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(54) NOZZLE FOR A VACUUM CLEANER

(57) A nozzle (1) for a vacuum cleaner, comprises: a housing (11) having a turbine chamber (3) equipped with an outflow opening (35) which is in communication with a connection tube (6) connecting the turbine chamber (3) to a suction unit of the vacuum cleaner and an inflow opening (34) which is in communication with a suction opening (12) of the housing (11), a turbine (7) that is rotated by an axis "A2", is placed inside the turbine chamber (3) and being movable connected with a shaft (75) by a displacing means (77) used for axially displacing the turbine (7) with respect to the inflow opening (34) along the shaft (75), a floor cleaning roller (4) mounted in the housing (11) close to the suction opening (12) and rotatable relative to the housing (11) about an axis of rotation "A1", a transmissions means (2) transferring a drive torque "T" produced by the turbine (7) to the floor cleaning roller (4), wherein the displacing means (77) comprises at least one projection (78) provided on inside wall of a tubular section (781) of the turbine (7), a sleeve (79) spaced radially inwardly apart the tubular section (781) on the shaft (75) provided with a guide mean (791) which receives projection (78) and therefore engages the turbine (7) with the sleeve (79) and the guide mean (791) is formed as a closed loop path (92) at least partially shaped as a helical groove (92'), along which the projection (78) is moved accordingly to a difference between the drive torque "T" produced by the turbine (7) and a load torque "L" applied on the shaft (75) by power uptake of the floor cleaning roller (4) through the transmission means (2), therefore an axial displacing (D) of the turbine (7) with respect to the inflow opening (34) is ensured.

Thus, a reciprocating movement of the turbine along the shaft with respect to the inflow opening is provided by the projection which slides along the guide mean, that is formed as the closed loop path, what results that the projection is moved from a starting point i.e. when the turbine is not displaced, to the extreme point i.e. when the turbine experiences the maximum axial displacing "D" via longer path than when it returns from the extreme point to the starting, thereby the projection faster achieves the starting point on the sleeve when the load torque "L" falls down.

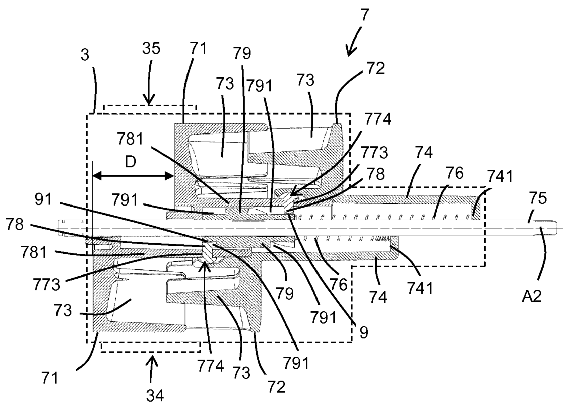

Fig. 4

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Description

[0001] The present invention relates to a vacuum cleaner nozzle for cleaning of surfaces such as floors, carpets, furniture etc., comprising a rotatable, elongated brush, which is provided with brush means and adapted to rotate during cleaning to brush off debris and dust from the surface, wherein said brush is rotatably driven by an air turbine, which is powered by the airflow produced by suction unit of the vacuum cleaner.

[0002] In the vacuum cleaner heads where the rotatable, elongated brush is driven by an air turbine, which is powered by the airflow produced by suction unit of the vacuum cleaner, there generally occurs the problem that when the vacuum cleaner head is lifted clear of the surface being cleaned beneath it, the rotation speed of the roller brush increases since there is no longer any force on it. The rotation speed increase applies not only to the roller brush but also to the air turbine driving it, and this not only leads to considerable stressing of the turbine bearings but also greatly increases the level of noise emitted.

[0003] Document US6151752A describes a vacuum cleaner head which has a housing having a turbine chamber and a connection tube connecting the turbine chamber to a suction aggregate of a vacuum cleaning machine. The housing has a suction opening and the turbine chamber has an inflow opening communicating with the suction opening. Air flow is sucked in by the suction aggregate through the suction opening and the inflow opening. A rotary roller brush is mounted in the housing close to the suction opening such that bristles of the roller brush project outwardly through the suction opening when the brush is in a lowest position. An air turbine is mounted in the turbine chamber such that the air turbine is acted upon by the air flow passing through the inflow opening. A device is provided for axially displacing the air turbine relative to the inflow opening when the power uptake of the roller brush is reduced.

[0004] Document DE3308294A1 discloses a vacuum cleaner nozzle with a sliding base and a rotating brush cylinder which is driven by a turbine wheel, a secondary air valve is provided in a secondary air path which opens out into the suction circuit behind the turbine wheel. In suction operation with the sliding base resting on the carpet or the like, the secondary air valve is kept closed. When the sliding base is raised, the secondary air valve is opened automatically and conducts outside air into the suction circuit such that the rotational speed of the turbo brush during idling hardly increases and there is no annoying increase in noise of the nozzle.

[0005] DE4036634A1 describes a dust-sucking mouthpiece which comprises a rotary roller brush. In this dust-sucking mouthpiece there is a braking device which acts on the roller brush or its drive system and which can be released from its braking position depending on whether or not the mouthpiece is resting on a surface to be cleaned.

