

Method for operating a vacuum cleaner comprising a suction nozzle, and vacuum cleaner comprising a suction nozzle

- 5 The invention relates in first instance to a method for operating a vacuum cleaner comprising a suction nozzle, a suction air volume flow being produced in the vacuum cleaner in a motor-driven manner, creating a negative pressure in the suction nozzle, and a force load that
- 10 occurs when the vacuum cleaner is displaced (operated by pushing and/or pulling), and results in the user experiencing a resistance to pushing or pulling, being measured.
- 15 A method of the type in question is known from WO 97/26819 A2. This document provides a method by means of which the respective direction of movement at any one time, i.e. the direction of displacement of the suction nozzle, is sensed and, dependent on this
- 20 direction, the effective negative pressure is varied. This solution results from the finding that, in particular when suction is used on carpets, a relatively high negative pressure prevails in the region of the suction opening corresponding to the
- 25 floor to be cleaned and this negative pressure itself alone results in the user experiencing a resistance. As a result of the actuation of the suction nozzle by the user, generally by using a rigid handle, for example a suction tube or the like, a further
- 30 resistance occurs, varying according to the direction in which the suction nozzle is displaced. Depending on whether the suction nozzle is pushed or pulled by the user, different pressing and operating conditions are created for the suction nozzle. The solution provided
- 35 in the aforementioned WO application responds by varying the negative pressure in dependence on the direction of movement of the suction nozzle.

In view of the prior art described above, it is considered that the invention is based on the technical problem of improving a method of the type in question in a way making it more advantageous for use.

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This problem is solved first and foremost by the subject matter of Claim 1, it being provided that, at least when it is being operated by pushing, at least the resistance to the pushing of the vacuum cleaner is automatically influenced in dependence on a measured force load. According to the invention, a constant check is kept on the force load, the resistance to pushing being influenced in dependence on the value recorded, which results in a positive effect for the user. Therefore, depending on the underlying surface and possibly also on the combination of equipment, an appropriate volume flow window is automatically set, so that the user always obtains a cleaning result that is optimum with respect to the underlying surface, and in this case does not increase the pushing force unnecessarily. The essence of the invention is the recording of the pushing force of the suction nozzle and the feedback to suitable devices for adapting the resistance to pushing. At least when the vacuum cleaner is being operated by pushing, this involves measuring the force load and leveling out the resistance to pushing. It is further preferred for the force load to be measured both during operation by pushing and by pulling and, as a consequence of this, regulating the resistance to pushing and pulling to an approximately equal level. In this respect, it is further proposed that the influence is brought about by changing the negative pressure in the suction nozzle, choosing with respect to the changing of the negative pressure a value which achieves an appropriate, constant force load for the user with a cleaning result that is optimum with respect in particular to the

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underlying surface. This proves to be advantageous in particular to the extent that, for carpet cleaning, depending on the type of carpet, only certain maximum volume flows are required in order to clean the carpet optimally. Higher volume flows would only produce higher pushing or pulling forces, unwanted by the user. The constant, automatic measurement of the force load allows a constant adaptation of the cleaning performance and the force load to be achieved, it being possible to use not only the nature of the carpet to be cleaned but also further parameters for the variation, such as for example the type and operating state of the suction nozzle and/or the compressive load exerted by the user on the suction nozzle, for example via the suction tube. The force load that causes the user to experience a resistance to pushing or pulling may be measured in the region of an actuating shank, such as for example in the region of a suction tube or a handle of the vacuum cleaner. A force sensor is in this case located in the force flow chain, for example between the handle of the vacuum cleaner in the case of hand-held vacuum cleaners, or the suction tube in the case of a floor-supported vacuum cleaner, and the suction nozzle. This force sensor registers the pushing force both during operation by pulling and during operation by pushing. The measured variable serves as an input signal for a control system, which for example influences the negative pressure at the suction nozzle in such a way that the pushing force corresponds to a predetermined setpoint. As an alternative or in combination with this, the force load may be measured in the suction nozzle. Furthermore, there is also the possibility of measuring the force load in the region of a joint between the vacuum cleaner and the suction nozzle as well as at other locations that are influenced by force in the region of the vacuum cleaner or suction nozzle. In the case of suction nozzles

