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Device for vacuum cleaning

10 FIELD OF THE INVENTION

The invention relates to a device for vacuum cleaning comprising a vacuum cleaner having a suction hose connected to the housing of the vacuum cleaner, and comprising a filter bag, in particular a disposable filter bag made of non-woven fabric.

15 DEFINITIONS

For describing the state of the art and the invention the following standards, definitions and measurement methods are used.

VO 666/ 2013: Commission Regulation (EU) No 666/2013 of 8 July 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners

VO 665/ 2013: Commission Delegated Regulation (EU) No 665/2013 of 3 May 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of vacuum cleaners

Rated power input: The rated power input [W] refers to the electric input power specified by the manufacturer, wherein for devices including other functions in addition to the vacuum cleaner function, only the electric power input during the use as a vacuum cleaner is relevant (VO 666/2013, Annex II, Para. 2, lit. k).

EN 60312: Unless expressly stated otherwise, EN 60312 refers to the standard DIN EN 60312-1 (VDE 0705-312-1) in the January 2014 edition: Vacuum cleaners for household use - Part 1: Dry vacuum cleaners - Methods for measuring the performance (IEC 60312-1:2010, modified + A1:2011, modified); German version EN 60312-1:2017 + A11:2022

Determination of the air-related data: The air-related data of a vacuum cleaner are determined in accordance with EN 60312 section 5.8. The measuring device B according to section 7.3.7.3 is employed. In case motor-blower units are measured separately, i.e. without vacuum cleaner housing, measuring device B is also used. For any necessary adapters for connection to the measuring chamber the provisions in section 7.3.7.1 apply.

Power input of a vacuum cleaner: The power input P_1 of a vacuum cleaner at a given orifice is determined in accordance with EN 60312 section 5.8. The measuring device B according to

section 7.3.7.3 is employed for that. For any necessary adapters for connection to the measuring chamber the provisions in section 7.3.7.1 apply.

Power input of a motor-blower unit: The power input P_1 of a motor-blower unit at a given orifice is determined in accordance with EN 60312 section 5.8, too. The measuring device B according to section 7.3.7.3 is employed for that. For any necessary adapters for connection to the measuring chamber the provisions in section 7.3.7.1 apply.

Average electric input power of a vacuum cleaner: The average input power of a vacuum cleaner is measured using the test set-up for determining the air-related data in accordance with EN 60312 section 5.8. The measuring chamber of version B is used. For any necessary adapters for connection to the measuring chamber the provisions in section 7.3.7.1 apply. The average input power is defined by

$$P = 0,5 (P_f + P_i)$$

P_f = Power input in watts after 3 minutes of operation with the measuring chamber at orifice 9 (nominal diameter $d_0 = 50$ mm)

P_i = Power input in watts after an additional 20 s of operation with the measuring chamber at orifice 0 (nominal diameter $d_0 = 0$ mm)

Average electric input power of the motor-blower unit: The average electric input power of a motor-blower unit is measured using the test set-up for determining the air-related data in accordance with EN 60312 section 5.8. For this purpose, the motor-blower unit is connected directly to the measuring chamber (version B). For any necessary adapters for connection to the measuring chamber the provisions in section 7.3.7.1 apply. The average input power is defined by

$$P_m = 0,5 (P_f + P_i)$$

P_f = Power input in watts after 3 minutes of operation with the measuring chamber at orifice 9 (nominal diameter $d_0 = 50$ mm)

P_i = Power input in watts after an additional 20 s of operation with the measuring chamber at orifice 0 (nominal diameter $d_0 = 0$ mm)

Average power input when determining the operational characteristics with full dust container: The average power input when determining the performance characteristics with a full dust container is measured following EN 60312. Departing from this standard the measurement is carried out with measuring chamber B at orifice 8. The average power input when determining the performance characteristics with a full filter bag is defined as the mean value of the power input with an empty filter bag and the power input with a full filter bag. For vacuuming the test dust and the maximum amount to be sucked in (full filter bag) the measuring conditions from section 5.9.2, in particular from 5.9.2.3, apply.

5 **Air flow:** The air flow is determined in accordance with EN 60312 using the measuring chamber (version B). The air flow may be determined with different orifices. In accordance with EN 60312, measurements are taken with an orifice having a diameter of 30 mm. In case measurements are taken with another orifice will be indicated. In the state of the art, this air flow is often also referred to as volume flow or suction air flow.

10 **Airflow drop:** The airflow drop is determined in accordance with EN 60312 section 5.9 with the measuring chamber (version B). Departing from this standard the measuring chamber is equipped with a 40 mm perforated plate (as opposed to 30 mm according to the standard). The vacuum values h_f in the measuring chamber are converted into an air flow in accordance with section 7.3.7. The difference between the air flow with an empty filter bag and the air flow with a full filter bag is referred to as the air flow drop.

15 **Disposable filter bag:** The terms "disposable filter bag" or "disposable bag" for the purposes of the present invention refer to a non-reusable filter bag.

Flat bag: A flat bag is a filter bag whose filter bag wall is formed from two separate layers of filter material having the same surface area in such a way that the two separate layers are joined only at their circumference (the term "same surface area" does not, of course, exclude the possibility that the two separate layers differ from each other in that one of the layers includes an inlet opening).

The individual layers may be joined by one or more (e.g. four) welded or glued seams along the entire circumference of the two individual layers.

25 Alternatively, the filter bag may be formed by a single layer of filter material that is folded around one of its symmetry axes and the remaining open circumferential edges of the resulting two sublayers of which are welded or glued to each other (forming a so-called tubular bag). This type of production therefore requires one or more (e.g. three) circumferentially welded or glued seams. Two of these seams form the periphery of the filter bag, while the third seam may also form an edge of the filter bag or be placed on the surface of the filter bag.

Each of the above-mentioned individual layers of filter material may comprise several nonwoven layers, as is presently common for nonwoven filter bags.

The welded or glued seams can also be configured as a folded spiral seam.

Flat bags may also include so-called side gussets. These side gussets may be completely folded open. A flat bag with such side gussets is shown, for example, in DE 20 2005 000 917 U1 (see Fig. 1 with folded-in side gussets and Fig. 3 with unfolded side gussets). Alternatively, the side gussets may be welded to parts of the circumferential edge. A flat bag of this type is shown in DE 10 2008 006 769 A1 (see in particular Fig. 1).

5 **Filter bag with surface pleats:** EP 2 366 320 A1 and EP 2 366 321 A1 disclose filter bags with surface pleats within the scope of the present application.

Suction power: The suction power is the product of vacuum [kPa] and air flow [l/s] and is designated P_2 in accordance with EN 60312.

10 **Efficiency:** The efficiency of the motor-blower unit or a vacuum cleaner is calculated from the suction power P_2 and the power input P_i in accordance with EN 60312 section 5.8 (see in particular section 5.8.4., 4th paragraph). For that the motor-blower unit or the vacuum cleaner is connected to the measuring chamber (version B). For any necessary adapters for connection to the measuring chamber the provisions in section 7.3.7.1 apply. The nominal diameters d_0 of the respective orifices can be found in the table in section 7.3.7.3. The efficiency for any given orifice
15 is calculated according to

$$\eta[\%] = (P_2/P_i) \cdot 100$$

P_i is the power input of the vacuum cleaner (at a given orifice) and P_2 is the air output (at a given orifice), i.e. the product of air flow (see above) and vacuum (see below).

20 **Vacuum in the measuring chamber with specified orifice:** The vacuum in the measuring chamber at a specified orifice is determined in accordance with EN 60312 section 5.8. For this purpose, the motor-blower unit is connected directly to the measuring chamber (version B). For any necessary adapters for connection to the measuring chamber the provisions in section 7.3.7.1 apply. The nominal diameters d_0 of the respective orifices can be found in section 7.3.7.3.

25 **Average cross-sectional area of a suction hose:** To obtain the average cross-sectional area of a suction hose the cross-section of the suction hose is measured at 10 spots evenly distributed along the length of the suction hose and the average value of these measurements is determined. The first measurement is taken at one end of the hose and the tenth measurement is taken at the other end of the hose. The measurement of the cross-section is determined using limit gauges for inside widths that correspond to the shape of the cross-sectional area to be measured. For hoses
30 with varying cross-sectional area, the limit gauge is inserted into the suction hose in the direction of the increasing cross-sectional area. Apart from irregular cross-sectional areas thus the cross-sectional areas of spirally or helically wound or otherwise structured suction hoses can also be determined. In particular, this method may also be employed for conical suction hoses.

