

Automatically displaceable floor dust collecting device

The invention relates in first instance to an automatically displaceable floor dust collecting device with an electromotive drive, a dust collecting container and a cover, the floor dust collecting device being provided with an obstacle detection.

A floor dust collecting device of the type in question is known from DE 102 42 257 A1. With regard to the operating principle and behavioral strategy for obstacle detection, the content of this patent application is hereby incorporated in full in the disclosure of the present invention, including for the purpose of incorporating features of this patent application in claims of the present invention.

When traveling around a room, an automatically displaceable floor dust collecting device must detect objects and delimitations of the room and react by appropriate maneuvering and evasive movements. The obstacle detection may take place contactlessly with the aid of optical or acoustic distance sensors or in a tactile manner. Known devices operate with an impact detection or at least with a combination of distance detection, for example by means of ultrasound, and impact detection as a safeguard in the event of failure of the distance detection. In the tactile obstacle detection, the robot comes into contact with the obstacle. The contact force or an impact pulse that is dependent on the respective assemblies and how they are disposed triggers a sensor. The signal is processed by a microprocessor, which in turn causes the drive wheels to stop. During this time period, and as a result of the system inertia, the device continues to move toward the obstacle and thereby exerts a force, which in the worst case leads to the obstacle being damaged or at least displaced. Moreover, disturbances and events may

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lead to incorrect obstacle detection. For example, unevennesses such as transitions from carpets to hard floors, and vice versa, or unevennesses caused by relief-like textures of the floor covering as well as vibrations caused by traveling movements when accelerating, turning or traveling in a curved manner lead to incorrect measurements. The known sensitive sensor technology is susceptible to disturbances such as vibrations caused by traveling movements. This problem can be countered by suspension with strong springs, also achieving the effect that restrained movement, for example of a hood of the robot, is possible before the sensor is triggered. Such obstacle detection is ultimately not susceptible to disturbances but is also insensitive, so that the solutions prove to be inadequately sensitive, which in the event of a collision may result in objects and furniture being damaged.

With regard to the prior art described above, a technical problem for the invention is seen as that of improving a floor dust collecting device of the type in question with regard to the obstacle detection in such a way that it is not susceptible to disturbances and at the same time is sensitive.

This problem is solved first and foremost by the subject matter of Claim 1, it being provided that a plurality of feeler elements disposed in a prominent position are provided. As a result of this configuration, feeler elements which respectively have a low mass are provided. The local triggering requires smaller forces, the disposal of a plurality of feeler elements in a prominent position allowing locational information concerning the detected obstacle to be supplied. At the same time, when there are changes in speed, only small forces of inertia act. These consequently do not act as a significant disturbance.

Furthermore, it is provided that the floor dust collecting device has a circumferential contour and that the feeler elements are in a prominent position with respect to the circumferential contour. With preference, the collecting device has a circular outline contour here. With preference, the feeler elements cover a region corresponding to more than 25% of the circumference. With further preference, the feeler elements are disposed over the entire circumference of the collecting device, so that the feeler elements disposed in a prominent position act together in the manner of a bumper ring. In this respect, it may also be provided that a feeler element is formed as a rigid part, which is resiliently mounted at its foot, the foot being associated with the outline of the floor dust collecting device. When contact is made with an obstacle, a friction element may also be displaced by means of such a feeler element. The frictional force, which is generally less than the direct impact-induced force, displaces this friction element via the feeler element, a restoring force returning the friction element into the starting position again, such as for example by a spring that is tensioned on impact.