[0006] From DE4229030A1 a vacuum cleaner head is known, which comprises a roller brush driven by an air turbine. To avoid a drastic increase in rotation speed when the roller brush is raised, a throttle element for the airflow drawn in is provided, which when the vacuum cleaner head is lifted clear of the surface being cleaned, throttles the airflow drawn in until the roller brush comes almost or completely to rest.

[0007] The objective of the present invention is to provide an improved nozzle for a vacuum cleaner with improved adaptation to changing working conditions, i.e. changing the type of the surface being cleaned, and with improved protection against uncontrolled increase a rotation speed of the floor cleaning roller when the nozzle is lifted clear of the surface being cleaned.

[0008] In accordance with the present invention, there is provided a nozzle for a vacuum cleaner, comprises: a housing having a turbine chamber equipped with an outflow opening which is in communication with a connection tube connecting the turbine chamber to a suction unit of the vacuum cleaner and an inflow opening which is in communication with a suction opening of the housing. A turbine that is rotated by an axis "A2", is placed inside the turbine chamber and being movable connected with a shaft by a displacing means used also for axially displacing the turbine along the shaft with respect to the inflow opening. A floor cleaning roller is mounted in the housing, over near the suction opening and rotatable relative to the housing about an axis of rotation "A1". Additionally the housing is provided with transmissions means which mechanically connects the turbine via the turbine shaft with the floor cleaning roller, therefore it can transfer a drive torque "T" produced by the turbine to the floor cleaning roller. The turbine is movable connected with the shaft via the displacing means which comprises at least one projection provided on inside wall of a tubular section of the turbine, a sleeve which is spaced radially inwardly apart the tubular section and firmly fixed on the shaft, wherein the shaft does not change its axial position relative to the inflow opening. Said sleeve is provided with a guide mean which receives the projection and therefore engagement between the turbine and the sleeve and finally the turbine is achieved. The guide mean is formed as a closed loop path at least partially shaped as a helical groove, along which the projection is moved accordingly to a difference between the drive torque "T" produced by the turbine and a load torque "L" applied on the shaft by power uptake of the floor cleaning roller through the transmission means. The movement of the projection along the guide mean causes that said projection experiences an axial displacement "D", and the same the axial displacement "D" of the turbine with respect to the inflow opening is ensured.

Because of that the guide mean is formed at least partially as the helical groove in which the projection is moved, the turbine can be screwed or unscrewed along the shaft with respect to the sleeve, therefore the turbine is reciprocally moved i.e. longitudinally and rotatably to a limited extent with respect to the difference between the drive torque "T" produced by the turbine and a load torque "L" applied on the shaft. The guide mean formed as the closed loop path causes that movement of the projection takes place along a predetermined closed loop path. Finally it results in that, that depending on the loading of the floor cleaning roller, the proportion of the airflow drawn in which acts upon the turbine can be adjusted by relative displacement of the turbine with respect to the inflow opening, and the turbine rotation speed is therefore variable according to need and can, if necessary, be reduced to a minimum speed which is safe for user and components of the nozzle.

[0009] Advantageously, a reciprocating movement of the turbine along the shaft with respect to the inflow opening is provided by the projection which slides along the guide mean, that is formed as the closed loop path, what results that the projection is moved from a starting point i.e. when the turbine is farthest from the inflow opening, to the extreme point i.e. when the turbine experiences the maximum axial displacing "D" via different, namely longer path than when it returns from the extreme point to the starting, thereby the projection faster achieves the starting point on the sleeve when the load torque "L" falls down.

[0010] Preferably, when the load torque "L" applied on the shaft increases from minimal to maximal, the projection is moved from the starting point along the helical groove of the guide mean to the extreme point what causes that the turbine experiences the maximum axial displacing "D" towards the inflow opening, wherein after the load torque "L" reductions the projection returns to the starting point along at least partially a longitudinal retaining wall, which is a part of the guide mean. The longitudinal retaining wall provides shorter way back of the projection to the starting point therefore the turbine faster reduces its rotation speed. Moreover an inclination of the helical groove can change with reference to the shaft, what provides variable characteristics for screwing or unscrewing the turbine along the shaft, for better adaptation of the axial displacement of the turbine with respect to the difference between the drive torque "T" produced by the turbine and a load torque "L" applied to the shaft.

[0011] Preferably, the displacing means comprises a spring which is mounted on the shaft that rotated by the axis "A2", wherein the spring acts on between the sleeve and the turbine. Preferably, the spring is a compression helical spring which provides mutual repulsion between the sleeve and the turbine along the shaft therefore it exerts a force oppositely directed to movement of the projection from the starting point to the extreme point. Said force aims to maintain the turbine in a position without axial displacement, where the projection is in the starting point. When the turbine is rotated by airflow with the drive torque "T", as the load torque "L" grows, the turbine is unscrewing towards the inflow opening. The movement of the projection along the guide mean depends on a resultant force of a force produced by the spring, a force from the drive torque "T" and a force from the load torque "L". When said forces are in a balance the turbine works with a constant axial displacement, then the projection doesn't move along the guide mean.