35 **Bag surface area of a filter bag:** The bag surface area of a filter bag is the surface area between the peripheral weld seams that determine the outer shape of the filter bag. Side gussets and surface pleats must be taken into account for the calculation. The surface area of the filling opening including a weld seam surrounding said opening is subtracted from the surface. Herein reference is made to the theoretically usable area only. Variations in the flow through the bag or incomplete unfolding of the filter bag are not taken into account. In the case of filter bags other than flat bags

5 all additional surfaces (e.g. block bottom bags with side surfaces and end surface) are of course also taken into account when determining the bag surface stop.

Volume of filter bag receiving space: The volume can be determined from the three-dimensional drawing data of the vacuum cleaner or by gauging the capacity with water or granulate.

10 **Deflection device:** Deflecting means for deflecting air for the purposes of the application are disclosed, for example, in WO 2007 059936 A1, WO 2007 059937 A1, WO 2007 059938 A1 and WO 2007 059939 A1.

Spacing device: A spacing device is a means for ensuring that there is a gap between the filter bag and the wall of the filter bag receiving chamber. In particular, the spacing means may consist
15 of a base and/or at least one side wall and/or a lid partially or completely surrounding the filter bag. It is to be ensured that the contact surface between the filter bag and the spacing means is as small as possible. The spacing means may be made of any material and may be removable or fixedly installed. In case filter bags with surface pleats are used, a spacing means can be used that is particularly adapted to these surface pleats. From WO 2012 126612 (in particular Figs. 3
20 and 4) the configuration of such a spacing means can be seen.

Efficient vacuum cleaner: An efficient vacuum cleaner has an energy efficiency class of B or better (according to VO 665/2013, ANNEX I) and at the same time a cleaning class of C or better (according to VO 665/2013, ANNEX I).

25 **PRIOR ART**

The demands made on vacuum cleaning devices have changed significantly in recent years.

Since 2017 VO 666/2013 requires the rated power input of vacuum cleaners to be limited to less than 900 W. VO 665/2013 provides that in the long term the annual energy consumption of a vacuum cleaner should be less than 10 kWh. This results in a rated power input of a vacuum
30 cleaner being less than 300 W. However, users of vacuum cleaning devices will expect that the cleaning performance will not deteriorate in comparison to currently implemented devices for vacuum cleaning having a significantly higher input power. VO 665/2013, too, takes that into account, for example by setting the requirement for an A rating (carpet cleaning class) for the dust pick-up of carpets to $\geq 91\%$.

35 The Miele S 8340 vacuum cleaner, for instance, one of the vacuum cleaners of the prior art considered to be particularly energy-efficient achieves a suction air flow of 38.5 l/s when determining the air-related data (in accordance with EN 60312 section 5.8.4) at orifice 8 (40 mm) and a power input P_1 of 1310 W (power level setting on the vacuum cleaner "hard floor, heavily soiled carpets and rugs", hereinafter referred to as "max"). The air flow at a power consumption

P₁ of 704 W (power level setting on the device "quality velour carpets, rugs and runners", hereinafter referred to as "carpet") is insufficient for satisfactory dust collection. With a power input of 704 W (at orifice 8), an air flow of only 30.0 l/s is achieved.

The air flow gets even weaker when the filter bag is gradually filling during the use of the vacuum cleaner. Fig. 1a and Fig. 1b show examples of the air flow (volume flow in l/s) achieved by a Miele S 8340 with the original Miele accessories for this vacuum cleaner (suction hose and suction tube) and the original Miele filter bags at an average power input of 698 W (carpet) or 1286 W (max) when determining the performance characteristics with a full dust container, depending on the filling with up to a maximum of 400 g DMT dust type 8 in accordance with EN 60312.

To ensure efficient vacuuming, air flows of at least 33 l/s are desirable.

The Miele S 8340 uses a motor-blower unit whose characteristics, i.e. its air-related data, are shown in Fig. 2a (carpet) and Fig. 2b (max).

The average electric input power of the vacuum cleaner must be clearly distinguished from the average electric input power of the motor-blower unit, as the total average electric input power of the motor-blower unit is essentially transformed into the air flow to be achieved, whereas the average electric input power of the vacuum cleaner is also used to compensate for the flow losses resulting from the flow paths in the vacuum cleaner device (from the floor nozzle to the air outlet from the device - without the motor-blower unit).

The average electric input power of the motor-blower unit of the Miele S 8340 is 1121 W (max) or 622 W (carpet). With this average input power, an air flow of approximately 55.5 l/s (max) and approximately 43.7 l/s (carpet) can be achieved at orifice 8 (this orifice corresponds approximately to the conditions for vacuuming on hard floors), which, when using this motor-blower unit in the Miele S 8340, eventually results in air flows of 38.5 l/s (max) and 29.9 l/s (carpet) already specified above for orifice 8 (which are then actually available for vacuuming).

The suction hose of the Miele S 8340 has an average cross-sectional area of approximately 9.1 cm². Another device for vacuum cleaning is disclosed in EP 2 641 523 A1.

DESCRIPTION OF THE INVENTION

In view of the above-mentioned disadvantages of the prior art, the invention is based on the task to provide a device for vacuum cleaning with filter bags, in which the efficiency is improved compared to the devices according to the state of the art and in the determination of the air-related data according to EN 60312 (section 5.8.4) at orifice 8 (40 mm), a suction air flow of more than 33 l/s is achieved, so that a cleaning class of C according to VO 665/2013 or better can be achieved, and wherein the average electric input power of the vacuum cleaner is as low as possible, so that an energy efficiency class of B according to VO 665/2013 or better is

5 achieved, i.e. an efficient vacuum cleaner for the purposes of the present invention is realized.

This object is solved by a device for vacuum cleaning according to claim 1.

The device comprises a vacuum cleaner having a suction hose connected to the housing of the vacuum cleaner and a filter bag, in particular a disposable filter bag, made of non-woven fabric,

10 wherein the vacuum cleaner includes a motor-blower unit having an average electric input power between 1000 W and 200 W. The motor-blower unit is configured so that at an average electric input power between 1000 W and 800 W and an orifice (23 mm) a negative pressure in the measuring chamber is > 12.5 kPa and at an orifice 8 (40 mm) a negative pressure in the measuring chamber is > 4.0 kPa; at an average electric input power between 799 W and 600 W at an orifice 6 a negative pressure in the measuring chamber is > 10.0 kPa, and at an orifice 8 a negative

15 pressure in the measuring chamber is > 3.4 kPa; at an average electric input power between 599 W and 400 W at an orifice 6 a negative pressure in the measuring chamber is > 7.0 kPa, and at an orifice 8 a negative pressure in the measuring chamber is > 2.5 kPa; and at an average electric input power between 399 W and 200 W at an orifice 6 a negative pressure in the measuring chamber is > 4.0 kPa, and at an orifice 8 a negative pressure in the measuring chamber is > 1.4 kPa.

20 This specific characteristic of the motor-blower unit differs from the characteristic of motor-blower units normally used in vacuum cleaning devices.

The differences in the air-related data between the present invention and the prior art are illustrated in Fig. 2a and Fig. 2b, which show the prior art, as well as in Fig. 3a and 3b, which show an embodiment according to the invention. With the same input power, the motor-blower unit with the characteristic according to the invention provides a significantly stronger air flow at the orifices (D6 and D8) that are essential for the cleaning effect. D6 corresponds approximately to vacuuming carpets, D8 corresponds approximately to vacuuming hard floors.

25 Surprisingly, it turned out that a motor-blower unit as specified above in combination with a suction hose with an average cross-sectional area of at least 9.5 cm^2 allows to particularly increase the efficiency of vacuum cleaners and, that, combined with the disposable filter bags made of non-woven fabric, it's cleaning effect is comparable to current devices for vacuum cleaning with a much higher input power.

30 To achieve this the suction hose must have an average cross-sectional area of at least 9.5 cm^2 , more particularly at least 11 cm^2 or most particularly at least 13 cm^2 . This cross-sectional area should also not be significantly smaller for the pipe section forming the connection between the suction hose and filter bag in the vacuum cleaner.

