

VACUUM CLEANER WITH CONTACTLESS CONVERSION OF A POWER
CONTROLLER SIGNAL

The invention relates to a vacuum cleaner comprising a
5 base unit, which has an electric motor, and a shank
which can be plug-connected to said base unit and has
an operating handle and/or an attachment which has an
electric motor, and the vacuum cleaner also comprising
10 a control unit for controlling the power of the
electric motor, control information which is required
to control the power of the electric motor being
mechanically transmitted from the shank to the base
unit and/or attachment and there being converted into a
corresponding signal for the electric motor.

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Vacuum cleaners of the type under discussion are known.
These vacuum cleaners generally have a control element,
for example in the form of a multiple-contact switch,
in the region of the shank-side manual operating
20 handle, by means of which control element the power of
the electric motor, which is provided in the base unit,
of a suction/blower unit and/or an electric motor which
is provided in the attachment, for example when the
attachment is in the form of a brush unit, can be
25 controlled. By way of example, DE 197 20 949 A1
discloses a vacuum cleaner of this type. This vacuum
cleaner has a control unit in the operating handle. A
further power controller is provided directly on the
base unit.

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With regard to the above-described prior art, a
technical problem underlying the invention is seen as
that of further improving a vacuum cleaner of the type
under discussion, in particular with regard to the
35 transmission of the control information which is
required to control the electric motor.

This problem is solved first and foremost by the subject matter of Claim 1, which provides that the control information is provided by a respective position of the mechanical element, and that conversion
5 of the control signal in the base unit and/or attachment is effected by interrogation of the position of the mechanical element, which interrogation is basically contactless and may be optical, magnetic or electromagnetic. Accordingly, the control information
10 is in first instance transmitted purely mechanically from the control unit to the interrogation unit which, in the case of a configuration with a shank-side control unit and an electric motor, which is to be controlled by means of said control unit, in the base
15 unit, is disposed in said base unit, specifically in the interface region between the shank and base unit. By way of this configuration, control can be achieved of the power of an attachment which is connected both electrically and in terms of flow via the base unit.
20 Furthermore, the base unit can also have a control unit in the form of a multiple-contact switch or the like which likewise transmits the required control information in a purely mechanical manner to an interrogation unit which is disposed in the attachment,
25 specifically in the interface region between the base unit and the attachment. In this case, the mechanical element, which, in the case of the shank, extends through said shank between the control unit and that end of the shank which is associated with the interface
30 to the base unit, preferably transmits the actuation-induced displacement of the control unit directly, for example with a ratio of 1:1 or furthermore also with a step-down or a step-up. Transmission of control information is effected in a purely mechanical manner,
35 as a result of which, in particular, a shank with an operating handle can be decoupled from an electrical power supply. Accordingly, no electrical connections are required between the shank and the base unit for signal transmission purposes. When power is supplied to

the electric motor in the base unit by direct connection of said base unit to the domestic mains supply, the shank which guides the base unit can be kept completely free of current. Sensing of the
5 mechanically transmitted control information is preferably effected in the appliance part which has the electric motor to be controlled, for example in the base unit which requires a supply of power in any case. This evaluation is performed either by way of optical,
10 magnetic or electromagnetic interrogation of the position of the mechanical element which is to be displaced by means of the control unit, this interrogation being possible fundamentally in a contactless manner, possible contact preferably only
15 serving the purpose of guiding or supporting the mechanical element in the region of the interrogation element.

The subject matters of the other claims are explained
20 below with reference to the subject matter of Claim 1, but may also be important in their independent formulation.