which have a rotatable brush that can be driven by an electric motor for acting on the floor, it is proposed that the power consumption of the brush motor is evaluated in addition to the force load. As a result, short-term sudden changes in the pushing force, caused primarily by the floor covering changing, can be detected quickly and reliably. The motor current changes very quickly when the floor covering changes, the load usually being high in the case of carpets and comparatively low in the case of hard floors. Since, however, the motor current also depends on other parameters, such as motor wear or contaminants between the brush and the brush holder, according to the method not the absolute value of the motor current but rather the change in this value is evaluated, since it supplies a distinct measuring signal independently of the absolute value. The changing of the negative pressure is carried out in proportion to the measured compressive force and/or power output of the brush motor. Alternatively, it is also conceivable for the changing of the negative pressure to be carried out in disproportion, upward or downward, to the measured compressive force and/or power output of the brush motor. It may also be provided that the vacuum cleaner has its own displacement drive for propulsion, changing of the propulsion possibly being automatically performed in addition to changing of the negative pressure. Accordingly, in the case of floors which, on account of how they are formed or the degree of soiling, have to be cleaned with an increased cleaning performance, and consequently with an increased negative pressure, the resistance to pushing and or pulling can be regulated to a level appropriate for the user by activation of the displacement drive. This may involve for example the displacement drive only being switched on in pushing mode. The changing of the negative pressure to influence the resistance to

pushing and/or the resistance to pulling is carried out more preferably by means of varying a secondary air opening and/or changing the rotational speed of a fan impeller. A secondary air opening, the opening cross
5 section of which is changed to a greater or lesser extent depending on the measured force load, may be correspondingly provided in the suction nozzle. As an alternative or else in combination with this, the changing of the negative pressure may also take place
10 in dependence on the measured force load by electrical control of the motor power output or rotational speed of the fan impeller producing the suction air volume flow. As a further alternative, changing of the negative pressure may also take place by regulating the
15 suction output cross-section, such as for example by controlling a pivoted flap in the suction line. The distance between the bottom of the suction nozzle and the floor to be cleaned may also be varied to change the negative pressure. The method according to the
20 invention considerably increases the ease with which a vacuum cleaner can be operated. On very different underlying surfaces (carpets of different densities, or hard floors), the suction performance can be kept constant in pushing and pulling mode, whereby
25 furthermore simple and meaningful limitation of the pushing force is achieved for the user by an automatic function. Furthermore, an indirect identification of the floor coverings is conceivable by means of existing physical parameters or the use of special measuring
30 sensors, such as for example negative pressure sensors etc., which can possibly also use parameters additionally for regulating the resistance to pushing.

The invention also relates to a vacuum cleaner
35 comprising a suction nozzle and a fan impeller driven by a motor for producing a suction air volume flow, by which a negative pressure is produced in the suction

nozzle, a force measuring device being provided in the vacuum cleaner, for example a vacuum cleaner shank, for determining a force load that results in the user experiencing a resistance to pushing or pulling, which
5 at least in pushing mode determines a compressive force. A vacuum cleaner of the type in question is known from WO 97/26819 A2, mentioned at the beginning. That document describes a vacuum cleaner which has sensor means which respond to the respective direction
10 of movement (forward, backward) of the suction nozzle and additionally has further switching means which vary the negative pressure or the air flows in the region of the suction nozzle in dependence on the direction of movement recorded. In order to make a vacuum cleaner
15 of the type in question easier to operate, it is proposed that at least the resistance to pushing is automatically influenced in dependence on the force load recorded. According to the invention, a constant check is kept on the force load, the resistance to
20 pushing being influenced in dependence on the value recorded, which results in a positive effect on the user. Therefore, depending on the underlying surface and possibly also on the combination of equipment, an appropriate volume flow window is automatically set, so
25 that the user always obtains a cleaning result that is optimum with respect to the underlying surface, and in this case does not increase the pushing force unnecessarily. The essence of the invention is the recording of the pushing force of the suction nozzle
30 and the feedback to suitable devices for adapting the resistance to pushing. At least when the vacuum cleaner is being operated by pushing, this involves measuring the force load and leveling out the resistance to pushing. It is further preferred for the
35 force load to be measured both during operation by pushing and by pulling and, as a consequence of this, regulating the resistance to pushing and pulling to an

