a relatively wider mouth distal end toward the periphery of the sucker membrane and a relatively narrower proximal end toward the centre of the sucker membrane. This has been found to aid in relieving the applied suction when the edge of the flexible skirt is lifted. The groove is preferably extends outwardly onto the underside of the peripherally extending skirt, and is beneficially positioned radially in line with the lifting portion of the skirt.

According to a further aspect, therefore, the present invention provides a suction device including a flexible sucker membrane having a peripherally extending skirt, the underside of the sucker membrane including a suction relieving groove having a relatively wider

distal end toward the periphery of the sucker membrane and a relatively narrower proximal end toward the centre of the sucker membrane.

Desirably, the suction relieving groove tapers from the relatively wider distal end toward the relatively narrower proximal end.

In certain embodiments, devices in accordance with the invention will include a grab handle enabling the device to be used, for example, for lifting. Apparatus in accordance with the invention may make use of a plurality of suction devices, including one or more suction devices according to one or more aspects of the invention. A grab handle may be provided extending between two suction devices. Suction devices may be used for mounting one or more components or apparatus to a surface. For example suction devices according to the various aspects of the invention have utility in the activities of glazing panel replacement and repair for example for use in lifting glazing panels or mounting removal or repair apparatus to glazing panels.

The invention will now be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a suction device in accordance with the invention;

Figure 2 is a side view of the device of figure 1 with the actuator lever in a neutral position;

Figure 3 is a side view of the device of figure 1 with actuator lever in suction relief configuration;

Figure 4 is a view of the underside of a suction device in accordance with the invention; and,

Figure 4 is a perspective view of two sucker grab handle apparatus in accordance with the invention.

Referring to the drawings, and initially to figures 1 to 3, there is shown a sucker device 1 for use in securing to generally gas impermeable surfaces such as, for example, glazing panels, enabling lifting or attachment of other apparatus. The device 1 comprises a hard plastics mounting shell 2, to the underside of which is secured a flexible rubber membrane having a body disc 3 and an integral peripherally extending flexible skirt 4. An actuation lever 6 is pivotally mounted at pivot 7, to the hard plastics mounting shell 2, the primary purpose of the actuation lever being to to energise or de-energise the sucker. Such arrangements are known in the art and an exemplary such lever actuator arrangement is disclosed, for example, in DE 20103755, in which a lever having a cam is movable to urge a cam follower pin to push down the concave dish of the flexible sucker body 3, so energising or de-energising the suction device. The present arrangement is designed to operate in this manner.

The lever 6 includes an aperture 10 locating a cross pin 11, to which is attached the proximal end of a flexible link tether 15. Flexible link tether 15 is connected at its distal end to a pull tab 17 which is formed integrally with the skirt 4 and projects upwardly therefrom. The purpose of the pull tab 17 is to enable the rim lip 18 of the flexible skirt to be selectively lifted in order to enable full release the suction applied by the device. The present invention enables the lip to be release by means of actuation remote from the rim lip 18. Alternative means may be provided for securing the distal end of the flexible link tether 15 to the portion of the skirt to be lifted. In the embodiment shown, the flexible linkage is received in a guide channel 19 formed in the hard plastics mounting shell 2.

Referring to figure 2, the device 1 is shown in with the actuator lever 6 in a neutral position standing upright from the hard plastics mounting shell 2. In this position the vacuum is not fully applied and the rim lip 18 is not being lifted. In the energised configuration, with the actuator lever 6 pivoted forward (as shown in dashed line in figure 2), the cam action causes push down of the flexible sucker body 3, so energising the suction. In this arrangement the underside of the flexible skirt 4 is pressed face down against the substrate surface.

When seeking to release the applied suction, the lever 6 is returned to the neutral position and then pivoted forward over centre (as shown in figure 3). This has the effect of causing

flexible link tether 15 to slide in the direction of arrow A in guide channel 19, pulling upwardly on pull tab 17 and on so doing, lifting the rim lip 18 of skirt 4. This permits air to pass under the skirt and body of the sucker membrane 3, relieving the applied suction. the suction device can then easily be lifted from the substrate surface.