Therefore, an advantageous development of the subject
25 matter of the invention provides for the mechanical element to be a rod or a possibly circumferentially disposed strip. Preferred in this case is a stable transmission part which ensures exact transmission by sliding displacement of the element, for example a
30 rigid rod or strip or possibly a floppy rod or strip which follows the bend, which is provided over the longitudinal extent, of the shank, which rod or strip is guided in correspondingly realized portions of the shank or the base unit for the purpose of secure signal
35 transmission. The mechanical element does not necessarily have to be bar- or rod-like with an end which faces the control unit and the interrogation unit in the base unit to be controlled in each case. Instead, solutions are also conceivable with endless

elements, for example circumferentially disposed strips, cords or the like which transmit the required control information. In this case, operation of the control unit effects correspondingly implemented
5 further displacement of the strip or the like. In a preferred construction of the subject matter of the invention, provision is made for the optical interrogation to be performed by a light barrier. This light barrier is passed through by the mechanical
10 element - in the case of a circumferentially disposed strip, passed through by a correspondingly identified strip portion. The light barrier detects the presence of the mechanical element or a change in the mechanical element during the course of the linear displacement,
15 which is effected by means of the control unit, of the mechanical element in the direction of its longitudinal extent. Therefore, the control information can be provided by different shaping of the mechanical element over its length, which different shaping is detected by
20 the light barrier. For example, a mechanical element which is formed as a rod can have different raised portions and lowered portions which are spaced apart from one another as viewed over the length and are detected by the interrogation. The different shaping
25 forms a code for unambiguous identification of the control information to be transmitted. In the case of a circumferentially disposed cord, this cord can have, over its length, different characterizing threads or the like which can be optically detected. In a
30 preferred configuration, the different shaping is provided by slots or notches, and this is done particularly in the case of an element which is formed as a rod. The slots and/or notches are made or applied in the manner of a bar code. Their arrangement provides
35 unambiguous identification of the control signal to be transmitted. In this respect, it has also proven particularly advantageous for the different shaping over the length of the mechanical element to be repeated in accordance with the possible telescoping

capability of the shank, so that the required control signal is unambiguously detected and transmitted by operation of the control unit independently of the selected telescopic position of the shank in relation to the base unit. A plurality of mechanical elements can be provided, for example in accordance with the number of different switching stages of the control unit, further for example in the case of a control unit for controlling the electric motor by way of three power stages of four mechanical elements, the fourth element, in conjunction with the control unit, transmitting a control signal for switching off the electric motor. Accordingly, the control unit can have one or more control switches. When there are a plurality of control switches, one such control switch is directly associated with each mechanical element. The control switch may be in the form of a control lever which is pivoted about an axis by, for example, being pushed by a thumb, the mechanical element being linearly displaced about a defined path by way of an articulation point. This displacement path corresponds at least to the length of the element portion on which the different shapings are stored as control information. In addition, the control switch may be in the form of a control wheel. Finally, it is proposed that the control switch is pre-biased into its starting position. This starting position is a neutral position in which no control information is detected by the optical interrogation. The control information detected most recently is used to control the electric motor.

The invention is explained in greater detail below with reference to the accompanying drawing which illustrates only two exemplary embodiments and in which:

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Fig. 1 shows a perspective illustration of a vacuum cleaner according to the invention comprising a telescopic shank which is plug-connected to a base unit;

Fig. 2 shows an enlargement of the region II in Fig. 1;

5 Fig. 3 shows a longitudinal section through the region of an operating handle of the shank and the plug-connection region between the shank and the base unit;

10 Fig. 4 shows an enlargement of the region IV in Fig. 3;

Fig. 5 shows a sectional illustration which corresponds to Fig. 4, but after displacement
15 of a mechanical element which is guided in the shank;

Fig. 6 shows an enlargement of the region VI in Fig. 3;

20 Fig. 7 shows a sectional illustration which corresponds to Fig. 6, but with operation of a control switch in order to displace the mechanical element into the position
25 illustrated in Fig. 5;

Fig. 8 shows a perspective illustration of four control switches with articulated mechanical elements which have different shapings and a
30 light barrier which senses the shapings;

Fig. 9 shows a sectional illustration according to Fig. 6, but relating to an alternative configuration of the control switch in the form
35 of a control wheel.

Illustrated and described in first instance with reference to Figure 1 is a vacuum cleaner 1, in particular a domestic vacuum cleaner, which is realized

as a hand-guided shank-type appliance. This vacuum cleaner has in first instance a base unit 2 with an electric motor (not illustrated in any detail) for a suction/blower unit. A filter cassette 3, which is
5 provided for accommodating the sucked-up dust, is connected to the base unit 2. This filter cassette contains a filter bag (not illustrated).