approximately equal level. In this respect, it is further proposed that the influence is brought about by changing the negative pressure in the suction nozzle, choosing with respect to the changing of the negative pressure a value which achieves an appropriate, constant force load for the user with a cleaning result that is optimum with respect in particular to the underlying surface. This proves to be advantageous in particular to the extent that, for carpet cleaning, depending on the type of carpet, only certain maximum volume flows are required in order to clean the carpet optimally. Higher volume flows would only produce higher pushing or pulling forces, unwanted by the user. The constant, automatic measurement of the force load allows a constant adaptation of the cleaning performance and the force load to be achieved, it being possible to use not only the nature of the carpet to be cleaned but also further parameters for the variation, such as for example the type and operating state of the suction nozzle and/or the compressive load exerted by the user on the suction nozzle, for example via the suction tube. The force load that causes the user to experience a resistance to pushing or pulling may be measured in the region of an actuating shank, such as for example in the region of a suction tube or a handle of the vacuum cleaner. A force sensor is in this case located in the force flow chain, for example between the handle of the vacuum cleaner in the case of hand-held vacuum cleaners, or the suction tube in the case of a floor-supported vacuum cleaner, and the suction nozzle. This force sensor registers the pushing force both during operation by pulling and during operation by pushing. The measured variable serves as an input signal for a control system, which for example influences the negative pressure at the suction nozzle in such a way that the pushing force corresponds to a predetermined setpoint. As an alternative or in

combination with this, the force load may be measured in the suction nozzle. Furthermore, there is also the possibility of measuring the force load in the region of a joint between the vacuum cleaner and the suction
5 nozzle as well as at other locations that are influenced by force in the region of the vacuum cleaner or suction nozzle. The changing of the negative pressure is carried out in proportion to the measured compressive force. Alternatively, it is also
10 conceivable for the changing of the negative pressure to be carried out in disproportion, upward or downward, to the measured compressive force. It may also be provided that the vacuum cleaner has its own displacement drive for propulsion, changing of the
15 propulsion possibly being performed automatically in addition to changing of the negative pressure. Accordingly, in the case of floors which, on account of how they are formed or the degree of soiling, have to be cleaned with an increased cleaning performance, and
20 consequently with an increased negative pressure, the resistance to pushing and or pulling can be regulated to a level appropriate for the user by activation of the displacement drive. This may involve for example the displacement drive only being switched on in
25 pushing mode. The changing of the negative pressure to influence the resistance to pushing and/or the resistance to pulling is carried out more preferably by means of varying the secondary air opening and/or changing the rotational speed of a fan impeller. A
30 secondary air opening, the opening cross section of which is changed to a greater or lesser extent depending on the measured force load, may be correspondingly provided in the suction nozzle. As an alternative or else in combination with this, the
35 changing of the negative pressure may also take place in dependence on the measured force load by electrical control of the motor power output or rotational speed

of the fan impeller producing the suction air volume flow. Changing of the negative pressure may also take place for example by controlling a pivoted flap in the suction line to vary the diameter of the line. In a
5 further configuration given by way of example, changing of the negative pressure is achieved by changing the distance between the bottom of the suction nozzle and the underlying surface to be cleaned. The measurement of the force takes place primarily in the direction of
10 the shank or suction tube, that is in the operative direction. It is also conceivable to measure and use the force parallel to the floor by means of a conversion. The main locations that would be suitable as measuring points are the shank of the cleaner in the
15 case of a hand-held vacuum cleaner, the suction tube in the case of a floor-supported vacuum cleaner, the piece providing a joint with the attachment, the coupling point with respect to the vacuum cleaner, the connector to the vacuum cleaner or else a point in the attachment
20 or in the suction nozzle that is influenced by force. The force measuring device may comprise a strain gage. It is also alternatively conceivable for a force sensor, a capacitive sensor, a piezoresistive sensor, a Faraday sensor or else a pressure sensor to be
25 provided. The force measuring device may also comprise a spring-deflection system with limit switches. In a further alternative configuration, it is provided that the force measuring device comprises a continuously operating signal transmitter. In addition, a
30 combination of the different force measuring devices is also conceivable. The force measurement can therefore take place by means of a strain gage disposed on a plastic part of the joint shell. As an alternative, the force measurement takes place on a metal plate
35 which is inserted in a plastic part. In combination with the force measurement in the main force flow, a secondary force flow may possibly also be used, for