[0012] Preferably, the turbine is created by two coaxially connected parts, wherein a first part of the turbine comprises a side wall with a portion of the blades with coaxially arranged the tubular section for receiving the sleeve having the projection provided on inside wall of the tubular section, a second part having a side wall with a second portion of the blades with a cup shape portion extends outside of the turbine coaxially with the axis "A2" for receiving the spring and creating a supporting means for the spring. The blades of said parts are directed each other. Preferably the first part of the turbine has an opening provided on the tubular section for receiving and fixing a peg. Therefore the turbine is easy and cheap to produce and assembly. its components can be mass produced in plastic injection molding technology.

[0013] Preferably, the peg is longer than a thickness of the wall of the tubular section, therefore the peg extends from the inside wall of the tubular section and creates the projection for engaging the turbine with the shaft for transferring drive torque "T" from the turbine to the floor cleaning roller through the transmission means. Therefore the tools for producing the turbine are not complex which has a positive effect on production costs, moreover it is easy to adapt length of the projection to specific needs.

[0014] Preferably, the turbine chamber comprises: a cylindrical body elongated coaxially with the axis "A2", equipped with an outflow opening and inflow opening, a circular flat cover for closing a first end of the cylindrical body that is provided with a bearing for bearing a first end of the shaft, a second circular cover for closing a second end of the cylindrical body having coaxially provided a bearing for bearing a second end of the shaft wherein the second end of the shaft is mechanically connected with the transmission means. The second circular cover can be provide with a cylindrical portion which coaxially extends to outside of the turbine chamber and is formed for receiving the cup shape portion of the turbine. Therefore the shape of the turbine chamber is adapted to achieve the highest efficiency of the system and is adapted to a shape of the turbine and includes that, the turbine is axially displaced in the chamber.

[0015] Preferably, the second end of the shaft is disposed with a first toothed belt wheel for driving a belt which connects a second toothed belt wheel which is mechanically engaged with the floor cleaning roller for transferring the drive torque "T" from the turbine to the floor cleaning roller and for transferring the load torque "L" to the shaft in a opposite direction. The projection placed in the turbine with corresponding the guide mean placed on the sleeve create the mechanical connection between the turbine and the shaft. Such transmission means comprises the first toothed belt wheel, the belt and the second toothed belt wheel is easy to produce and provides quiet drive what increases the comfort of use.

[0016] Preferably, the turbine chamber comprises the outflow opening and the inflow opening, having the turbine that is mounted on the shaft and engaged together by the displacing means, further comprises the first toothed belt wheel which is mounted on the second end of the shaft, wherein the turbine chamber has an airtight subassembly structure that is mounted in the housing. Said airtight structure of the turbine chamber increases efficiency of the system because it prevents from uncontrolled the air-stream leakage and can be preassembled and inserted to the housing as the subassembly, what has favorable effect on the production.

[0017] In the drawings:

Fig. 1 is a exploded perspective view of a nozzle for a floor cleaning with the preferred embodiment of the present invention.

Fig. 2 is a perspective view of the internal elements of the nozzle as shown in Fig. 1.

Fig. 3 is a perspective view of the turbine and the shaft as shown in Fig. 2.

Fig. 4 is an axial section through a turbine that can be displaced in a turbine chamber.

Fig. 5 is an embodiment of a guide mean.

[0018] Reference is made to Fig. 1 which is a exploded reference is made to Fig. 1 which is a exploded perspective view of a nozzle for a floor vacuum cleaner with the preferred embodiment of the present invention. A nozzle 1 for a vacuum cleaner, comprises: a housing 11 divided horizontally into upper parts and a lower part, having a turbine chamber 3 which is equipped with an outflow opening 35 (not visible on this figure). Further the outflow opening 35 is in a communication with a connection tube 6, what provides fluid connection between the turbine chamber 3 and the vacuum cleaner (not visible on this figure). The inflow opening 34 placed on the opposite side in relation to the outflow opening 35, is in communication with a suction opening 12 (not visible on this figure) arranged as an elongated opening in the lower part of the housing. The nozzle 1 also comprises a turbine 7 (not visible on this figure) that is rotated by an axis "A2", which is arranged inside the turbine chamber 3 and being movable connected with a shaft 75 (not visible on this figure) by a displacing means 77 (not visible on this figure) used for axially displacing the turbine 7 with respect to the inflow opening 34 along the shaft 75. Therefore the proportion of the airflow drawn in which acts upon the turbine 7 can be adjusted by relative displacement of the turbine 7 with respect to the inflow opening 34 what influences directly on a value of the drive torque "T" produced by the turbine 7. Therefore the value of the drive torque "T" is variable according to need and can, if necessary. The nozzle 1 further comprises a floor cleaning roller 4 (not visible on this figure) mounted in the housing 11 above and close to the suction opening 12 and rotatable relative to the housing 11 about an axis of rotation "A1". Said floor cleaning roller 4 is driven via a transmissions means 2 transferring the drive torque "T" produced by the turbine 7 to the floor cleaning roller 4.

