CLAIMS

1. A device (10), in particular for cleaning a surface, for example a glass surface, comprising a frame (12) carrying at least one rolling member (22, 24) and at least one first (14) and one second (16) member for applying a vacuum to a surface (18) connected to means (52) for supplying a vacuum, the first (14) and second (16) members being independently of one another movably mounted on the frame (12) between a first position in which they are adapted to come into contact with a surface (18) of an object to apply a vacuum thereto and a second position in which they are remote from said surface (18), the device further comprising means (21) for controlling the vacuum of each of the first (14) and second (16) members in their first position configured to provide a sliding contact on the surface (18), the first member (14) and the second member (16) each comprising a suction cup (32) intended to be applied to a surface (18) of an object, and the internal chamber (36) of which is connected to the vacuum providing means (52), the suction cups are each fixed to the end of a rod (48) integral with a piston (46) sealingly separating a first and a second chambers (42, 44) provided in a cylinder (38) body (40), and wherein:

i) the first chamber (42) houses a, for example elastic, return member (50) for the suction cup in its first position and the second chamber (44) is connected to means for applying a back pressure (52a) controlled by the control means, or

ii) the second chamber (44) houses a, for example elastic, return member (50) for the suction cup in its second position and the first chamber is connected to means for applying a back pressure controlled by the control means.

the rod (48) being hollow and fluidly connects the internal chamber (36) of the suction cup (32) to that of the first chamber (42) and the second chamber (44) housing the return member (50), which chamber is fluidly connected to the vacuum providing means (52).

2. A device according to claim 1, wherein it comprises means (P) for measuring the vacuum applied by each of said first (14) and second (16) members, said measuring means (P) forming an input of the control means (21).

3. A device according to claim 1 or 2, wherein the control means are configured so that each of the first and second members applies, in their first position, a vacuum ΔP_2 such that

$T/N > k$, where

- T represents the tangential force (in Newton) at the surface considered which is a function of the weight of the device,
- N represents the normal effort (in Newton) at the surface considered and
- k represents the sliding coefficient between the member of application of the vacuum and the surface under consideration.

4. The device according to one of the preceding claims, wherein the vacuum application surface of each of said suction cups is dimensioned so that the force N is very large relative to the back pressure force F and wherein the volume of the chamber of each suction cup is very large relative to the volume variation that the chamber housing the spring undergoes between a first positioning of the device wherein the rolling member(s) is/are supported on a surface on which the suction cups are in their first position and a second positioning of the device wherein the rolling member(s) is/are positioned on a projecting part of the surface, the first and second suction cups being in their first position.

5. A device according to one of the preceding claims, wherein the rod is rotatably mounted about the axis of the cylinder body.

6. A device according to one of claims 1 to 5, wherein it comprises at least two rolling members and at least two, preferably three, members for applying a vacuum are located in the same plane substantially perpendicular to the axes of rotation of the rolling members and containing the centre of gravity of the device.

7. A device according to claim 6, wherein it comprises at least five vacuum application members aligned as above.

8. A device according to one of the above claims, wherein it comprises at least one arm carrying a roller (28), preferably a cleaning roller, capable of being held in support on a surface of an object, preferably by elastic support means.

9. A device according to claim 8 wherein the roller has an axis substantially parallel to said at least one rolling member and mounted at one end of the frame with respect to a direction of movement of said device, the arm being rotatably articulated on the frame around an axis parallel to said axis of rotation of said at least one rolling member and the elastic support means ensuring an application of the roller to the surface.

10. A device according to claim 8 or 9, wherein the roller is rotated by motorized means configured to rotate the roller in a counter-clockwise direction when viewed from a left side flank of the device.

11. A device according to one of claims 8 to 10, wherein the arm comprises a degree of rotational freedom about an axis substantially perpendicular to the axis of rotation of said at least one rolling member.

12. A device according to one of claims 8 to 11, wherein it comprises means (30) for spraying a cleaning liquid configured to spray the liquid onto the surface of an object and upstream of the cleaning roller (28) with respect to a direction of movement of the device.

13. A device according to one of the preceding claims, comprising means (20) for hanging the frame on a stationary structure.

14. A device according to one of claims 1 to 13, wherein said at least one rolling member is a wheel and wherein it preferably comprises four wheels.

15. A device according to one of claims 1 to 14, wherein the contact areas with the surface of said at least two rolling members together define a plane through which the members for applying a vacuum are mounted to move.

16. A device according to claim 15, wherein the members for applying a vacuum are mounted to move in a direction substantially perpendicular to said plane.

17. A method for moving the device according to one of the preceding claims on a surface of an object having an obstacle, comprising the following steps:

a) the first and second members being in their first position, controlling the movement of the first member (14) from its first position to its second position,

b) sliding the device in a given direction so that the obstacle is located between the first member (14) and the second member (16) in said direction,

c) controlling the movement of the first member (14) from its second position to its first position,

d) controlling the movement of the second member (16) from its first position to its second position,

e) controlling the movement of the second member (16) from its second position to its first position.

18. A method according to claim 17, wherein step b) is carried out by means of one or more cable(s) (20) connecting to the frame (12) of the device.

19. A method for using the device according to claim 4, wherein it comprises:

- Arranging the device opposite a surface so that the members applying a vacuum can come into contact with the surface, the first and second suction cups being moved to their first position and a vacuum being created in the chamber of each suction cup,
- Moving the frame so as to apply the rolling member(s) to the surface,
- Measuring the pressure value in the chamber housing the return member,

- Establishing whether the vacuum ΔP_2 in the chamber housing the return member is such that $\Delta P_2 > \Delta P_1 \times S_1/S$,

where ΔP_1 represents the overpressure in the other chamber,

S_1 represents the surface which the overpressure $\Delta P_1$is applied on, and

S represents the surface of the object which the depression $\Delta P_2$is applied on.

- If so, stop increasing the value of ΔP_2
- If not, continue to increase the value by ΔP_2.