example by means of a leaf spring. A spring-deflection system by means of a potentiometer track or limit switches or additionally by means of optical resolution is also conceivable. A capacitive sensor may be
5 disposed for example between a suction connector and the air duct. If an optical sensor is provided for force measurement, it is used to measure the changing of the light intensity or the refractive index. Detection of the deflection of the force is also
10 possible by means of a spring-deflection system in the form of an eccentric between a piece providing a joint and the chassis. A certain moment or force can be applied by means of springs, opposing the user's pushing force. This change of deflection can be
15 correspondingly interrogated. In addition to the compressive force, the power consumption of a motor and/or the speed of a rotating brush located in the suction nozzle may be evaluated. In connection with such attachments or suction nozzles having a carpet
20 brush, it is also known to provide them with a parking switch, by means of which at least the drive motor of the brush can be switched off when the vacuum cleaner is at a standstill, in spite of the suction blower motor running, so as to spare the floor covering. The
25 configuration according to the invention makes it possible to dispense with such a parking switch. The force measuring device detects the position of rest, since no pushing or pulling load occurs in this position. As a consequence, the rotating brush is
30 automatically switched off. In general, this parking position can also be used for carrying out a balancing of the system. The parking position is detected and evaluated, the weight of the vacuum cleaner housing, the suction tube and/or the suction hose that acts on
35 the suction nozzle or on the attachment serving as a tare weight. Balancing is also possible in any other defined position of rest as well as by forming a mean

value from the measured values for the forward and backward travel. Depending on the detected force and return to the floor, the rotating brush can also be controlled with respect to its rotational speed. It

5 proves to be particularly advantageous that the recording of precise gravimetric measured variables is not absolutely necessary. It is just required for changes with respect to a system zero point to be recorded and assessed. In addition, the connected

10 vacuum cleaner can also detect by means of an electrical coding in the attachment or the suction nozzle which volume flow window is required for the optimum cleaning result. By means of a rotating brush in the suction nozzle, the type of carpet can also be

15 detected. Therefore, the speed of the brush on the carpet, the power consumption of the respective motor or else the wear of the bristles can be used as parameters. In order to achieve high accuracy in this respect, the parameters are measured while the brush is

20 running freely and while it is being used on the floor, thereby achieving a calibration of the system. Similarly, hard floors can also be detected, as a result of free running of the rotating brushes, and the appropriate setting made. The individual limit values

25 for the different floors are stored for example in a table of values in the respective attachment and in this way are used for controlling the vacuum cleaner. Apart from fully automatic operation for regulating the resistance to pushing without user intervention,

30 control with a default setting is also possible. In this case, the pushing force may be preselected by the user as the manipulated variable. Adaptation of the pushing force to different user groups (the elderly or frail and so on) is therefore possible for example.

35 The solution according to the invention provides a vacuum cleaner which is easier to use. On very different underlying surfaces (carpets of different

densities, or hard floors), the suction performance can be kept constant in pushing and pulling mode, whereby furthermore simple and meaningful limitation of the pushing force is achieved for the user by an automatic function. Furthermore, an indirect identification of the floor coverings is conceivable by means of existing physical parameters or the use of special measuring sensors, such as for example negative pressure sensors etc., which parameters can possibly additionally also be derived for regulating the resistance to pushing.

The invention is explained in more detail below on the basis of the accompanying drawings, which merely represent exemplary embodiments and in which:

Figure 1 shows a vacuum cleaner according to the invention comprising a suction nozzle in a perspective representation;

Figure 2 shows a schematic sectional representation through a suction nozzle with an arrangement of a number of alternative or combined force measuring devices;

Figure 3 shows a basic circuit diagram to explain the method according to the invention;

Figure 4 shows a sectional representation according to Figure 2, for a further embodiment.

Figure 1 firstly shows a vacuum cleaner 1 in the form of a hand-held vacuum cleaner, with which a suction nozzle 2 in the form of an attachment is both electrically and pneumatically associated.

The suction nozzle 2 has in the usual way a suction space 3 which extends transversely in relation to the

customary direction of movement (r , r') and is associated with the end region of the suction nozzle 2, being formed virtually over the entire width of the same. The suction space 3 opens into a suction opening 5 toward the floor 4 to be cleaned.

From the suction space 3 there extends a suction channel 6, which at the other end opens out into a receiving connector 7, disposed toward the rear of the suction nozzle 2. Said receiving connector serves for connecting the suction nozzle 2 to a suction tube 8 at the foot of the vacuum cleaner 1. The receiving connector 7 forms a joint 9 in the suction nozzle 2 for the individual, angular adaptation of the vacuum cleaner 1 to the suction nozzle 2.