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The invention also relates to a floor dust collecting device according to the features of the preamble of Claim 1, it being proposed here to achieve the object that at least one feeler element disposed in a prominent position is provided and that the feeler element is actively movable for checking a region. As a result of this configuration, an active feeler is preferably provided in front of the collecting device in the direction of travel, which feeler actively senses the surroundings and detects objects before the collecting device runs into them. The feeler element may therefore be movable in relation to a vertical axis of the floor dust collecting device. It is therefore

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further proposed that the feeler element is movable with respect to a horizontal plane of the floor dust collecting device, whereby sensing in the manner of a blind man's stick is achieved. There is also the possibility that the feeler element is movable with respect to a vertical plane of the floor dust collecting device, whereby running under obstacles is also counteracted at the same time. As a further alternative, the feeler element may also perform a circular movement. Alternatively, there is the possibility that the feeler element is movable about a vertical axis outside the outline of the device. In order to improve the obstacle detection further in this respect, it is provided that a number of feeler elements are provided in such a way that they are distributed over the circumference, the feeler elements covering a region of the device corresponding to more than 25% of the circumference. In a preferred configuration, the feeler element operates at the same time as a rotating brush, but without floor contact. There is also the possibility that the feeler element is part of a peripheral feeler band that is adapted to the outline of the device. Such a feeler band may carry individual feeler elements, for example needle-like elements. However, it is also conceivable for a number of feeler elements operating at the same time as a brush to be disposed on the feeler band, which brushes are distributed over the circumference and are movable about a vertical axis outside the outline of the device. The feeler band may also be formed as a brush band, that is to say as a peripheral strip of bristles. The evaluation of the feeler element takes place by means of monitoring the drive current that is required for the movement of the feeler element. It is also conceivable to provide an evaluation by means of a strain measuring principle. A further possibility for evaluation is, for example, that of monitoring the contacting of two or more conductive bristles disposed

next to one another when contact is made with the obstacle. A mechanically oscillating system may also be provided, the oscillating length being changed by the impact and the associated deformation, which leads
5 to the system becoming unbalanced.

The invention also relates to a floor dust collecting device according to features of the preamble of Claim 1, it being proposed to achieve the defined object that
10 a deformable feeler element disposed in a prominent position is provided and that the feeler element is disposed over the entire circumference and a deformation can be sensed by way of a change of the electrical resistance. For example, two thin wires or
15 two thin foils may be disposed over the entire circumference, with a dielectric between them. In the event of impact, the distance between the wires or the foils is reduced, and consequently so is the capacitance. The conversion of an elastic deformation
20 into an electrical characteristic variable, such as resistance and inductance, may also be used for obstacle detection. For example, in the event of impact, a preferably electrically conductive foam is compressed, changing the electrical resistance as a
25 result of the deformation. The conversion of an elastic change in length into an electrical characteristic variable, such as resistance and inductance, can be used for obstacle detection. An impact is converted here into a radial elastic change
30 in length, the magnitude of the electrical resistance of the lengthened component changing and the change in resistance being detected. Alternatively, a core may be pulled out from a coil by means of a mechanism, whereby the inductance changes. There is also the
35 possibility of providing obstacle detection by way of the changing of the electrical potential, an impact element for example acting in a pressing manner on a conductor track. Furthermore, a resistance wire may be

pressed against the conductor track, whereby a local resolution is also achieved for determining the position of the obstacle.

5 The invention also relates to a floor dust collecting device according to the features of the preamble of Claim 1, it being proposed to achieve the object that a feeler element is provided and that the feeler element is part of the cover formed as a hood or is formed by
10 the cover itself and that the feeler element extends over the entire circumference of the cover. For instance, two magnets may be provided, one of which is formed as a bearing, for example in the form of a ring magnet, and one magnet is movably formed, the bearing
15 magnet preferably being secured to the chassis and the movable magnet preferably being secured to the hood. In the event of impact, the system is moved out of the first position. The changing of the magnetic field is once again detected. The restoration to the basic
20 position takes place automatically by alignment in the magnetic field or else with the assistance of spring force.

The invention is also concerned with a floor dust
25 collecting device according to the features of the preamble of Claim 1, it being provided to achieve the object that a feeler element disposed in a prominent position is provided and that the feeler element is formed as an air-filled flexible tube disposed in the
30 prominent position and a change of air pressure caused by contact can be sensed by a pressure gage. On contact with an obstacle, the air-filled flexible tube is deformed by the force acting. The detection preferably takes place by means of a pressure sensor.
35 In order to achieve a local resolution, preferably a number of pressure sensors, two for example, are disposed in each end of the separated tube, whereby a

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local resolution can be performed by a transit time comparison.

