

Vacuum cleaner

The invention relates to a vacuum cleaner comprising a base apparatus, which has an electric motor, and a shank which can be plug-connected to said base apparatus and has an operating handle with an actuating unit, which can be moved mechanically, for controlling the power of the electric motor, a signal which is required to control the power of the electric motor being passed from the shank to the base apparatus, and a signal receiver being disposed in the base apparatus.

Vacuum cleaners of the type under discussion are known. The shank of these vacuum cleaners, which shank can be plug-connected to the base apparatus, has an operating handle on which, for example, a thumb-operated power controller which forms the mechanical actuating unit is further disposed. This power controller acts on switches disposed in the base apparatus electrically via cables located in the operating handle or mechanically.

With regard to the above-described prior art, a technical problem underlying the invention is seen in further improving a vacuum cleaner of the type under discussion with respect to controlling the power of the electric motor in the base apparatus.

This problem is solved first and foremost by the subject matter of Claim 1 which provides that a signal transmitter, which itself is supplied with energy by the mechanical movement of the actuating unit, is disposed in the operating handle. This refinement according to the invention provides an arrangement by means of which the power of the base apparatus or the electric motor disposed in the base apparatus for providing the suction power can be regulated, without a separate energy supply means for the actuating unit,

for example in the form of a rechargeable battery or in the form of an electrical connection which simultaneously also serves as an electrical connection for the base apparatus via the plug connection, being
5 provided in the operating handle which has the actuating unit which can be moved mechanically and furthermore preferably in the entire shank which can be plug-connected. In the proposed solution, the base apparatus is supplied with power via a connection cable
10 which is connected directly to the electrical unit of said base apparatus. The shank or the operating handle is configured as an autonomous unit which supplies itself with energy. The operating handle, which may be in the form of a sliding switch, therefore generates a
15 signal which is passed to the base apparatus by means of the energy generated by the mechanical movement of the actuating unit, and there is evaluated by a signal receiver. The operating handle functions independently of the association state with the base apparatus and
20 also independently of the charge state of any energy storage means, for example in the form of a rechargeable battery. Accordingly, the operating handle and the provided signal transmitter are in a constant state of readiness from which a signal for controlling
25 the apparatus-end electric motor can be generated in an extremely simple manner. A corresponding configuration can also be used to control an active attachment of the vacuum cleaner, in which configuration the attachment can be regulated by means of the shank-side operating
30 handle and the actuating unit, which is provided there and can be moved mechanically, such that the base apparatus is bypassed.

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

In an advantageous development of the subject matter of the invention, provision is therefore made for the

mechanical movement of the actuating unit to act on a piezo element for generating energy. The energy for transmitting the switching information is accordingly obtained from the mechanical movement of the switching process. The actuating unit which can be moved mechanically is preferably in the form of a multiple-contact switch. This switch is combined with a piezo key or the like. When the piezo key is operated, a piezo crystal is pressed in a pulsed manner by means of a spring which is initially prestressed during operation and which is then suddenly relieved of stressing when the actuating unit is operated further. As a result, electrical energy in the form of electrical charge is generated, and this is then used to transmit the switching information to the base apparatus. The position assumed by the actuating unit is checked by means of an electrical circuit at the same time as the mechanical actuating unit moves, and this information is then transmitted, preferably by optical means. In accordance with the refinement according to the invention, no battery or the like is required in the region of the shank which can be plug-connected to the base apparatus. In addition, no electrical or mechanical connections are required either, particularly when the generated actuating signal is passed to the base apparatus through the shank by optical means. The refinement according to the invention has proved particularly advantageous in the sense that there are no electrical connections to (domestic) voltage-carrying parts. This also provides cost-effective and also low-wear and therefore low-maintenance signal transmission.

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

Fig. 1 shows a perspective illustration of a vacuum cleaner of the type under discussion comprising

a base apparatus, an attachment and a shank which is plug-connected to the base apparatus;

5 Fig. 2 shows a perspective illustration, which is enlarged in relation to Fig. 1, of the shank in a detached association position from the partially illustrated base apparatus; and

10 Fig. 3 shows a schematic illustration of the circuit arrangements in the shank and in the base apparatus.

A vacuum cleaner 1, in particular a domestic vacuum cleaner, which is implemented as a hand-guided shank-type appliance is illustrated and described in first
15 instance with reference to Fig. 1. In first instance, said vacuum cleaner has a base part 2 with an electric motor M (not illustrated in any detail) for operating a suction/blower unit. A filter cassette 2' is docked on
20 the base part 2 in order to accommodate the sucked-up dust. Said filter cassette contains a filter bag (not illustrated). Power is supplied to the electric motor M and further electrical/electronic components/assemblies by means of a mains cable which is routed directly into
25 the base part 2.