[0019] Reference is made to Fig. 2 which is a perspective view of the internal parts of the nozzle as shown in Fig. 1. The nozzle 1 for a vacuum cleaner has the housing 11 (not visible on this figure) divided horizontally into two upper parts and a lower part. The cleaning roller 4 which is placed in the housing 11 and rotatable driven on an axle 41 on a bearing 26 about the axis A1. The cleaning roller 4 is mechanically engaged with the second toothed belt wheel 23 of the transmission means 2, which also comprises a belt 28 connecting a first toothed belt wheel 25 with the second belt wheel 23, a fixing means 24 used for mounting the bearing 26 and a bearing 27 and for setting constant distance between the axis "A1" and the axis "A2", and a transmission means housing 21 for supporting the fixing means 24 inside the housing 11. The first toothed belt wheel 25 is mounted on an end of the shaft 75 which is mechanically engaged with the turbine 7 by the displacing means 77 (not visible on this figure). The turbine 7 is created by two coaxially connected parts: the first 71 and the second 72, wherein the first part 71 of the turbine 7 comprises a side wall with the portion of the blades 73 with coaxially arranged the tubular section 781 (not visible on this figure) for receiving a sleeve 79 (not visible on this figure), further comprises a projection 78 (not visible on this figure) provided on inside wall of the tubular section 781, the second part 72 having a side wall with the second portion of the blades 73 with a cup shape portion 74 having coaxial opening for receiving the shaft 75, and extends outside of the turbine 7 coaxially with the axis "A2" for receiving a spring 76 (not visible on this figure) with the bottom portion of the cup shape portion 74 creates a supporting means 741 for the spring 76. The turbine 7 is placed in the turbine chamber 3 comprises: a cylindrical body 31 elongated coaxially with the axis "A2", equipped with the outflow opening 35 and the inflow opening 34, the circular flat cover 32 for closing the first end of the cylindrical body 31 that is provided with the bearing 5 for bearing the first end of the shaft 75, the second circular cover 33 provided with the cylindrical portion 331 which coaxially extends to outside of the turbine chamber 3 and is formed for receiving the cup shape portion 74 of the turbine 7. In relation to a loading applied on the cleaning roller 4 as the load torque "L" the displacing means 77 move the turbine 7 along the shaft 75 towards the inflow opening 34, therefore adjusts the value of the drive torque "T" as the proportion of the airflow drawn in which acts upon the turbine 7.

[0020] Reference is made to Fig. 3 which is a perspective view of the turbine and the shaft as shown in Fig. 2. The nozzle 1 has the housing 11 with the turbine 7 for driving the cleaning roller 4. The turbine 7 is placed in the turbine chamber 3 (not visible on this figure). The turbine 7 is created by two coaxially connected parts: the first 71 and the second 72, wherein the first part 71 of the turbine 7 comprises the side wall with the portion of the blades 73 with coaxially arranged the tubular section 781 for receiving the sleeve 79. The sleeve 79 is firmly mounted on the shaft 75. The tubular section 781 is provided with the radial through opening 773 used for receiving a peg 774. The peg 774 is longer than thickness of the wall of the tubular section 781, therefore after assembling, a portion of the peg 774 protrudes from an inside wall of the tubular section 781 and forms the projection 78 (not visible on this figure). Further the turbine 7 comprises the second part 72 having the side wall with the second portion of the blades 73 with the cup shape portion 74 having coaxial opening for the shaft 75. Said cup shape portion 74 extends outside of the turbine 7 coaxially with the axis "A2" and is used for receiving the spring 76 for which the bottom portion of the cup shape portion 74 creates a supporting means 741. The spring 76 is a compression helical spring which provides mutual repulsion between the sleeve 79 and the turbine 7 along the shaft 75, therefore it exerts a force oppositely directed to movement of the projection 78 moving from the starting point 9 to the extreme point 91. Therefore the spring 26 is responsible for holding the projection 78 in the starting point 9 of the guide mean 791 when the load torque "L" is negligible small, then the shaft 76 is no loaded and there is practically no torque between the sleeve 79 and the turbine 7. As the load torque "L" increases, namely when the cleaning roller 4 is loaded that appears the torque between the sleeve 79 and the turbine 7, this forms a force acting on the projection 78 which is placed in the helical groove 92' causes that after overcoming the force coming from the spring 26, the projection 78 is moved from the starting point 9 along helical groove 92', thereby the turbine 7 is unscrewed from the sleeve 79 and is moved axially towards the inflow opening 34, what causes that increases the portion of the turbine 7 covered by the air stream what increases the drive torque "T" and balances the loading. Therefore the nozzle 1 can respond for increasing the load applied to the cleaning roller 4.