35 Experiments have shown that, the combination of the above-mentioned motor-blower unit and the above-mentioned suction hose which also fully meet future energy policy requirements when

- 5 determining the performance characteristics with a full dust container at an average power input of approximately 670 W is sufficient for generating an air flow of more than 41 l/s (with an empty filter bag) and thus for achieving a more than satisfactory vacuuming result.
- The filter bag may preferably have a bag area between 1000 cm² and 4000 cm².
- The suction hose may be at least partially tapered and may have a larger cross-sectional area at
- 10 an end close to the motor-blower unit than at an end far from the motor-blower unit. In this case the suction hose may have a minimum and a maximum cross-sectional area and the minimum diameter of the suction hose may be by at least 5 %, in particular by at least 20 %, smaller than the maximum cross-sectional area. For example, the smallest diameter of the tapering suction hose may be 35 mm at the near end and 47 mm at the far end. Alternatively, the suction hose may
- 15 have a cylindrical shape throughout. A tapering shape of the suction hose may not only provide easy handling but may also improve the performance of the vacuum cleaner.
- Other cross-sectional shapes of the suction hose (tapering or having a uniform cross-section) are also possible, as long as the claimed cross-sectional areas are maintained.
- The suction hose may have a length of 1 m to 3 m.
- 20 A suction tube connected to the suction hose may have a diameter of more than 30 mm, preferably more than 33 mm and particularly preferably more than 36 mm.
- The motor-blower unit may have efficiency according to EN 60312 of at least 35 %, preferably at least 38 % and particularly preferably least 40 % at an orifice 7 (30 mm). This further embodiment of the invention provides particularly efficient vacuum cleaning devices.
- 25 According to a further embodiment of the invention described above, including said further embodiments of the invention, the vacuum cleaner includes spacing means.
- It may have a base and/or at least one side wall and/or a lid. Thus the spacing means may enclose the filter bag partially, i.e. at least on one side of the filter bag, or completely. As a result, the filter bag is at least partially spaced from at least one inner housing wall of the device for vacuum
- 30 cleaning. If the spacing means is to fully enclose the filter bag, it will have a base, a lid and a number of side walls corresponding to the filter bag receiving space.
- Preferably the spacing means is configured so that overflow paths, i.e. fluid communication links are provided between the bottom and/or the at least one side wall and/or the lid. This allows the entire surface area of the filter bag to be utilized to suck the air from the filter bag into the motor-
- 35 blower unit.
- Furthermore, the spacing means may be integral with the filter bag receiving space of the vacuum cleaner. Alternatively, it may also be provided as a separate unit that can be completely removed from the filter bag receiving space.

- 5 The above measures can (completely or partially) prevent a reduction in filter performance due to the filter surface contacting an inner wall of the filter bag receiving space.
- According to a further embodiment of the device described above within the device the following features may be sequentially arranged opposite to the direction of the airflow:
- An air intake opening in the at least one side wall or in the base or in the lid through which air is
- 10 sucked from the filter bag receiving space into the motor-blower unit when the vacuum cleaner is in operation, a holder for a motor protection filter, and the spacing means wherein the spacing means is arranged at a distance from the holder for the motor protection filter.
- Thus it is ensured that there is always a gap between the holder for the motor protection filter and the filter bag and that the filter bag does not cover the holder for a motor protection filter
- 15 which would otherwise result in the air from the filter bag only being sucked out of the region of the filter bag that covers the motor protection filter.
- The spacing means may be configured in the form of a perforated plate and/or in the form of a grid and/or in the form of webs, web-shaped sections, brackets, bracket-shaped sections, ribs, rib-shaped sections and/or pins.
- 20 In these further embodiments, the holder for the motor protection filter may be configured so that a motor protection filter can be inserted into the holder for the motor protection filter, for example. The material of the motor protection filter may have sufficient inherent strength to be able to be pushed in, for example, or it may be provided with a frame or a stabilizing element (e.g. mesh). This makes it particularly easy to exchange the motor protection filter.
- 25 According to a further embodiment of all the above-described devices a seat for a filter bag holding plate may be provided which is arranged hingeably with respect to the device for vacuum cleaning or can be completely removed from the device for vacuum cleaning. This measure makes it particularly easy to replace the vacuum cleaner filter bag when it is full.
- In all of the above-described embodiments, the filter bag may be provided in the form of a flat bag.
- 30 The flat bag shape is the most common shape for non-woven bags, as bags having this shape are very easy to manufacture. In contrast to the paper filter material used for paper filter bags, non-woven filter material is very difficult to fold permanently due to its high resilience, so that manufacture of more complex bag shapes, such as block bottom bags or other bag shapes having a bottom, is possible, but very complex and expensive.
- 35 In particular, the filter bag may include surface pleats.
- The filter bag may also be provided with at least one deflecting means. Accordingly, the above-mentioned spacing means may be configured to hold filter bags including surface pleats.
- The various further embodiments can be used individually or in combination with each other as required.

5

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

- Figs. 1a and 1b illustrate the dependence of the achieved air flow on the filling level of the filter bag according to the prior art;
- 10 Figs. 2a and 2b illustrate air-related data for a motor-blower unit used in devices for vacuum cleaning according to the prior art;
- Figs. 3a and 3b illustrate air-related data for a motor-blower unit that is particularly suitable for implementing the present invention;
- Fig. 4 illustrates the dependence of the achieved air flow on the filling level of the filter bag for a device according to the invention;
- 15 Figs. 5a to 5p show various views of a spacing means of the device for vacuum cleaning according to the invention; and
- Fig. 6 shows an illustration of a filter bag that is particularly suitable for the present invention.

20

EMBODIMENTS OF THE INVENTION

In the device for vacuum cleaning according to the invention, a motor-blower unit with a special characteristic is used in combination with a suction hose having a relatively large diameter. Surprisingly, this combination makes for efficient vacuum cleaners as defined by the invention, i.e.

25 a vacuum cleaner that comes into an energy efficiency class of B or better (according to VO 665/2013, ANNEX I) and at the same time into a cleaning class of C or better (according to VO 665/2013, ANNEX I).

The motor-blower unit is characterized by a high volume flow, high air output and high efficiency at orifices 7 (30 mm) and 8 (40 mm). The corresponding values are listed in Table 1.

- 30 Figs. 3a and 3b illustrate air-related data for an exemplary embodiment of the motor-blower unit as used in accordance with the invention, in this case a model 467.3.601-7 motor-blower unit manufactured by the Domel company. The suction air flow is plotted on the abscissa in units of dm^3/s or l/s . The ordinate represents the values of the vacuum (in kPa), the efficiency (in %), the input power (in W) and the air output (in W). Fig. 3a and Fig. 3b illustrate results for an average
- 35 electric input power of approximately 480 W and approximately 976 W, respectively.

As already mentioned above Figs. 2a and 2b illustrate the air-related data for a motor-blower unit of the prior art by way of comparison. Fig. 2a and Fig. 2b illustrate results for an average electric input power of approximately 622 W and of approximately 1121 W, respectively.

5 Table 1 shows a comparison between the relevant measured values for an exemplary embodiment of the motor-blower unit according to the invention and a motor-blower unit according to the prior art. With lower average electric input power, both the air flow at orifice 7 and orifice 8 as well as the air output at orifice 7 and orifice 8 and the efficiency at orifice 7 and orifice 8 are significantly higher for the exemplary embodiment than for the prior art. For the exemplary
10 embodiment, for instance, the air output at orifice 8 and an average electric input power of approximately 480 W is about 70% higher than for the prior art at an average electric input power of 622 W.

With comparable power input efficiency and air flow of the embodiment according to the invention are superior to those of the motor-blower unit of the prior art. An excellent air flow can, for example,
15 be achieved with a relatively low average electric input power at the respective orifices which correspond to real hard floors and carpets, thus obtaining a good cleaning class.

Fig. 4 illustrates the dependence of the achieved air flow on the filling level of the filter bag for a device for vacuum cleaning according to the invention. The illustrated results are compared to those for prior art vacuum cleaning devices shown in Figs. 1a and 1b.