A further invention relates to a floor dust collecting device according to features of the preamble of Claim 1. In order here to provide obstacle detection that is not susceptible to disturbances and at the same time is sensitive, it is provided according to the invention that a feeler element disposed in a prominent position is provided and that the feeler element is formed as a light barrier. Used with preference here is an infrared light barrier, which is disposed at least in the front region, that is to say in the forward region of the device in the customary direction of displacement. An interruption of the light beam by an object is detected reliably and at an early time. In order to provide such obstacle detection over a greater part of the circumference of the device, it is provided that deflecting mirrors are used to extend the length of the light barrier in the manner of a line trace. The light beam can be directed over the entire circumference of the device by means of the deflecting mirrors. It is also conceivable for a number of individual light barriers to be disposed in a prominent position. It is possible for instance to use deflecting mirrors and transmitters, which may be provided with sensitive tactile sensors. A major advantage of this solution is that no mass has to be moved in the region of the light barrier for obstacle detection. This obstacle detection takes place in the segments, i.e. in the region of the light barrier, outside the deflecting mirrors and transmitters, without impact.

The invention also relates to a floor dust collecting device according to the features of the preamble of Claim 1, it being proposed here to achieve the object that a feeler element disposed in a prominent position

is provided and that the feeler element comprises spaced-apart reflectors facing one another, which are preferably formed in such a way that they run around the outline of the device and that a light conduction that is changed by deformation of a reflector is evaluated. For instance, a transmitted light is completely reflected between two parallel walls. The reflection properties are changed by deformation on impact. In this respect, a light guide which interrupts the conduction in the event of deformation may alternatively also be provided.

Finally, the invention relates to a floor dust collecting device according to the features of the preamble of Claim 1. Here it is provided to achieve the object that a plurality of capacitively and/or inductively operating distance sensors are disposed in such a way that they are distributed over the circumference of the outline of the device. A capacitively or inductively operating distance sensor reacts even as an obstacle is approached, in a way similar to parking assistance in motor vehicles. Obstacles are hereby detected without impact if, as preferred, the sensor is provided in such a way that it runs around the hood of the device.

The solutions according to the invention that are described above are pertinent to obstacle detection both on their own and in a combination of one solution with one or more other solutions.

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

Figure 1 shows a floor dust collecting device in perspective representation;

Figure 2 shows a perspective view from below of the floor dust collecting device according to the invention;

5 Figures 3
to 11 show schematic representations of various embodiments of an obstacle detection according to the invention for the collecting device.

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Represented and described is a floor dust collecting device 1 in the form of a cleaning robot with a chassis 2, which carries on the underside, facing the floor to be treated, displacement wheels 3 driven by electric
15 motor and also a brush 5, which is likewise driven by electric motor and protrudes beyond the lower edge of the chassis base 4. Engaging over the chassis 2 is a device hood 6, the floor cleaning device 1 having a circular outline. However, the device 1 may also have
20 an outline departing from a circular shape, being made up as a further example by a semicircular portion and a portion connected to it of a rectangular shape.

The displacement wheels 3 are disposed behind the brush
25 5 in the customary direction of displacement r of the floor cleaning device 1, a dirt ramp 7 that is similar to a sweeping plate and via which the brushed-up dirt is thrown into a container-like receptacle also being disposed behind the brush 5.

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Positioned in front of the brush 5 in the customary direction of displacement r is a supporting wheel in the form of a slave wheel 8, as a result of which a three-point support of the floor cleaning device 1 on
35 the floor to be treated is achieved.

In particular in the case of cleaning robots, there is the need to detect obstacles 9. For this purpose, an

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impact-sensitive obstacle detection 10 is provided according to the invention, by means of which contact with the obstacle 9 is detected, the floor dust collecting device 1 at the same time coming to a
5 standstill before the obstacle 9 is displaced, pushed over or damaged. By means of the various obstacle detections 10 described below, the floor dust collecting device 1 is not misdirected by disturbances, such as for example vibrations caused by going over
10 unevennesses of a floor. High shock sensitivity is achieved along with low susceptibility to disturbances.