Supply of power to the electric motor which is
10 integrated in the base unit 2 is effected by means of an electric cable 4 which enters the base unit 2.

The base unit 2 also has a swan neck-like projection which extends over the region of the filter cassette 3.
15 In the region of the free end, this projection forms a plug-type receptacle 5 for a shank 6 of the vacuum cleaner 1. The associated ends of the receptacle 5 and shank 6 are formed as mechanical plug-type connection elements in known manner. An operating handle 7 is
20 formed in the region of the free end of the shank 6. This operating handle has a thumb-operated control unit 8 in an ergonomically favorable position and the power of the electric motor which is accommodated in the base unit 2 can be adjusted by means of said control unit,
25 as a result of which the suction power of the vacuum cleaner 1 can be matched, for example, to the floor covering.

For floor-treatment purposes, the base unit 2 is flow-
30 connected to an attachment 9. This attachment can be a suction nozzle which has a rotating brush.

In order to control the electric motor in the base unit 2, control information is passed from the operating
35 handle 7 or from the control unit 8 to the base unit 2, and there is detected by an information receiver. This information is used by means of an evaluation electronics system to control the electric motor.

The operating handle-side control unit 8 has four separate control switches 11 which are in the form of control levers 10 and are positioned in an ergonomically favorable manner in the region to be engaged by the thumb.

These control switches 11 are mounted in the operating handle 7, in each case about a pivot axis x which is oriented transverse to the longitudinal extent of the shank 6. Limbs which are directed in opposite directions protrude from the switch portion which starts at the axial body 12 which forms the pivot axis x, of which limbs one forms a contact portion 14 which passes through the operating handle 7 in the region of a correspondingly provided opening 13. Inside the opening 13 in the handle, this contact portion is provided with an approximately radially projecting stop portion 15 for stop-limited abutment of the control switch 11 in the edge region of the opening, for the purpose of defining a normal switch position.

The limb which faces away from the contact portion 14 and protrudes from the axial body 12 is a crank arm portion 16, at the free end of which there is connected, in an articulated manner, by means of a pin 17 which is oriented parallel to the axial body 12, a rod-like mechanical element 18 which extends through the operating handle 7 and the shank 6.

In the illustrated exemplary embodiment, the mechanical element 18 is formed in the manner of a strip with a thickness which ensures a certain inherent stability of the element 18. In this case, the orientation is selected such that the pivot axis 17 passes through the element 18 in the region of the broad side areas.

As can be seen particularly in the perspective illustration in Fig. 8, the control switches 11 are pre-loaded into the normal position, which is

illustrated in Fig. 6 for example, by means of leg
springs 19 which are disposed on the axial bodies 12,
one limb of the leg spring 19 being supported on the
cover of the hollow operating handle 7, which cover
5 contains the openings 13, whereas the other limb acts
against the underside of the stop portion 15 of the
control switch 11.

The rod-like elements 18, which extend through the
10 shank 6 as far as the end region which faces the plug-
type receptacle and beyond this open shank end, are
guided in the shank 6 and in the operating handle 7.
Two guide zones 20 are schematically illustrated in the
illustrations. One of these guide zones 20 is provided
15 at the end of the shank 6 in order to produce a defined
element exit out of the shank 6. Each mechanical
element 18 is provided with control information which
is associated with the respective control switch 11,
this being done by detectable different shaping by
20 means of slots 21. These slots 21 are provided
particularly in the end region of the element 18 which
protrudes beyond the shank 6 and their arrangement and
width are selected to be different in order to
differentiate between the various items of control
25 information from the four elements 18 which are
provided in the exemplary embodiment. Even within an
element 18, the slots 21 which are disposed one after
the other in the longitudinal extent of said element
are different in terms of their width - that is to say
30 in the longitudinal extent of the element. A kind of
bar code is produced on each mechanical element 18,
which bar code can be detected on the base unit side in
the region of the plug-type receptacle 5 by an optical
interrogation means 22 in the form of a light barrier
35 23.

A window 24 which has an elongated rectangular outline
is provided in the longitudinal extent of the element
18 on both sides of a control information slot

arrangement S. The light beam of the forked light barrier 23 passes through one of these windows 24 without being impeded in the spring-loaded, stop-limited normal position of the element 18 and the control switch 11.