Associated with the suction space 3 and the suction opening 5, respectively disposed upstream and downstream in the customary direction of movement (r , r'), is a sealing element 10, extending parallel to the suction space 3, for example in the form of a strip of bristles or a sealing lip. These sealing elements 10 are adjustable in height in a known manner. They are therefore lowered to seal the suction space 3 when cleaning hard floors, and thereby protrude beyond the bottom 11 of the suction nozzle until they are almost in sealing contact with the floor 4 to be cleaned. When cleaning a carpet, on the other hand, the sealing elements 10 are raised.

Furthermore, in the rear region, remote from the suction space 3, the suction nozzle 2 has displacement wheels 12.

In the exemplary embodiment represented, a brush 15, which can be driven by means of an electric motor 13 integrated in the suction nozzle 2, is disposed in the

suction space 3. This brush is formed as a brush roller, which, aligned centrally with respect to the suction space 3, rotates about an axis aligned in the extent of the suction space. The bristles of the brush
5 15 protrude downward beyond the bottom 11 of the suction nozzle out of the suction opening 5, to act with the mechanical action of a brush on the carpet to be cleaned.

10 For producing the suction air volume flow, a suction/blower motor 16 is disposed in the vacuum cleaner 1. This motor has a fan impeller (not represented any more specifically), by means of which a negative pressure can be produced in the suction
15 opening 5 of the suction nozzle 2.

In order to regulate the force load occurring when the vacuum cleaner 1 is displaced during its operation - operated by pushing in the direction of the arrow r
20 and/or operated by pulling in the direction of the arrow r' - resulting in the user experiencing a resistance to pushing or pulling - in such a way that on the one hand the pulling/pushing forces lie in a range that is comfortable for the user and on the other
25 hand optimum cleaning of the floor to be treated is still ensured, an active measurement of the force load is provided, and an influence derived from it on the resistance to pushing. The drawings only show a selection of possible force measuring devices 17.

30 For instance, such a force measuring device 17 may be disposed in the region of the vacuum cleaner shank 19, provided with a handle 18. The force measuring device 17 may in this case be a customary pressure sensor 20.
35 As an alternative, a force measuring device 17 may also be disposed in the region of the suction tube 8, it being possible here for it to take the form of a

spring-deflection system 21 with limit switches or continuously operating signal transmitters, such as for example a potentiometer track. Furthermore, a force measurement by means of a strain gage 22 in the region of the receiving connector 7 is also conceivable, which strain gage 22 is disposed on the receiving connector 7 formed as a plastic part. As an alternative, the force measurement may also take place on a metal plate inserted in the plastic part.

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A force measurement may also take place by means of a spring-deflection system, which is disposed as an eccentric between the articulated receiving connector 7 and the suction nozzle housing. A certain moment or force can be applied by means of springs, opposing the user's pushing force. This change of deflection can be correspondingly interrogated.

The force measuring device 17 may also be provided in the region of a point in the suction nozzle 2 that is influenced by force.

As schematically represented in Figure 3, the force load values recorded by the force measuring device 17 are preferably recorded and evaluated both in pushing mode in the direction of the arrow r and in pulling mode in the direction of the arrow r' by a control unit 23 disposed in the suction nozzle 2.

This controls the resistance to pushing of the vacuum cleaner 1 in dependence on the measured force load, that is by changing the negative pressure in the suction nozzle 2 or in the suction space 3. This changing of the negative pressure may take place by changing the rotational speed of the suction/blower motor 16 in the vacuum cleaner 1. As an alternative or else in combination with this, the negative pressure in

the suction space 3 may also be adapted by means of varying a secondary air opening 24 in the suction nozzle 2. This variation takes place by adapted changing of the cross-section of the secondary air opening 24, for example in a slide-controlled manner. As an alternative or else in combination with this, changing of the negative pressure may also take place by controlling a pivoted flap 30 schematically represented in Figure 4, by means of which changing of the cross-section of the suction channel 6 can be achieved.

Furthermore, with respect to Figure 4, changing of the negative pressure may also be achieved by raising or lowering the suction nozzle 2 or the nozzle housing 31. For this purpose, the nozzle housing 31, which carries the suction space 3 as well as the brush 15 and the suction channel 6, can be displaced in the vertical direction in relation to a carriage 32 carrying the displacement wheels 12. This displacement, dependent on the force measurement, takes place in the exemplary embodiment shown by means of a bellows 33, which can be actuated by pressure, is supported on the underside on the carriage 32 and on the upper side exerts a load on a carrier 34 rigidly connected to the housing 31. If the bellows 33 is actively actuated, this causes the housing 31 to be raised, and consequently the distance between the suction opening 5 and the floor 4 that is to be cleaned to be increased. The negative pressure is reduced.