The base part 2 also has a swan neck-like projection which extends over the region of the filter cassette 2'. In the region of the free end, this projection
30 forms a plug-type receptacle 2'' for a shank 3 of the vacuum cleaner 1. The associated ends of the plug-type receptacle 2'' and the shank 3 are formed in a known manner as mechanically acting plug-type connection elements. The shank 3 is decoupled from the power
35 supply of the vacuum cleaner 1.

An operating handle 4 is formed in the region of the free end of the shank 3. Said operating handle has a thumb-operated actuating unit S in the form of a power

controller in an ergonomically favorable position. The power of the electric motor M which is accommodated in the base apparatus 2 can be adjusted by means of this actuating unit S, as a result of which the suction
5 power of the vacuum cleaner 1 can be adapted, for example to the floor covering, by means of the actuating unit S.

For floor-treatment purposes, the base apparatus 2 is
10 flow-connected to an attachment 5 which, in the illustrated exemplary embodiment, is in the form of a suction nozzle.

In order to control the electric motor M, a signal is
15 passed from the operating handle 4 or from the actuating unit S to the base apparatus 2, and there is detected by a signal receiver. The acquired signal is used by means of an evaluation electronics system to control the electric motor M.

20 In the illustrated exemplary embodiment, signals are transmitted by means of light waves, and an optical waveguide 7 is disposed in the shank 3 for this purpose. Said optical waveguide extends from the
25 operating handle 4 or from the region of the actuating unit S to the free plug-type end of the shank 3.

An evaluation electronics system which is denoted II in Fig. 3 is provided on the base apparatus in the region
30 of the plug-type receptacle 2''. This evaluation electronics system comprises in first instance a light wave sensor LWS and a microprocessor MC₂ which acts on the motor M so as to control it by means of a triac D₃. This motor control is dependent on the detected light
35 signal.

Said light signal is emitted by a light-emitting diode LED which is a constituent part of a control electronics system I which is disposed in the region of

the actuating unit S, that is to say in the region of the operating handle 4. This light-emitting diode LED is associated with that end of the optical waveguide 7 which is remote from the plug-type end of the shank 3.

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The control electronics system I is implemented as an autonomous circuit and accordingly does not require a separate energy supply. The required energy is produced by means of a piezo key P, this being combined with the actuating unit S which can be moved mechanically. When the piezo key P is operated, a piezo crystal is pressed in a pulsed manner by means of a spring which is initially prestressed during operation and which is then suddenly relieved of stressing when the actuating unit is operated further. As a result, electrical energy in the form of electrical charge is generated.

The charge generated when the piezo key P is operated is buffer-stored in the capacitor C_1 with the aid of the diodes D_1 and D_2 . The capacitor C_2 is then charged via the resistor R_1 , the voltage being limited with the aid of a Zener diode Z_1 .

A constant voltage U_{z1} is now present in the capacitor C_2 as long as the voltage in the capacitor C_1 is greater than the voltage U_{z1} . The period of time for which the voltage in the capacitor C_2 is equal to U_{z1} depends on the generated charge and on the discharge current through the following circuit.

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The voltage in the capacitor C_2 is used to operate a microprocessor circuit (MC_1) which is activated after the minimum voltage U_{min} which is required for operating the microprocessor is exceeded. Immediately after its initialization, the microprocessor MC_1 checks the state of the actuating unit S which is in the form of a multiple-contact switch and, depending on the multiple-contact switching means a, b, c or d selected, emits a serial optical signal, which depends on the state of

the actuating unit S, by means of the light-emitting diode LED.

After the signal is emitted, the capacitor C_2 is
5 discharged, until the voltage falls below the voltage U_{min} .

The serial optical signal is transmitted to the optical receiver LWS in the base apparatus 2 directly by means
10 of the optical waveguide 7 in the interior of the shank 3 or, as an alternative, via reflections, and the vacuum cleaner 1 is controlled with the aid of said signal after an evaluation operation.

15 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
20 purpose of incorporating features of these documents in claims of the present application.

CLAIMS

1. Vacuum cleaner (1) comprising a base apparatus (2), which has an electric motor (M), and a shank (3) which can be plug-connected to said base apparatus and has an operating handle (4) with an actuating unit (S), which can be moved mechanically, for controlling the power of the electric motor (M), a signal which is required to control the power of the electric motor (M) being passed from the shank (3) to the base apparatus (2), and a signal receiver being disposed in the base apparatus (2), characterized in that a signal transmitter, which itself is supplied with energy by the mechanical movement of the actuating unit (S), is disposed in the operating handle (4).
2. Vacuum cleaner according to Claim 1, characterized in that the mechanical movement of the actuating unit (S) acts on a piezo element (P) for generating energy.
3. Vacuum cleaner according to any one of Claim 1 or 2, characterized in that the position assumed by the actuating unit (S) is checked by means of an electrical circuit (II) at the same time as the mechanical actuating unit (S) moves.