20 Fig. 4 shows results for an average input power of approximately 670 W when a flat bag with side gussets of Fig. 6 and a tapering hose having a minimum diameter of 42 mm and a maximum diameter of 47 mm is used that is equipped with spacing means.

Figs. 5a to 5o illustrate the spacing means in detail. Fig. 5p shows the spacing means together with the holder for a motor protection filter. As can be seen from Fig. 5p, the arrangement shown
25 ensures that there is always a gap between the motor protection filter and the filter bag and that the filter bag does not cover the holder for the motor protection filter, which would otherwise result in the air from the filter bag being sucked solely out of the region of the filter bag that covers the motor protection filter. A three-dimensional data set of the device for vacuum cleaning illustrated in Fig. 5 may be obtained from Eurofilters N.V., Lieven Gevaertlaan 21, 3900 Overpelt, Belgium.

30 In particular, the spacing means may be configured to hold a special filter bag, for example a filter bag as shown in Fig. 6.

This results in a value of 15.6 cm² for the average cross-sectional area of the embodiment according to the invention. The filter bag has a surface area of approximately 1800 cm². The filter material used was MTTTS9 obtainable from Eurofilters N.V., Lieven Gevaertlaan 21, 3900 Overpelt,
35 Belgium. It is a multi-layer filter material with a dust storage layer and a meltblown fine filter layer. The filter bag includes a deflector in the form of a slotted nonwoven made of the material LF75, which can also be obtained from Eurofilters N.V., Lieven Gevaertlaan 21, 3900 Overpelt, Belgium. Moreover, the embodiment according to the invention corresponds to the prior art as described above. Even with an average input power of only approximately 670 W, a volume flow of 41 l/s is

- 5 achieved with an empty filter bag; after filling with 400 g DMT type 8 and using a spacing means, a volume flow of almost 37 l/s is still achieved.

This means that the achievable volume flows are significantly higher than in the prior art, where a volume flow of only 30 l/s can be achieved with an empty filter bag at an average input power of approximately 698 W. After loading with 400 g DMT8 dust, the volume flow even drops under

- 10 27 l/s and is thus approximately 10 l/s lower than in the embodiment according to the invention.

The following table summarizes the air-related data for the Miele S 8340 (settings "max" and "carpet") in the prior art and for the embodiment of the vacuum cleaner according to the invention described above.

	Voltage [V]	Average Electric Input Power [W]	Air Flow Orifice 7 [l/s]	Air Flow Orifice 8 [l/s]	Air Output Orifice 7 [W]	Air Output Orifice 8 [W]	Efficiency Orifice 7 [%]	Efficiency Orifice 8 [%]
Motor-Blower Unit Miele S 8340 Power Setting „max“	233	1121	47,6	55,5	378,0	185,0	27,8	13,3
Domet 467.3.601-7	220	976	52,0	66,3	496,3	319,0	41,5	26,3
Motor-Blower Unit Miele S 8340 Power Setting „carpet“	233	622	37,8	43,7	186,0	89,6	25,2	11,9
Domet 467.3.601-7	130	480	40,6	51,8	232,0	150,2	40,9	26,3

Patentkrav**1.** Indretning til støvsugning, omfattende:

en støvsuger med en sugeslange, der er forbundet med støvsugerens hus, og
5 omfattende

en filterpose, især en engangsfilterpose, fremstillet af ikke-vævet materiale,
hvor støvsugeren omfatter en motorblæserenhed, som er konfigureret såle-
des, at dens gennemsnitlige indgangseffekt er mellem 1000 W og 200 W, og
ved en gennemsnitlig elektrisk indgangseffekt på mellem

10 - 1000 W og 800 W opstår

et undertryk i målekammeret ved åbning 6 på $> 12,5$ kPa og

et undertryk i målekammeret ved åbning 8 på $> 4,0$ kPa

- 799 W og 600 W opstår

et undertryk i målekammeret ved åbning 6 på $> 10,0$ kPa og

15 et undertryk i målekammeret ved åbning 8 på $> 3,4$ kPa,

- 599 W og 400 W opstår

et undertryk i målekammeret ved åbning 6 på > 7 kPa og

et undertryk i målekammeret ved åbning 8 på $> 2,5$ kPa,

- 399 W og 200 W opstår

20 et undertryk i målekammeret ved åbning 6 på $> 4,0$ kPa og

et undertryk i målekammeret ved åbning 8 på $> 1,4$ kPa,

hvor sugeslangen har et gennemsnitligt tværsnitsareal på mindst $9,5 \text{ cm}^2$, især
mindst 11 cm^2 eller 13 cm^2 .

25 **2.** Indretning ifølge krav 1, hvor filterposen har et poseoverfladeareal mellem
 1.000 cm^2 og 4.000 cm^2 .

3. Indretning ifølge krav 2, hvor sugeslangen er i det mindste delvist tilspidset
og har et større tværsnitsareal ved en ende tæt på motorblæserenheden end
30 ved en ende fjernt fra motorblæserenheden.

- 4.** Indretning ifølge krav 3, hvor sugeslangen har et minimalt og et maksimalt tværsnitsareal, og den mindste diameter af sugeslangen er mindst 5%, især mindst 20%, mindre end det maksimale tværsnitsareal.
- 5 **5.** Indretning ifølge et hvilket som helst af de foregående krav, hvor sugeslangen har en længde på 1 m til 3 m.
- 10 **6.** Indretning ifølge et hvilket som helst af de foregående krav, hvor et sugerør, der er forbundet med sugeslangen, har en diameter på mere end 30 mm, fortrinsvis mere end 33 mm og særligt foretrukket mere end 36 mm.
- 15 **7.** Indretning ifølge et hvilket som helst af de foregående krav, hvor motorblæserenheden har en virkningsgrad ifølge EN 60312 ved en åbning 7 (30 mm) på mindst 35%, fortrinsvis mindst 38% og særligt foretrukket mere end 40%.
- 20 **8.** Indretning ifølge et hvilket som helst af de foregående krav, hvor filterposen er udformet som en flad pose og/eller omfatter overfladefolder og/eller er forsynet med afbøjningsmidler.
- 25 **9.** Indretning ifølge et hvilket som helst af de foregående krav, hvor støvsugeren omfatter en afstandsholderindretning med en bund og/eller i det mindste en sidevæg og/eller et låg til i det mindste delvist at adskille en filterpose fra i det mindste en indre husvæg af indretningen til støvsugning.
- 30 **10.** Indretning ifølge krav 9, hvor afstandsholderindretningen er udformet således, at der er tilvejebragt overløbsbaner mellem bunden og/eller den mindst ene sidevæg og/eller låget.
- 30 **11.** Indretning ifølge krav 9 eller 10, hvor afstandsholderindretningen til en filterpose er udformet med overfladefolder.

12. Indretning ifølge et hvilket som helst af kravene 9 til 11, hvor der i indretningen imod luftstrømsretningen i følgende rækkefølge er anbragt:

en luftindsugningsåbning i bunden eller den mindst ene sidevæg eller låget, gennem hvilken luft suges fra filterposens optagelsesrum ind i motoren/blæserenheden, når støvsugeren er i drift,

en holder til et motorbeskyttelsesfilter og

afstandsholderindretningen,

hvor afstandsholderindretningen er anbragt i afstand fra holderen af motorbeskyttelsesfilteret.

13. Indretning ifølge krav 12, hvor afstandsholderindretningen er konfigureret i form af en perforeret plade og/eller i form af et gitter og/eller i form af et gitter og/eller i form af bånd, båndformede sektioner, bøjler, bøjleformede sektioner, ribber, ribbeformede sektioner og/eller stifter.

14. Indretning ifølge krav 12 eller 13, hvor holderen til motorbeskyttelsesfilteret er udformet således, at et motorbeskyttelsesfilter kan skubbes eller foldes ind i holderen til motorbeskyttelsesfilteret.

15. Indretning ifølge et hvilket som helst af de foregående krav, hvor der er tilvejebragt et filterposeholdepladeoptag, som er anbragt hængslet i forhold til indretningen til støvsugning eller helt kan fjernes fra indretningen til støvsugning.