For instance, Figures 3 to 6 show four different exemplary embodiments of a mechanical solution for
15 obstacle detection 10. In the case of the embodiment according to the schematic representation in Figure 3, the hood 6, or alternatively a hood segment, is mounted movably on the chassis 2, in particular movably in a horizontal plane, the hood 6 being supported in the
20 horizontal plane on the chassis 2 by means of spring elements 11, preferably in the form of foam bodies. A sensor 12, disposed with preference at the front in the direction of displacement r , serves for sensing movement of the hood when the floor dust collecting
25 device 1 comes into contact with an obstacle 9. The sensor 12 may be formed as a feeler or microswitch, which is triggered even by little contact force, the sensitivity, and consequently the susceptibility to disturbances, of this obstacle detection 10 being
30 adjustable by the choice of spring elements 11 or by the choice of foam material.

There is also the possibility of obstacle detection 10 by acceleration measurement, in which an acceleration
35 sensor in the floor dust collecting device 1, for example in the form of a pendulum or a ball, detects impact-induced decelerations. Here, the sensitivity is set in such a way that no reactions occur in the event

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of customary acceleration or vertical jolts, caused by unevennesses of a floor, for example at edges of carpets. Only reactions in the horizontal plane are sensed.

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A further alternative obstacle detection 10 is schematically represented in Figure 4. This is a case of local impact detection, an individual bumper ring 13 with a comparatively large mass being divided into a number of small resiliently mounted feelers 14 with a small mass, which bumper ring 13 may also be part of the hood 6. These feelers 14 are in a prominent position with respect to the circumferential contour of the floor dust collecting device 1, the bumper ring 13 that is formed by the feelers 14 extending over a circumference of about 180°. The feelers 14 are each formed as a rigid part, which is resiliently mounted on the chassis 2 or on the hood 6 at its foot 15, the foot being associated with the outline of the floor dust collecting device 1. On contact with an obstacle, the bumper ring 13 is only acted upon locally. As a result, only few feeler elements 14 are acted upon, those associated with the obstacle 9. This local triggering requires smaller forces and can at the same time supply locational information concerning the locality of the obstacle 9. At the same time, when there are changes in speed, only small forces of inertia act as disturbances. The local triggering of individual feeler elements 14 is sensed by means of sensors on the chassis.

The feeler element 14 may also be actively movable for checking a region, this being the case when the feeler element 14 is disposed in a prominent position with respect to the floor dust collecting device 1, in particular with respect to the hood 6. A corresponding exemplary embodiment is represented in Figure 5. Here, a feeler element 14 disposed in front of the floor dust

collecting device 1 in the customary direction of travel r is designed in the manner of a blind man's stick, which feeler element 14 is movable in relation to a vertical axis x of the floor dust collecting device in a horizontal plane of the same. The feeler element 14 swings in the horizontal plane about the vertical axis x and thereby senses the surroundings in front of the device. The evaluation of the feeler element 14 takes place for example by means of monitoring the drive current of the feeler-element drive motor that is required for moving said element. When an obstacle 9 is contacted, and the pivoting motion of the feeler element 14 is thereby restricted, the drive current increases. In combination with this, the feeler element 14 may also be designed to be sensitive to impact. Furthermore, there is the possibility of disposing a sensor system, by means of which the pivoting angle of the feeler element 14 is sensed. Locational information concerning the locality of the obstacle 9 can be achieved by means of the determined pivoting angle.

Furthermore, in the case of the embodiment according to the representation in Figure 5, an evaluation for obstacle detection may also take place on the basis of the strain measuring principle, since contacting of an obstacle 9 with pivoted displacement of the feeler element 14 in the horizontal plane causes a strain of the same on the side facing the obstacle 9. The feeler element 14 may also comprise a number of conductive bristles. These may be formed both as round and flat in cross-section. When there is contact with the obstacle 9, these conductive bristles are brought into contact, which is sensed by means of corresponding electronics.