If a force load exceeding a predetermined threshold value is recorded, the negative pressure is lowered by means of the control unit 23, the constant measurement of the force load achieving a constant adaptation of the resistance of the vacuum cleaner. 1 to

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pushing/pulling, that is by varying the negative pressure in the suction space 3.

5 In a further configuration, the displacement wheels 12 of the suction nozzle 2 may be capable of being driven by an electric motor. In this respect, it is further proposed that, possibly in addition to the regulation of the negative pressure in dependence on the measured force load, changing of the propulsion by means of the
10 displacement wheels 12 is automatically performed. By switching on the electromotive drive for the displacement wheels 12, the force load occurring is reduced to a level that is tolerable for the user.

15 Furthermore, in dependence on the measured force load, influence can also be exerted on the rotational speed and/or the direction of rotation of the brush 15 disposed in the suction space 3.

20 By means of an electrical coding in the attachment or the suction nozzle 2, the connected vacuum cleaner 1 can detect which volume flow window is required for the optimum cleaning result. For this purpose, the attachment impresses an electrical detection signal on
25 the vacuum cleaner 1. The module for the electrical coding of the attachment is provided in Figure 3 with the reference numeral 25.

The signal may comprise a voltage, a current, a
30 resistance, a capacitance, a series of pulses or a mixture of these components. The signal may also be derived from a change of inductance. As a further alternative, there is the possibility of a light signal or brightness signal, for example by an LED being
35 disposed in the suction nozzle and a downstream light guide to the control unit 23.

In general, the volume flow window can be made narrower for carpet cleaning. Depending on the type of carpet, only certain maximum volume flows are required for optimum cleaning of the carpet. If higher volume flows and a correspondingly higher negative pressure in the suction space 3 are absolutely necessary - which however will also lead to an increase in the pushing forces, unwanted by the user - automatic operation of the already indicated, electromotively drivable displacement wheels 12 is conceivable for example.

The brush 15 rotating in the suction space 3 can also be used for detecting the type of carpet, by parameters such as the rotational speed and/or the power consumption of the electric motor 13 driving the brush 15 being recorded. Depending on the required accuracy, the parameters must be measured while the brush 15 is running freely and while it is in use on the floor 4. In this way, a calibration of the system is conceivable. The individual limit values for the different floors are stored in a table of values 26 of the respective attachment, which is stored in the control unit 23, whereby the vacuum cleaner 1 is controlled.

A negative pressure measurement in the suction space 3 may also additionally serve for detection and as a further auxiliary variable for regulating the resistance to pushing.

All disclosed features are (in themselves) pertinent to the invention. The disclosure content of the associated/accompanying priority documents (copy of the prior application) is also hereby incorporated in full in the disclosure of the application, including for the purpose of incorporating features of these documents in claims of the present application.

CLAIMS

1. Method for operating a vacuum cleaner (1) comprising a suction nozzle (2); a suction air
5 volume flow being produced in the vacuum cleaner in a motor-driven manner, creating a negative pressure in the suction nozzle (2), and a force load that occurs when the vacuum cleaner (1) is displaced (operated by pushing and/or pulling), and results
10 in the user experiencing a resistance to pushing or pulling, being measured, characterized in that, at least when it is being operated by pushing, at least the resistance to the pushing of the vacuum cleaner (1) is automatically influenced in
15 dependence on a measured force load.
2. Method according to Claim 1 or in particular according thereto, characterized in that the
20 influence takes place by changing the negative pressure in the suction nozzle (2).
3. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the force load is measured in
25 the region of an actuating shank.
4. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the force load is measured in
30 the suction nozzle (2).
5. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the force load is measured in
35 the region of a point providing a joint (9) between the vacuum cleaner (1) and the suction nozzle (2).