[0021] Reference is made to Fig.4 which is an axial section through the turbine 7 that can be displaced in the turbine chamber 3. The upper half of Fig.4 shows the turbine 7 in no load position i.e. the projection 78 is in the starting point 9, i.e. when the load torque "L" is negligible small, namely the cleaning roller 4 is not loaded, while the lower half of Fig.4 shows the turbine 7 in the full-load position i.e. the projection 78 is in the extreme point 91, when the load torque reaches maximum value, namely when the cleaning roller 4 is under maximum load. Essentially the nozzle 1 comprises the housing 11 with the turbine 7 for driving the cleaning roller 4. The turbine 7 is placed in the turbine chamber 3 (outlined on this figure) having the inflow opening 34 and the outflow opening 35. The turbine 7 is created by two coaxially connected parts: the first 71 and the second 72, wherein the first part 71 of the turbine 7 comprises the side wall with the portion of the blades 73 with coaxially arranged the tubular section 781 for receiving the sleeve 79. The sleeve 79 is firmly mounted on the shaft 75. The tubular section 781 is provided with the radial through opening 773 used for receiving the peg 774. The peg 774 is longer than thickness of the wall of the tubular section 781, therefore after assembling, the portion of the peg 774 protrudes from the inside wall of the tubular section 781 and forms the projection 78. Further the turbine 7 comprises the second part 72 having the side wall with the second portion of the blades 73 and with the cup shape portion 74 having the coaxial throughout opening for receiving the shaft 75. Said cup shape portion 74 extends outside of the turbine 7 coaxially arranged with the axis "A2" and is used for receiving the spring 76 for which the bottom portion of the cup shape portion 74 creates the supporting means 741. The spring 76 is a compression helical spring which provides mutual repulsion between the sleeve 79 and the turbine 7 along the shaft 75, therefore it exerts a force oppositely directed to movement of the projection 78 from the starting point 9 to the extreme point 91. Therefore the spring 26 is responsible for holding the projection 78 in the starting point 9 of the guide mean 791 when the load torque "L" is negligible small i.e. the shaft 76 is no loaded and there is practically no torque between the sleeve 79 and the turbine 7. As the load torque "L" increases, the spring 26 is stressed, namely when the cleaning roller 4 is loaded that appears the torque between the sleeve 79 and the turbine 7 which forms a force acting on the projection 78 which is placed in the helical groove 92' causes that after overcoming the force coming from the spring 26, the projection 78 is moved from the starting point 9 along helical groove 92', thereby the turbine 7 is unscrewed from the sleeve 79 and is moved along the shaft 75 towards the inflow opening 34, while experiencing the axial displacement "D", what increases a portion of the turbine 7 covered by the air stream what increases the drive torque "T" and balances the loading on ongoing basis. Therefore the nozzle 1 can respond for increasing the load applied to the cleaning roller 4. When the load torque "L" decreases, the turbine 7 will be brought to no-load position shown in the upper half of Fig.4 because of the force produced by the spring 26. In relation to a loading applied on the cleaning roller 4 as a load torque "L" the displacing means 77 move the turbine 7 along the shaft 75 to the inflow opening 34 direction, therefore adjusts the value of the drive torque "T" as the proportion of the airflow drawn in which acts upon the turbine 7.

[0022] Reference is made to Fig. 5 which shows an embodiment of a guide mean 791 which is arranged on the sleeve 79. The guide mean 791 is formed as the closed loop path 92. First part of the guide mean 791 which is essentially formed as the helical groove 92', guiding the projection 78 from the starting point 9 to the extreme point 91. As the load torque "L" increases from no load to the maximum load, while the projection 78 is moved from the starting point 9 along the helical groove 92' to the extreme point 91, thereby the turbine 7 (not shown on this figure) is moved toward the inflow opening

34 what increases a portion of the turbine 7 which is covered by the air stream produced by a suction unit of the vacuum cleaner, what increases the drive torque "T" and thereby the loading is balanced by the drive torque "T" on ongoing basis. The helical groove 92' is arranged as a two steps continues groove with different sloping angles α and β with respect to axis A2, wherein $\alpha < \beta$. A first portion is inclined at the angle α that causes that a movement of the projection 78 from the starting point 9 towards the extreme point 91 needs more force, than the movement of the projection 78 towards the extreme point 91 along a second portion of the helical groove 92' that is inclined at angle β. The force which acts on the projection 78 in the guide mean 791 is the resultant force of a force produced by the spring 76, a force from the drive torque "T" and a force from the load torque "L". Further, when the load torque "L" decreases, the projection 78 is moved along the second part of the guide mean 791, essentially formed by the longitudinal retaining wall 92" to the starting point 9, primarily because of the force produced by the spring 26 (not shown on this figure). A path from the extreme point 91 to the starting point 9 via the longitudinal retaining wall 92" is shorter than via the helical groove 92' therefore the projection 78 can quickly come back to the starting point 9. In relation to a loading applied on the cleaning roller 4 (not shown on this figure) as a load torque "L" the projection 78 move the turbine 7 along the shaft 75 to the inflow opening 34 direction, therefore adjusts the value of the drive torque "T" as the proportion of the airflow drawn in which acts upon the turbine 7.

List of reference signs:

[0023]

1	nozzle
2	transmission means
3	turbine chamber
4	cleaning roller
5	bearing
6	connection tube
7	turbine
9	starting point
11	housing
12	suction opening
21	transmission means housing
23	second toothed belt wheel
24	fixing mean
25	first toothed belt wheel
26	bearing
27	bearing
28	belt
31	cylindrical body
32	flat cover
33	circular cover
34	inflow opening
35	outflow opening
41	axle
71	first part of the turbine
72	second part of the turbine
73	blade
74	cup shape portion
75	shaft
76	spring
77	displacing means
78	projection
79	sleeve
91	extreme point
92	closed loop path
92'	helical groove
92"	longitudinal retaining wall
331	cylindrical portion
741	supporting means
773	opening
774	peg
781	tubular section
791	guide mean
A1	axis of the fool cleaning roller
A2	axis of the turbine
D	axial displacement
L	load torque
T	drive torque
α	inclination angle
β	inclination angle