As a further alternative or in combination with the pendular motion of the feeler element 14 in the

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horizontal plane, it may also be movable in a vertical plane, whereby not only the desired obstacle detection is achieved but at the same time also a safeguard against running under obstacles. By means of such a
5 feeler element 14 moving in the vertical plane, the device is for example prevented from getting stuck under armchairs, cupboards, etc.

It is also possible, as represented in Figure 6, for
10 the actively movable feeler element 14 to be formed as a brush 16, which, disposed in a prominent position in relation to the device 1 outside the outline of the device, rotates about an axis y running parallel to the vertical axis x of the device 1. It is preferred here
15 for a number of feeler elements 14 or brushes 16 to be provided, distributed over the circumference of the device 1, with further preference in the region of the front side of the device 1 in the direction of displacement r. As represented in an example in Figure
20 6, five brushes 16 are provided, disposed in such a way that they are distributed at equal angles and together extending approximately over 25 to 30% of the circumference of the device. The direction of rotation of the brushes 16 differs. For instance, in the
25 exemplary embodiment, a front brush 16 and the two brushes 16 disposed to the right of this brush 16, when seen in plan view, rotate counterclockwise, whereas the two brushes 16 disposed to the left of the front brush 16 move clockwise.

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The spacing of the brushes 16 from one another and the distance from the wall of the device or the hood is chosen such that the bristles 17 of the brushes 16 rotate freely about the brush axis y without contacting
35 adjacent brushes 16 or contacting the device 1. The brushes 16 are also disposed at a distance from the floor that is to be cleaned. To counteract moving

under obstacles, the brushes 16 may protrude vertically upward beyond the top of the device.

5 A further alternative configuration of an active feeler element is represented in Figure 7. Here, the feeler element 14 is part of a peripheral feeler band 18 that is adapted to the outline of the device and is formed as a bristle band. The peripheral feeler band 18 has radially protruding feeler elements 14 in the form of
10 bristles 17, disposed in such a way that they are evenly distributed over the circumference.

In the exemplary embodiments according to the representations in Figures 6 and 7, contacting of an
15 obstacle can also be detected by way of drive current monitoring. Furthermore, it is also conceivable to dispose conductive bristles 17, which are brought into contact when there is contact with the obstacle 9.

20 Further mechanical solutions for obstacle detection - not represented - have a friction element which is displaced when there is contact with respect to the obstacle. The frictional force, which is generally less than the direct impact-induced force, displaces
25 this friction element, a restoring force returning the friction element into the starting position. This restoring force may be applied by a spring that is tensioned on impact. In the case of a mechanically oscillating system, the oscillating length can also be
30 changed by the impact and the associated deformation, whereby the system becomes unbalanced.

Apart from the mechanical solutions, electrical or electronic solutions for obstacle detection are also
35 proposed. For instance, as schematically represented in Figure 8, a deformable feeler element 14 is provided, which element is disposed over the entire circumference and it being possible for a deformation

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to be sensed by way of a change of the electrical resistance. Here, the feeler element 14 consists of an electrically conductive, compressed foam, which changes the electrical resistance on contact with an obstacle as a result of the deformation. In the case of such elastic deformation of a feeler element 14, it is also possible for the change in length to be converted into an electrical characteristic variable such as resistance or inductance. A central impact is converted into a radial elastic change in length, the magnitude of the electrical resistance of the lengthened component changing. This change in resistance is detected.

As a further alternative, a core may be pulled out from a coil by pulling on a line, whereby the inductance changes.

Two spaced-apart thin wires or foils may be disposed over the circumference of the device 1, with a dielectric between them. In the event of contact with an obstacle, the distance between the wires or foils is reduced, and consequently so is the capacitance, which reduction in capacitance can be sensed for obstacle detection.

An impact element which can be pressed against a conductor track by an obstacle acting upon it may also be provided. This impact element may be in combination with an active feeler element.