Actuation of the control switch 11 and the associated pivoting displacement of the crank arm portion 16 about the pivot axis x causes linear displacement of the mechanical element 18, and this in turn causes the bar code-like control information slot arrangement S to be guided through the region of the forked light barrier 23. The light signal which is detected by the optical interrogation means 22 here is evaluated by means of an electronics system (not illustrated in any detail) and converted into a control signal for the electric motor.

After the actuated control switch 11 is released, it is moved back into the normal position on account of the described spring action, and this is accompanied by a linear return displacement of the mechanical element 18 into the starting position in which the light beam of the forked light barrier 23 can again pass through the element-side window 24 without being impeded.

In principle, the light beam of the forked light barrier passes through the windows 24, which are disposed one after the other, of the provided four mechanical elements 18 in the normal position of the control unit system, that is to say when the control switches 11 are not actuated. Out of this normal position, actuation of one of the control switches 11 causes a characterizing slot pattern to be guided through the forked light barrier 23, which slot pattern effects the correspondingly stored command.

As can further be seen from the illustrations, the shank 6 is telescopically adjusted in a known manner. In order to transmit the control information by

interaction between the base unit-side light barrier 23 and the shank-side slot pattern independently of the selected telescopic position, each mechanical element 18 has, in a prescribed and repetitive manner, slot patterns or control information slot arrangements S which are positioned so as to be matched in terms of spacing and number to the telescoping capability of the shank 6.

As an alternative to the described lever-like control switches 11, provision may also be made, as illustrated by way of example in Fig. 9, of control wheels 25 which each have connected to them in an articulated manner on the inside of the handle a rod-like mechanical element 18. Rolling a finger over the lateral surface, which is exposed toward the outside, of a control wheel 25 causes relative displacement of the element 18, substantially in the longitudinal extent of said element.

Power control according to the invention is performed by optical sensing of a shank-side mechanism. As a result, electrical isolation of the shank and of the operating handle 7 is ensured. In this case, no energy is required for controlling power or for issuing commands. This power control can be achieved by means of mechanical push-to-run keys. Furthermore, the system is tolerant of mechanical deformation, it being possible to produce the mechanism as such in a simple and cost-effective manner.

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 included 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. Vacuum cleaner (1) comprising a base unit (2), which has an electric motor, and a shank (6) which can
5 be plug-connected to said base unit and has an operating handle (7) and/or an attachment (9) which has an electric motor, and the vacuum cleaner also comprising a control unit (8) for controlling the power
10 of the electric motor, control information which is required to control the power of the electric motor being mechanically transmitted from the shank (6) to the base unit (2) and/or attachment (9) and there being converted into a corresponding control signal for the
15 electric motor, characterized in that the control information is provided by a respective position of the mechanical element (18), and in that conversion of the control signal in the base unit (2) and/or attachment (9) is effected by interrogation of the position of the
20 mechanical element (18), which interrogation is basically contactless and may be optical, magnetic or electromagnetic.

2. Vacuum cleaner according to Claim 1 or in particular according thereto, characterized in that the
25 mechanical element (18) is a rod or a strip which may be disposed circumferentially.

3. Vacuum cleaner according to either or both of the preceding claims or in particular according thereto,
30 characterized in that the optical interrogation (22) is performed by a light barrier (23).

4. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto,
35 characterized in that the control information is provided by different shaping of the mechanical element (18) over its length.

5. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto, characterized in that the different shaping is provided by slots (21) or notches.

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6. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto, characterized in that the different shaping over the length of the mechanical element (18) is repeated in accordance with the possible telescoping capability of the shank (6).

7. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto, characterized in that a multiplicity of mechanical elements (18) is provided.

8. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto, characterized in that the control unit (8) has one or more control switches (11).

9. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto, characterized in that the control switch (11) is in the form of a control lever (10).

10. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto, characterized in that the control switch (11) is in the form of a control wheel (25).

11. Vacuum cleaner according to one or more of the preceding claims or in particular according thereto, characterized in that the control switch (11) is pre-loaded into its starting position.