Claims

1. A nozzle (1) for a vacuum cleaner, comprises: a housing (11) having a turbine chamber (3) equipped with an outflow opening (35) which is in communication with a connection tube (6) connecting the turbine chamber (3) to a suction unit of the vacuum cleaner and an inflow opening (34) which is in communication with a suction opening (12) of the housing (11), a turbine (7) that is rotated by an axis "A2", is placed inside the turbine chamber (3) and being movable connected with a shaft (75) by a displacing means (77) used for axially displacing the turbine (7) with respect to the inflow opening (34) along the shaft (75), a floor cleaning roller (4) mounted in the housing (11) close to the suction opening (12) and rotatable relative to the housing (11) about an axis of rotation "A1", a transmissions means (2) transferring a drive torque "T" produced by the turbine (7) to the floor cleaning roller (4), wherein the displacing means (77) comprises at least one projection (78) provided on inside wall of a tubular section (781) of the turbine (7), a sleeve (79) spaced radially inwardly apart the tubular section (781) on the shaft (75) provided with a guide mean (791) which receives projection (78) and therefore engages the turbine (7) with the sleeve

(79) **characterized in that** the guide mean (791) is formed as a closed loop path (92) at least partially shaped as a helical groove (92'), along which the projection (78) is moved accordingly to a difference between the drive torque "T" produced by the turbine (7) and a load torque "L" applied on the shaft (75) by power uptake of the floor cleaning roller (4) through the transmission means (2), therefore an axial displacing (D) of the turbine (7) with respect to the inflow opening (34) is ensured.

2. A nozzle (1) according to claim 1, **characterized in that** when the load torque "L" applied on the shaft (75) increases from minimal to maximal, the projection (78) is moved from a starting point (9) along the helical groove (92') of the guide mean (791) to the extreme point (91) what causes that the turbine (7) experiences the maximum axial displacing (D) towards the inflow opening (34), wherein after the load torque "L" reductions the projection (78) returns to the starting point (9) along at least partially longitudinal retaining wall (92"), which is a part of the guide mean (791).

3. A nozzle (1) according to claim 1 or 2, **characterized in that** the displacing means (77) comprises a spring (76) which is mounted on the shaft (75) that rotated by the axis "A2", wherein the spring (76) acts on between the sleeve (79) and the turbine (7).

4. A nozzle (1) according to claim 3, **characterized in that** the spring (76) is a compression helical spring which provides mutual repulsion between the sleeve (79) and the turbine (7) along the shaft (75) therefore it exerts a force oppositely directed to movement of the projection (78) from the starting point (9) to the extreme point (91).

5. A nozzle (1) according to any of the preceding claims, **characterized in that** the turbine (7) is created by two coaxially connected parts (71, 72), wherein a first part (71) of the turbine (7) comprises a side wall with a portion of the blades (73) with coaxially arranged the tubular section (781) for receiving the sleeve (79) having the projection (78) provided on inside wall of the tubular section (781), a second part (72) having a side wall with a second portion of the blades (73) with a cup shape portion (74) extends outside of the turbine (7) coaxially with the axis "A2" for receiving the spring (76) and creating a supporting means (741) for the spring (76).

6. A nozzle (1) according to claim 5, **characterized in that** the first part (71) of the turbine (7) has an opening (773) provided on the tubular section (781) for receiving and fixing a peg (774).

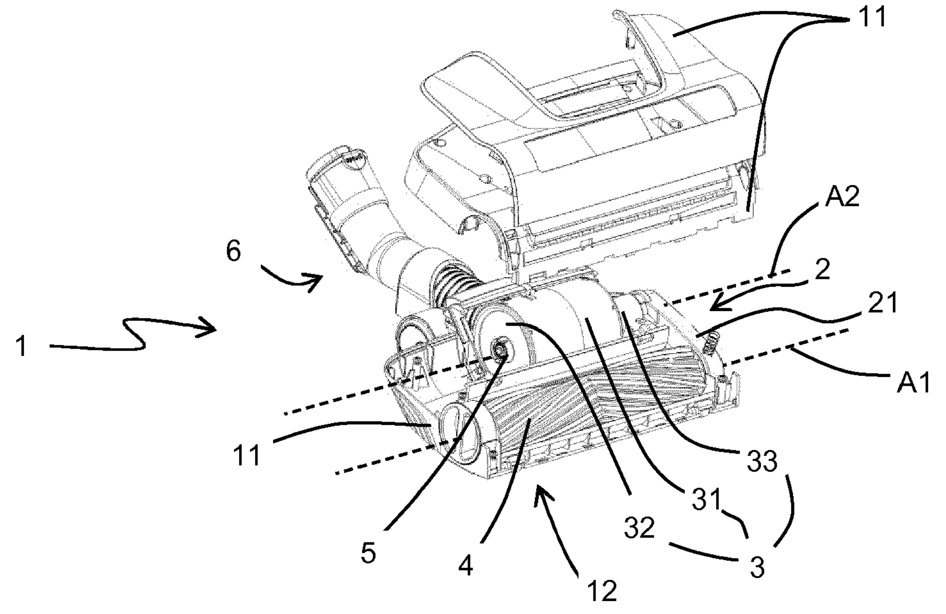
7. A nozzle (1) according to claim 6, **characterized in that** the peg (774) is longer than a thickness of the wall of the tubular section (781), therefore the peg (774) extends from the inside wall of the tubular section (781) and creates the projection (78) for engaging the turbine (7) with the shaft (75) for transferring drive torque "T" from the turbine (7) to the floor cleaning roller (4) through the transmission means (2).