The representation in Figure 9 shows a further electrical solution for obstacle detection, the chosen feeler element 14 being part of the hood 6 or the hood 6 itself and, furthermore, the feeler element 14 extending over the entire circumference of the cover. The obstacle detection 10 is formed as a magnetic switch, two magnets being provided, one bearing magnet

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19 on the chassis, formed for example as a ring magnet, and one movable magnet 20, secured to the hood 6 or the feeler element 14 formed by the latter. In the unloaded position, the magnetic system is in a rest position, preferably with the magnets 19 and 20 concentric to each other. If the feeler element 14 or the hood 6 collides with an obstacle 9, the system is moved out of this rest position, the magnetic field undergoing a change. This change is detectable. The restoration to the neutral position takes place automatically by alignment in the magnetic field, optionally with the assistance of springs, which however are designed in such a way that sensitive obstacle detection remains ensured.

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The schematic representation in Figure 10 shows a further alternative configuration. Here, the feeler element 14 is formed as an air-filled flexible tube 21 disposed in the prominent position and extending virtually over the entire circumference of the device 1. On contact with an obstacle 9, this flexible tube 21 can be deformed by the force acting. The change in air pressure caused by this contact can be sensed by a pressure sensor 22. Pressure sensors 22 are preferably provided at both ends of the flexible tube 21, as represented, as a result of which a local resolution can be performed by a transit time comparison.

As schematically represented in Figure 11, the feeler element 14 may also be formed as a light barrier 23, deflecting mirrors 24 being used to extend the length of this light barrier 23 over the entire circumference of the device 1 in the manner of a line trace. For instance, in the exemplary embodiment represented, a transmitter/receiver unit 25 and five deflecting mirrors 24, distributed over the circumference, are provided, two adjacent deflecting mirrors 24, aligned

radially in relation to the device 1, forming an angle of 60°.

5 The interruption of the light beam, in particular an infrared light beam, by an obstacle 9 is detected. The deflecting mirrors 24 and the transmitter/receiver unit 25 are provided with sensitive tactile sensors, so that a collision of these elements with an obstacle 9 is also detected.

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A further alternative configuration, though not represented, provides a feeler element 14, which is disposed in a prominent position in relation to the device 1 and comprises spaced-apart reflectors facing one another. These reflectors preferably extend over the entire circumference of the outline of the device. Light that is transmitted in is completely reflected between these two parallel reflector walls. The reflection properties are changed by deformation in the event of collision with an obstacle 9. Alternatively, in the event of impact, a light guide may also be deformed in such a way that the conduction is interrupted.

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25 There is also the possibility of disposing a plurality of capacitively and/or inductively operating distance sensors, which are disposed in such a way that they are distributed over the circumference of the outline of the device. Such distance sensors react even as an obstacle 9 is approached, as a result of which obstacles are detected without impact.

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The solution possibilities for obstacle detection described above can be combined with one another.

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The detection of an obstacle 9 by one of the obstacle detections 10 according to the invention leads to a strategic behavior of the autonomously operating floor

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dust collecting device 1, for example the device reversing and then going around the obstacle 9.

All disclosed features are (in themselves) pertinent to
5 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
10 claims of the present application.

CLAIMS

1. Automatically displaceable floor dust collecting
5 device (1) with an electromotive drive, a dust
collecting container and a cover, the floor dust
collecting device being provided with an obstacle
detection (10), characterized in that a plurality
of feeler elements (14) disposed in a prominent
position are provided.
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2. Floor dust collecting device according to Claim 1
or in particular according thereto, characterized
in that the floor dust collecting device (1) has a
circumferential contour and in that the feeler
15 elements (14) are in a prominent position with
respect to the circumferential contour.
3. Floor dust collecting device according to one or
more of the preceding claims or in particular
20 according thereto, characterized in that the feeler
elements (14) cover a region corresponding to more
than 25% of the circumference.
4. Floor dust collecting device according to one or
25 more of the preceding claims or in particular
according thereto, characterized in that a feeler
element (14) is formed as a rigid part, which is
resiliently mounted at its foot (15), the foot
being associated with the outline of the floor dust
30 collecting device (1).
5. Floor dust collecting device (1) according to the
features of the preamble of Claim 1, characterized
in that at least one feeler element (14) disposed
35 in a prominent position is provided and in that the
feeler element (14) is actively movable for
checking a region.