The present invention enables a lever or other actuator to be used to lift the rim lip of the skirt. By making this the primary suction application actuator lever 6, convenient and single handed release actuation may be achieved. The other hand may be used to support the device, for example by means of gripping a grip handle. such an arrangement is shown in figure 5, where a grip handle 21 extends between 2 suction devices 1a, 1b in accordance with the invention.

As most clearly shown in figure 4, the sucker membrane is provided on its underside (the side arranged to contact the substrate surface) with a suction relieving groove 25 extending across the junction between the flexible skirt 4 and the flexible body 3 of the sucker membrane. The groove 25 provides a conduit enabling rapid pressure equalisation when the rim lip 18 is sufficiently lifted. The pressure relieving groove 25 coincides substantially with the position of the lifting tab 17. It has been found that the operation of the pressure relieving groove 25 is enhanced in configurations in which the groove tapers from a relatively wider distal end 28 positioned toward the periphery of the sucker membrane to a relatively narrower proximal end 29 positioned toward the centre of the sucker membrane.

Additionally, the arrangement of the invention provides enhanced operation when securing the device to a substrate surface. This is achieved by placing the sucker device on the substrate surface and, with downward pressure applied via the device, first moving the lever 6 to the overcentre position (as shown in figure 3), with downward force applied via the device to the substrate, before moving the lever 6 all the way forward to the energised position (shown by the dashed line in figure 2). The initial overcentre movement with downward force applied lifts the skirt 4 and expels air from under the body 3 of the sucker membrane. This results in a greater vacuum effect.

Claims:

1. A suction device comprising;

a flexible sucker membrane having a peripherally extending skirt,;

a lever mounted to the sucker;

the lever operating an elongate lifter element extending to the sucker skirt, the lifter element operable to lift the edge of the skirt upon operation of the lever.

2. A suction device according to claim 1, wherein a lifting tab is provided for the skirt, the elongate lifter element being linked to the lifting tab.

3. A suction device according to any preceding claim, wherein the underside of the sucker membrane includes a suction relieving groove having a relatively wider mouth distal end toward the periphery of the sucker membrane and a relatively narrower proximal end toward the centre of the sucker membrane.

4. A suction device according to claim 3, wherein the suction relieving groove extends outwardly onto the underside of the peripherally extending skirt.

5. A suction device including a flexible sucker membrane having a peripherally extending skirt, the underside of the sucker membrane including a suction relieving groove having a relatively wider distal end toward the periphery of the sucker membrane and a relatively narrower proximal end toward the centre of the sucker membrane.

6. A suction device according to claim 5, wherein the suction relieving groove tapers from the relatively wider distal end toward the relatively narrower proximal end.

7. A suction device according to any preceding claim including a grab handle.

8. Apparatus including a plurality of suction devices, including one or more suction devices according to any preceding claim.

9. Apparatus according to claim 8, including a grab handle extending between two suction devices.

Application No:	GB1102028.6	**Examiner:**	Miss Alison Berry
Claims searched:	1-9	**Date of search:**	18 February 2011

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1, 2, 7-9	US 5454540 A (McPHERSON) See especially figures 3-5
X	1, 2, 7-9	SU 1184785 A (BUILD TECH ASSIST) See figure 1
X	1, 2, 7-9	SU 1111977 A (BUILD COMP EX MECHN) See figure 1
X	1, 2, 7, 9	JP 09206195 A (AKIYAMA) See especially figures 3 and 4
X	1, 2, 9	GB 2321274 A (HUNTLEIGH) See whole document
X,E	1, 2, 9	GB 2425724 A (MOUNTWAY) See especially figures 4(a)-(c)
X	1, 2, 9	JP 2000126014 A (NAKAMURA) See especially figures
A	-	WO 2005/106262 A1 (PÖTTERS) See especially figure 4

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

B25B; B65G; F16B

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
F16B	0047/00	01/01/2006
B25B	0011/00	01/01/2006
B65G	0049/06	01/01/2006