8. A nozzle (1) according to any of the preceding claims, **characterized in that** the turbine chamber (3) comprises: a cylindrical body (31) elongated coaxially with the axis "A2", equipped with an outflow opening (35) and inflow opening (34), a circular flat cover (32) for closing a first end of the cylindrical body (31) that is provided with a bearing (5) for bearing a first end of the shaft (75), a second circular cover (33) for closing a second end of the cylindrical body (31) having coaxially provided a bearing (27) for bearing a second end of the shaft (75) wherein the second end of the shaft (75) is mechanically connected with the transmission means (2).

9. A nozzle (1) according to any of the preceding claims, **characterized in that** the second end of the shaft (75) is disposed with a first toothed belt wheel (25) for driving a belt (28) and a second toothed belt wheel (23) which is mechanically engaged with the floor cleaning roller (4) for transferring the drive torque "T" from the turbine (7) to the floor cleaning roller (4) and for transferring the load torque "L" to the shaft (75) in a opposite direction.

10. A nozzle (1) according to claim 8 or 9, **characterized in that** the second circular cover (33) has a cylindrical portion (331) which coaxially extends to outside of the turbine chamber (3) and is formed for receiving the cup shape portion (74) of the turbine (7).

11. A nozzle (1) according to any of the preceding claims, **characterized in that** the turbine chamber (3) with the outflow opening (35) and the inflow opening (34), having the turbine (7) that is mounted on the shaft (75) and engaged together by the displacing means (77), with a first toothed belt wheel (25) which is mounted on the second end of the shaft (75), has an air-tight subassembly structure that is mounted in the housing (11).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A2
6
2
21
1
A1
11
33
31
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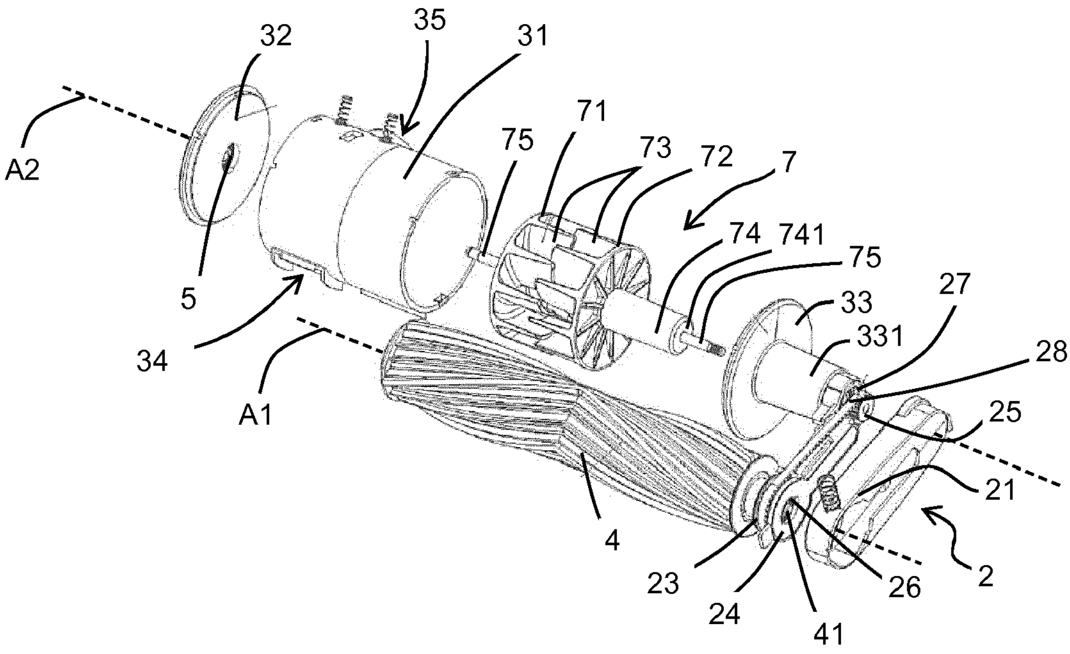
4
32
3
12

Fig. 1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72
7
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331
28
A1
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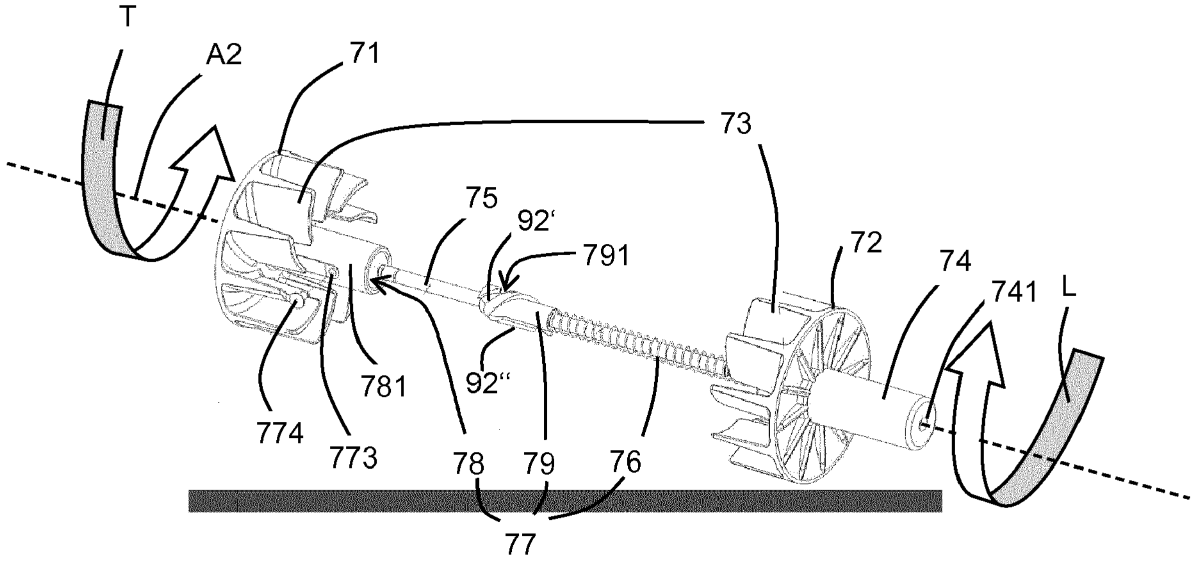
23
26
24
41