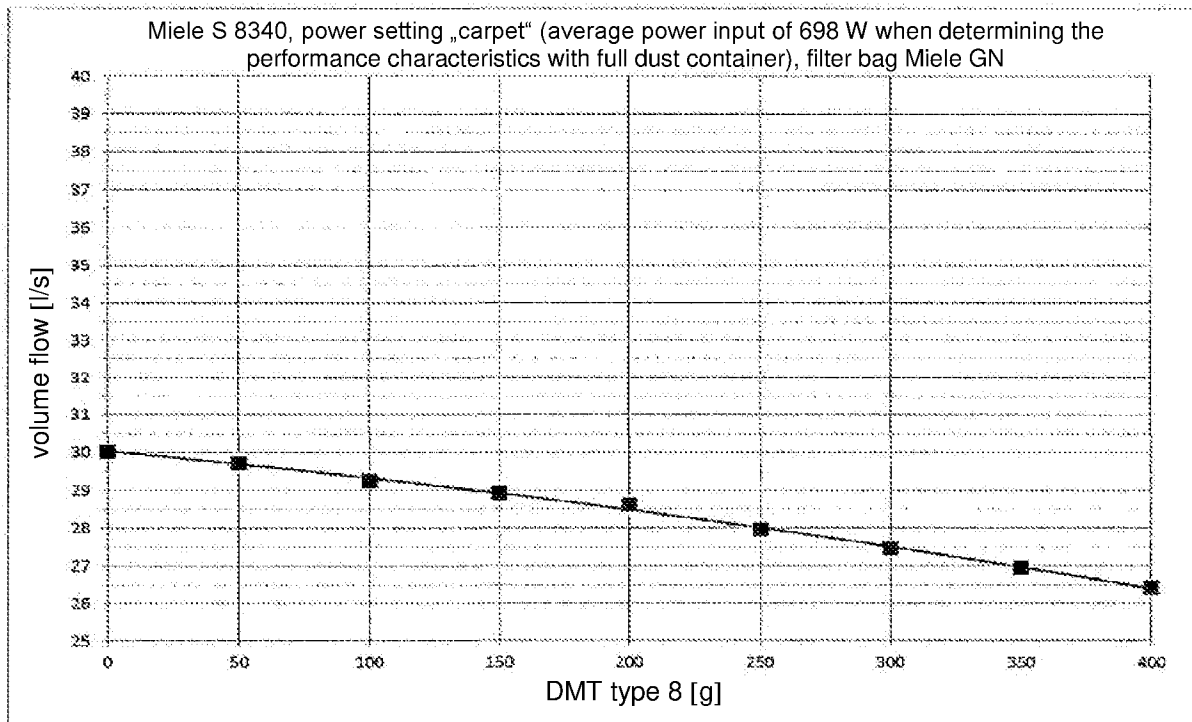


FIG. 1a

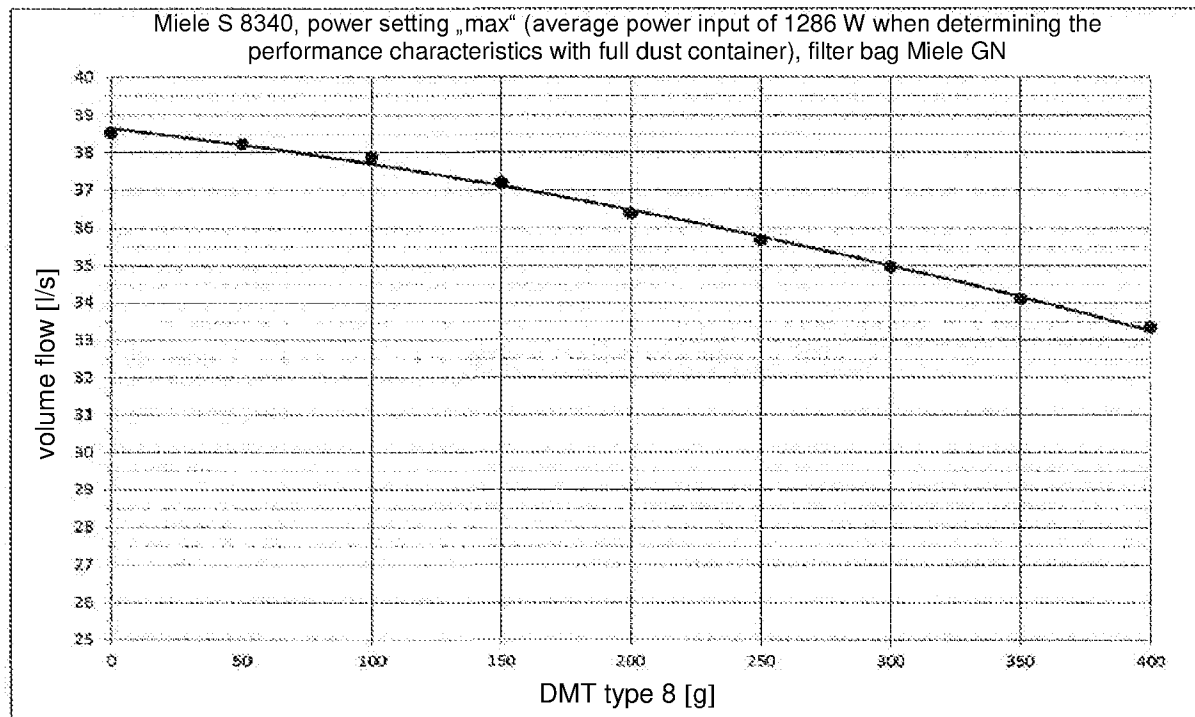


FIG. 1b

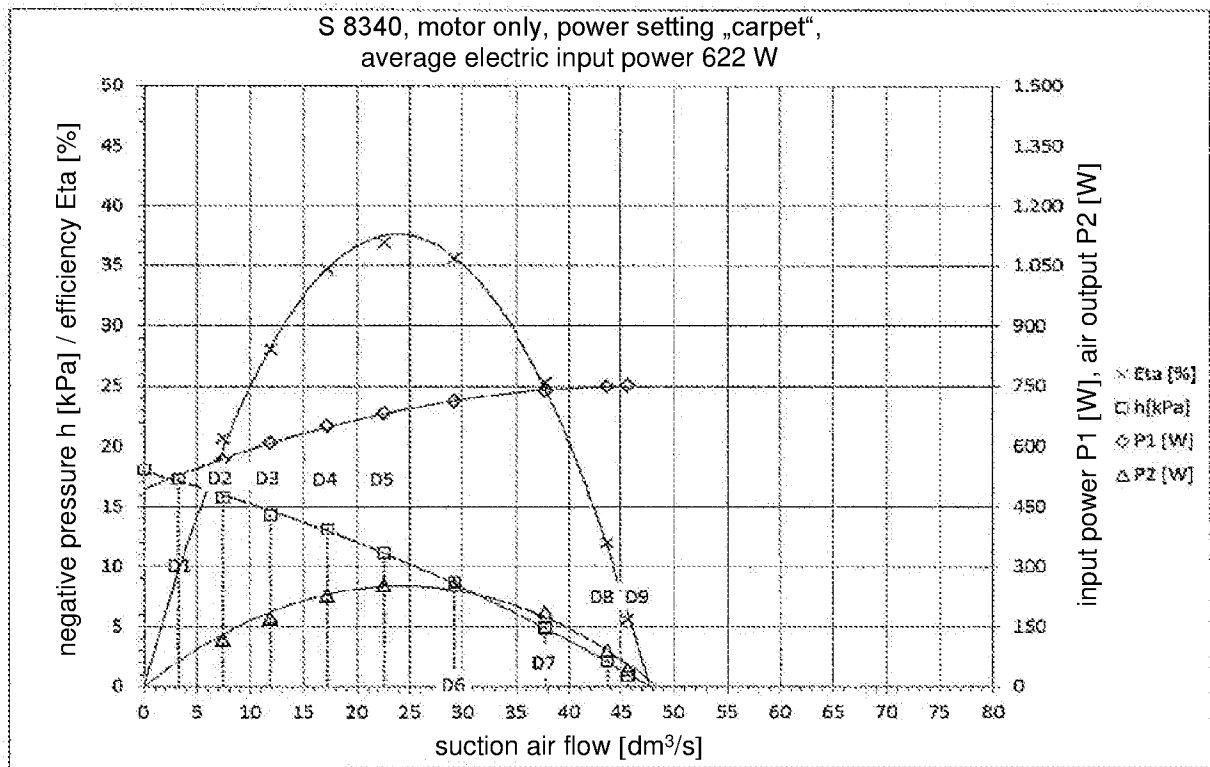


FIG. 2a