- 5 6. Method according to one or more of the preceding claims or in particular according thereto, a rotatable brush (15) that can be driven by an electric motor being disposed in the suction nozzle (2), characterized in that the power consumption of the brush motor (13) is evaluated in addition to the force load.
- 10 7. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the changing of the negative pressure is carried out in proportion to the measured compressive force and/or power output of the brush motor.
- 15 8. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the changing of the negative pressure is carried out in disproportion, upward or downward, to the measured compressive force and/or power output of the brush motor.
- 20 9. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the vacuum cleaner (1) has its own displacement drive for propulsion.
- 25 10. Method according to one or more of the preceding claims or in particular according thereto, characterized in that changing of the propulsion is possibly automatically performed in addition to changing of the negative pressure.
- 30 11. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the changing of the negative pressure is carried out by means of varying a
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secondary air opening (24) and/or changing the rotational speed of a fan impeller.

- 5 12. Method according to one or more of the preceding claims or in particular according thereto, characterized in that the changing of the negative pressure is carried out by means of varying a suction channel cross-section.
- 10 13. Vacuum cleaner (1) comprising a suction nozzle (2) and a fan impeller driven by a motor for producing a suction air volume flow, by which a negative pressure is produced in the suction nozzle (2), a force measuring device (17) being provided in the vacuum cleaner (1), for example a vacuum cleaner shank (19), for determining a force load that results in the user experiencing a resistance to pushing or pulling, which at least in pushing mode determines a compressive force, characterized in that at least the resistance to pushing is automatically influenced in dependence on the force load recorded.
- 15 14. Vacuum cleaner according to Claim 13 or in particular according thereto, characterized in that the influence takes place by changing the negative pressure in the suction nozzle (2).
- 20 15. Vacuum cleaner according to one or either of Claims 13 and 14 or in particular according thereto, characterized in that the force measuring device (17) is disposed in the suction nozzle (2).
- 25 16. Vacuum cleaner according to one or more of Claims 13 to 15 or in particular according thereto, characterized in that the suction nozzle (2) is part of an attachment.
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17. Vacuum cleaner according to one or more of Claims
13 to 16 or in particular according thereto,
characterized in that the attachment or the vacuum
5 cleaner (1) has a joint shell and the force
measuring device (17) is disposed in the joint
shell.
18. Vacuum cleaner according to one or more of Claims
10 13 to 17 or in particular according thereto,
characterized in that the vacuum cleaner (1) has
its own displacement drive for propulsion.
19. Vacuum cleaner according to one or more of Claims
15 13 to 18 or in particular according thereto,
characterized in that changing of the propulsion is
possibly automatically performed in addition to
changing of the negative pressure.
- 20 20. Vacuum cleaner according to one or more of Claims
13 to 19 or in particular according thereto,
characterized in that the changing of the negative
pressure is achieved by changing the rotational
speed of the fan impeller.
- 25 21. Vacuum cleaner according to one or more of Claims
13 to 20 or in particular according thereto,
characterized in that the changing of the negative
pressure is carried out by means of varying a
30 secondary air opening (24).
22. Vacuum cleaner according to one or more of Claims
13 to 21 or in particular according thereto,
characterized in that the changing of the negative
35 pressure takes place by means of varying a suction
channel cross-section.

23. Vacuum cleaner according to one or more of Claims 13 to 22 or in particular according thereto, characterized in that the force measuring device (17) comprises a strain gage (22).
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24. Vacuum cleaner according to one or more of Claims 13 to 23 or in particular according thereto, characterized in that the force measuring device (17) comprises a force sensor.
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25. Vacuum cleaner according to one or more of Claims 13 to 24 or in particular according thereto, characterized in that the force measuring device (17) comprises a capacitive sensor.
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26. Vacuum cleaner according to one or more of Claims 13 to 25 or in particular according thereto, characterized in that the force measuring device (17) comprises a piezoresistive sensor.
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27. Vacuum cleaner according to one or more of Claims 13 to 26 or in particular according thereto, characterized in that the force measuring device (17) comprises a Faraday sensor.
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28. Vacuum cleaner according to one or more of Claims 13 to 27 or in particular according thereto, characterized in that the force measuring device (17) comprises a pressure sensor (20).
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29. Vacuum cleaner according to one or more of Claims 13 to 28 or in particular according thereto, characterized in that the force measuring device (17) comprises a spring-deflection system (21) with limit switches.
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30. Vacuum cleaner according to one or more of Claims
13 to 29 or in particular according thereto,
characterized in that the force measuring device
(17) comprises a continuously operating signal
transmitter.
31. Vacuum cleaner according to one or more of Claims
13 to 30 or in particular according thereto,
characterized in that, in addition to the
compressive force, the power consumption of a motor
(13) and/or the speed of a rotating brush (15)
located in the suction nozzle (2) is evaluated.