Fig. 2


T
A2
71
73
73
75
92'
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741
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774
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781
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92''
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76
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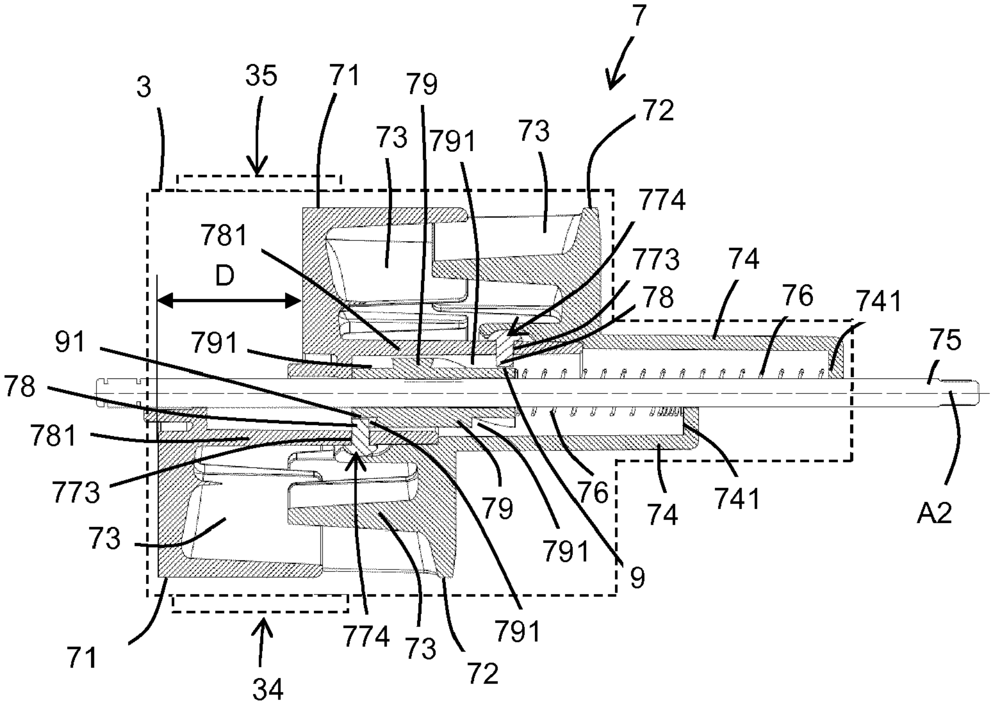
77

Fig.3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73
72
791
34

Fig. 4

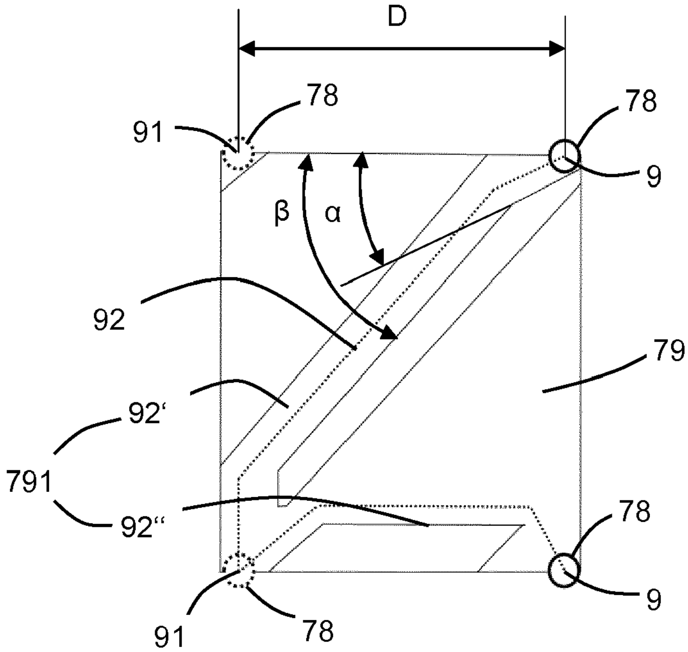

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 18 19 1256

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 March 2019	Trimarchi, Roberto

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CATEGORY OF CITED DOCUMENTS

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