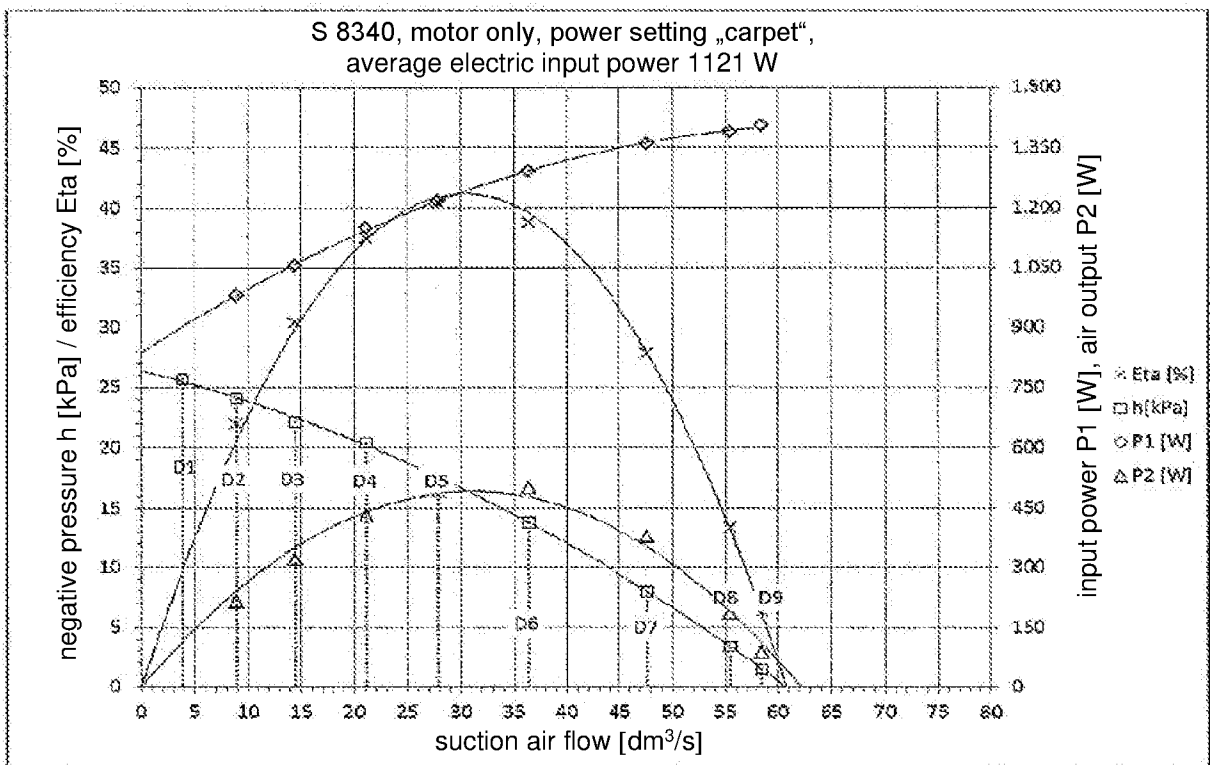


FIG. 2b

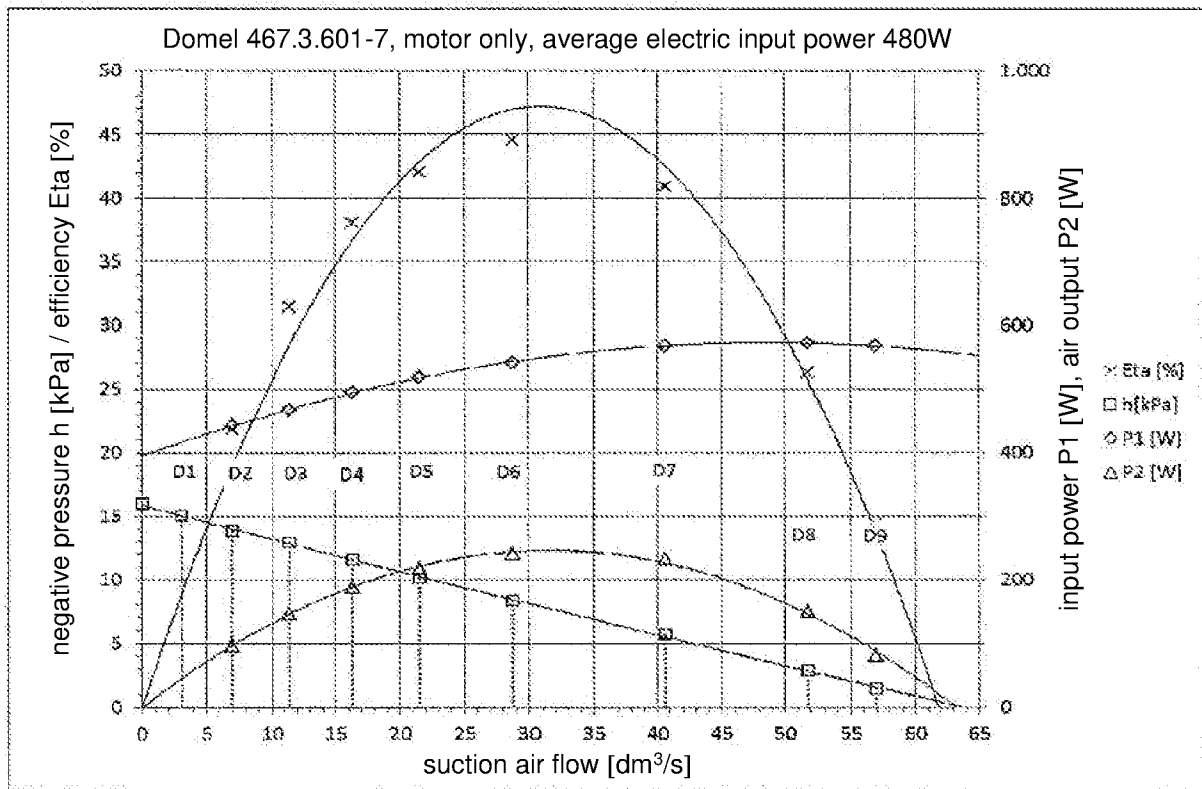


FIG. 3a

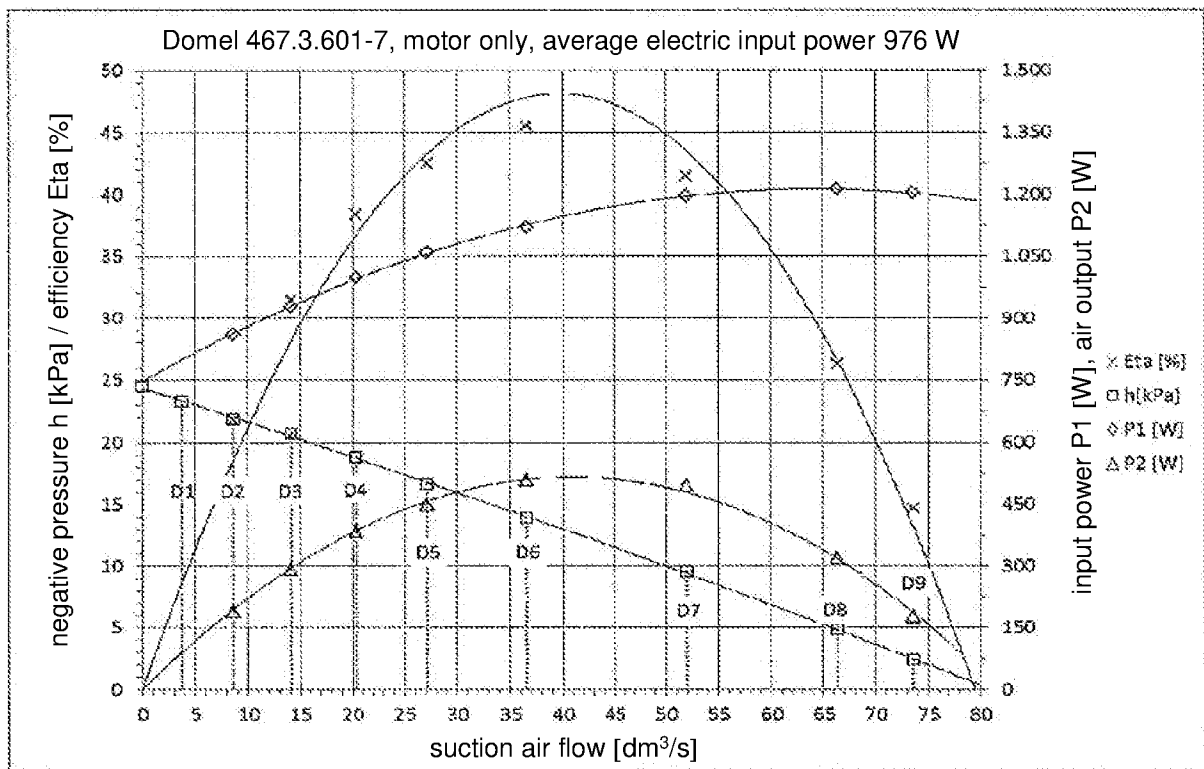
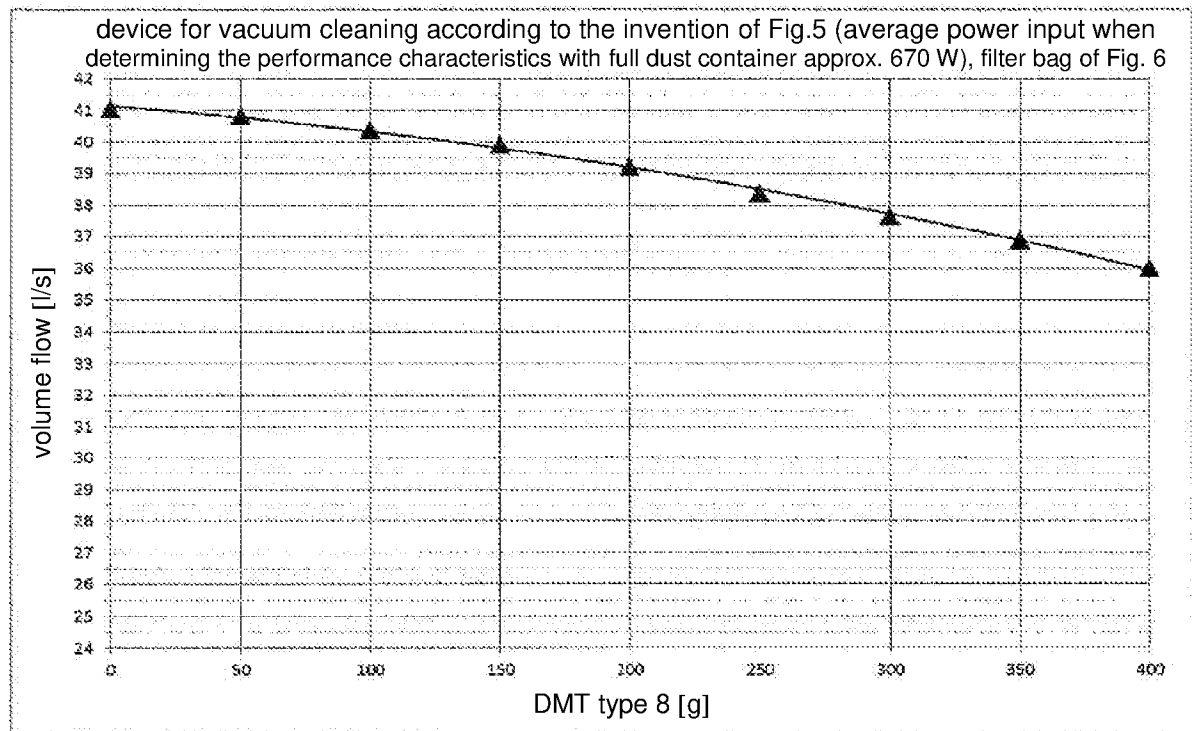