- 5 6. Floor dust collecting device according to Claim 5 or in particular according thereto, characterized in that the feeler element (14) is movable in relation to a vertical axis (x) of the floor dust collecting device (1).
- 10 7. Floor dust collecting device according to Claims 5 to 6 or in particular according thereto, characterized in that the feeler element (14) is movable with respect to a horizontal plane of the floor dust collecting device (1).
- 15 8. Floor dust collecting device according to Claims 5 to 7 or in particular according thereto, characterized in that the feeler element (14) is movable with respect to a vertical plane of the floor dust collecting device (1).
- 20 9. Floor dust collecting device according to Claims 5 to 8 or in particular according thereto, characterized in that the feeler element (14) is movable about a vertical axis (y) outside the outline of the device.
- 25 10. Floor dust collecting device according to Claims 5 to 9 or in particular according thereto, characterized in that a number of feeler elements (14) are provided in such a way that they are distributed over the circumference.
- 30 11. Floor dust collecting device according to Claims 5 to 10 or in particular according thereto, characterized in that a feeler element (14) operates at the same time as a brush (16).
- 35 12. Floor dust collecting device according to Claims 5 to 11 or in particular according thereto, characterized in that the feeler element (14) is

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part of a peripheral feeler band (18) that is adapted to the outline of the device.

- 5 13. Floor dust collecting device according to Claims 5 to 12 or in particular according thereto, characterized in that the feeler band (18) is formed as a brush band.
- 10 14. Floor dust collecting device according to Claims 5 to 13 or in particular according thereto, characterized in that the evaluation of the feeler element (14) takes place by means of monitoring the drive current that is required for the movement of the feeler element (14).
- 15 15. Floor dust collecting device (1) according to the features of the preamble of Claim 1, characterized in that a deformable feeler element (14) disposed in a prominent position is provided and in that the
- 20 feeler element (14) is disposed over the entire circumference and a deformation can be sensed by way of a change of the electrical resistance.
- 25 16. Floor dust collecting device (1) according to the features of the preamble of Claim 1, characterized in that a feeler element (14) is provided and in that the feeler element (14) is part of the cover formed as a hood (6) or is formed by the cover itself and in that the feeler element (14) extends
- 30 over the entire circumference of the cover.
- 35 17. Floor dust collecting device according to the features of the preamble of Claim 1, characterized in that a feeler element (14) disposed in a prominent position is provided and in that the feeler element (14) is formed as an air-filled flexible tube (21) disposed in the prominent

position and a change of air pressure caused by contact can be sensed by a pressure gage (22).

- 5 18. Floor dust collecting device according to Claim 17 or in particular according thereto, characterized in that a number of pressure sensors (22) are provided.
- 10 19. Floor dust collecting device according to one or either of Claims 17 to 18 or in particular according thereto, characterized in that a local resolution is performed by a transit time comparison.
- 15 20. Floor dust collecting device (1) according to the features of the preamble of Claim 1, characterized in that a feeler element (14) disposed in a prominent position is provided and in that the feeler element (14) is formed as a light barrier
20 (23).
21. Floor dust collecting device according to Claim 20 or in particular according thereto, characterized in that deflecting mirrors (24) are used to extend
25 the length of the light barrier (23) in the manner of a line trace.
- 30 22. Floor dust collecting device (1) according to the features of the preamble of Claim 1, characterized in that a feeler element (14) disposed in a prominent position is provided and in that the feeler element (14) comprises spaced-apart reflectors facing one another, which are preferably formed in such a way that they run around the
35 outline of the device and in that a light conduction that is changed by deformation of a reflector is evaluated.

23. Floor dust collecting device (1) according to the features of the preamble of Claim 1, characterized in that a plurality of capacitively and/or inductively operating distance sensors are disposed in such a way that they are distributed over the circumference of the outline of the device.
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