FIG. 3b

**FIG. 4**

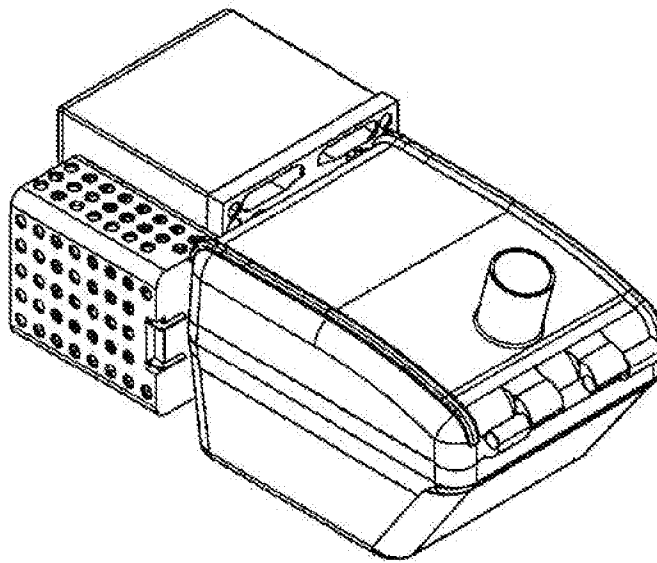
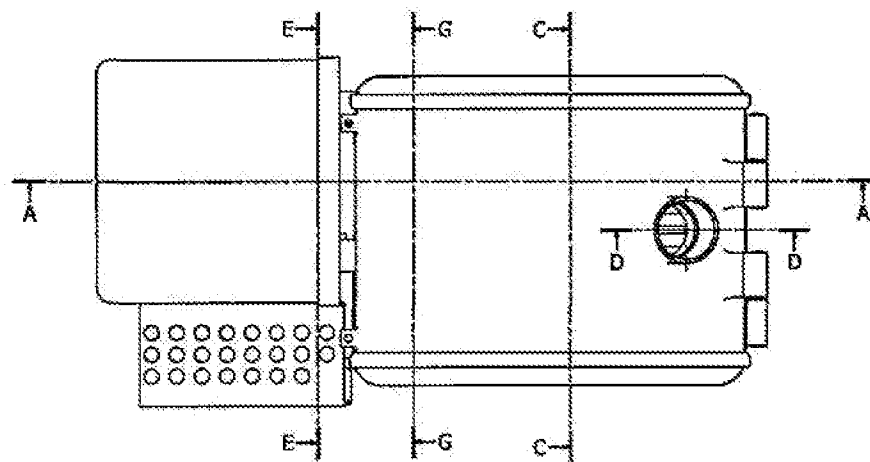
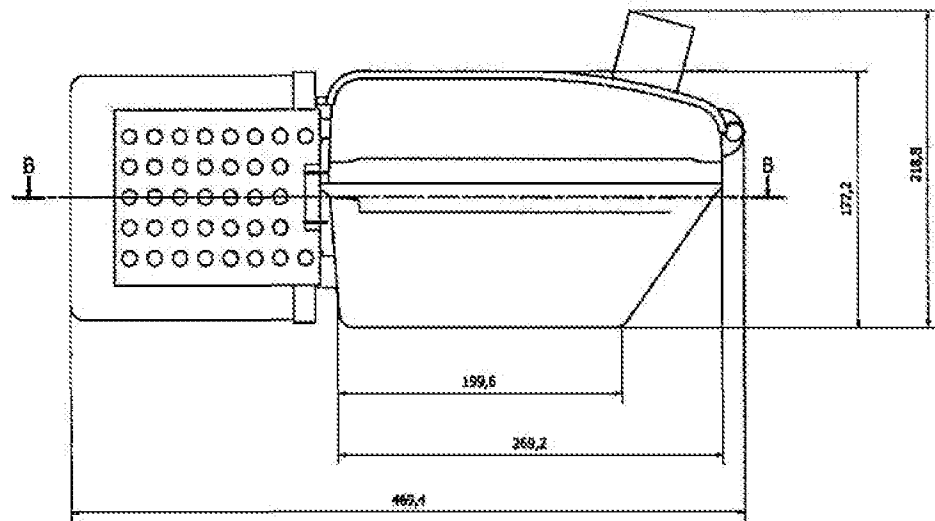


FIG. 5a



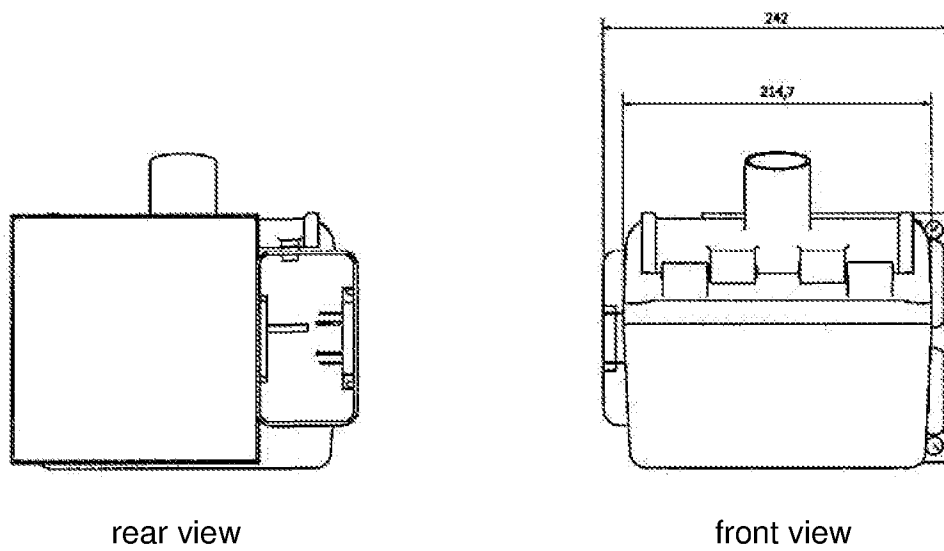
top view

FIG. 5b



side view

FIG. 5c



rear view

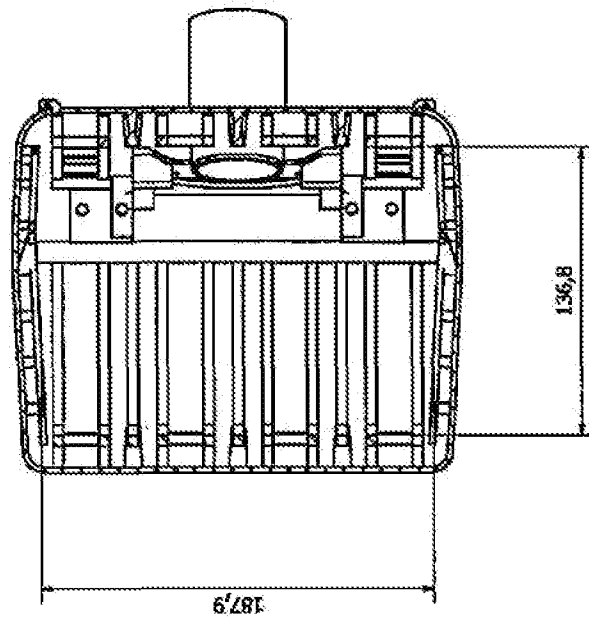
front view

FIG. 5d



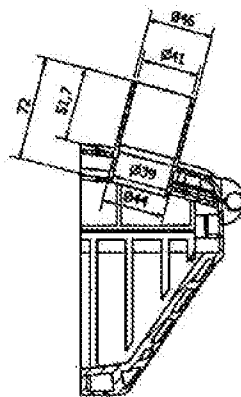
FIG. 5f





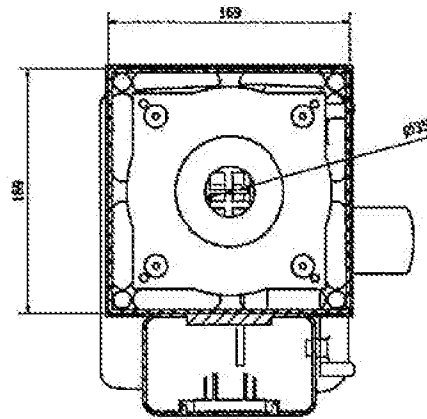
cross section C-C

FIG. 5g



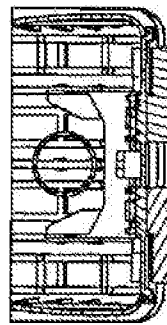
cross section D-D

FIG. 5h



cross section E-E

FIG. 5i



cross section F-F

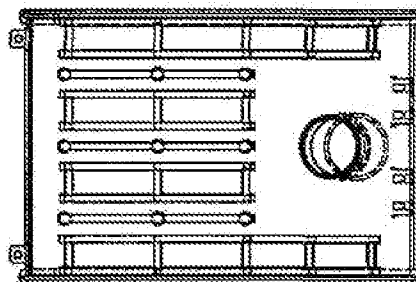
FIG. 5j



A line drawing of a rectangular tray with a raised rim. Inside the tray, there is a cylindrical container. The tray has a small latch or clip on the left side of the rim. The drawing is a perspective view from above.

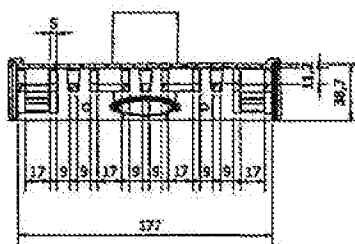
Technical drawing of a curved metal part. The drawing shows a side view of a curved component with a central section. Dimensions include a vertical distance of 42.6 on the left, a horizontal distance of 278.8 at the bottom, and a series of vertical dimensions on the right: 152.46, 84.1, 83.9, and 84.4. There are also two horizontal dimension lines labeled 'H' in the center.

FIG. 5m



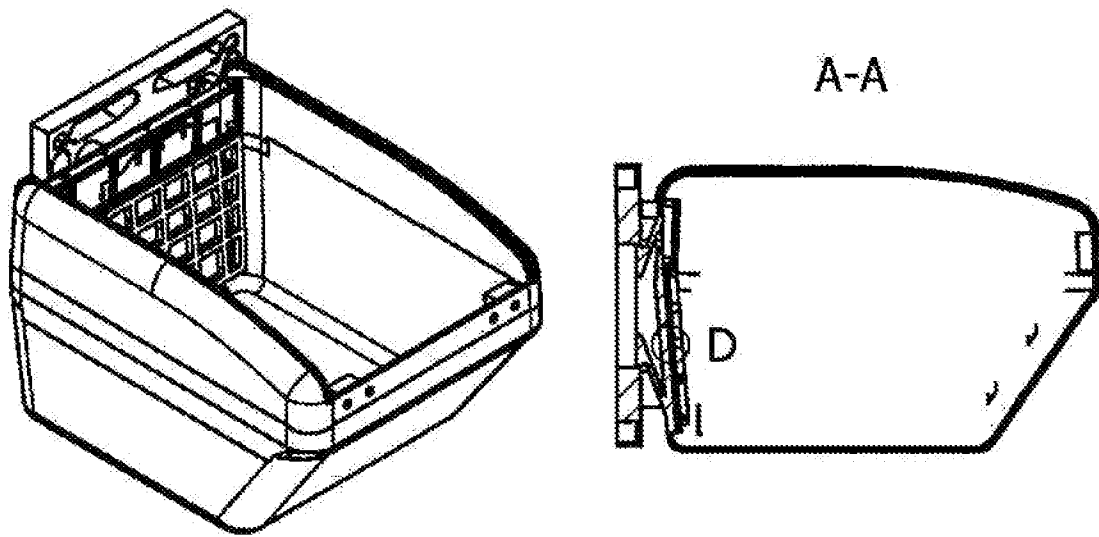
lid bottom view

FIG. 5n



lid cross section H-H

FIG 5o



detail D (2 : 1)

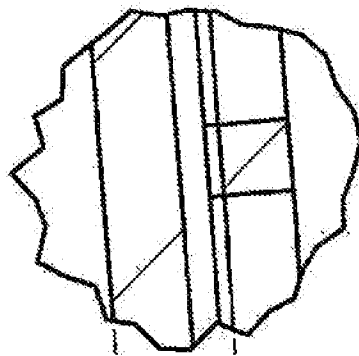


FIG. 5p

Fig. 6

