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[54] **VACUUM CLEANER CONSTRUCTION**

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[51] **Int. Cl.**[2] **A47L 9/04**

[58] **Field of Search** 15/371, 372, 385, 387, 15/29, 180

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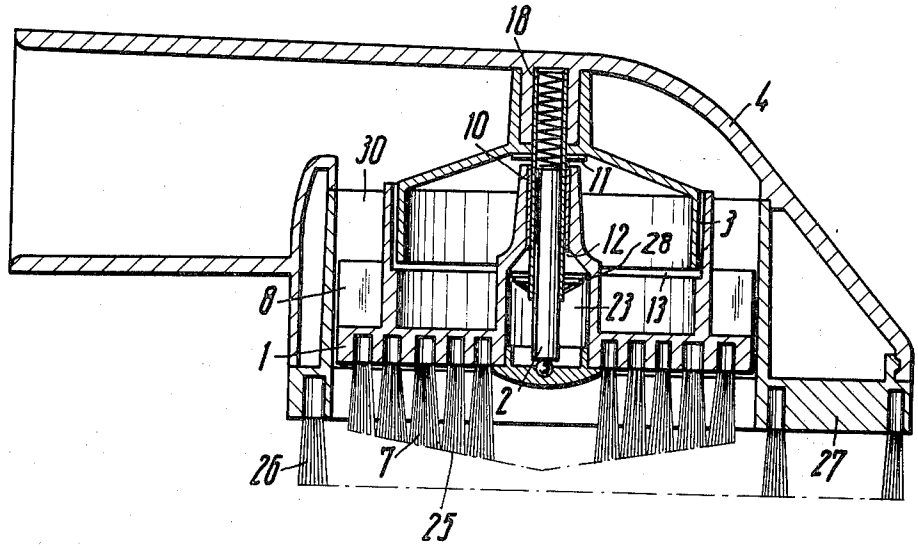
[57] **ABSTRACT**

A nozzle unit for a vacuum cleaner has a housing provided with an opening, and a brush disc is located in the housing and has bristles extending outwardly through the opening. A mounting arrangement mounts the disc so that it rotates about an axis which extends substantially normal to the plane of the opening, permitting the disc to be displaced inwardly of the opening along its axis of rotation. A biasing spring yieldably resists such inward displacement, and a sealing arrangement seals the mounting arrangement and the biasing spring with reference to the ambient atmosphere.

8 Claims, 5 Drawing Figures



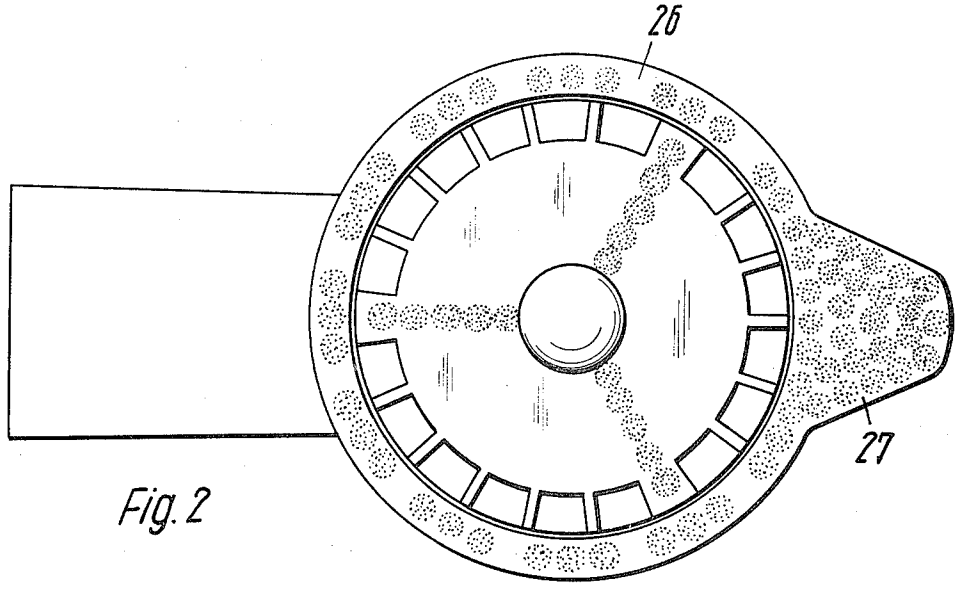


Fig. 2

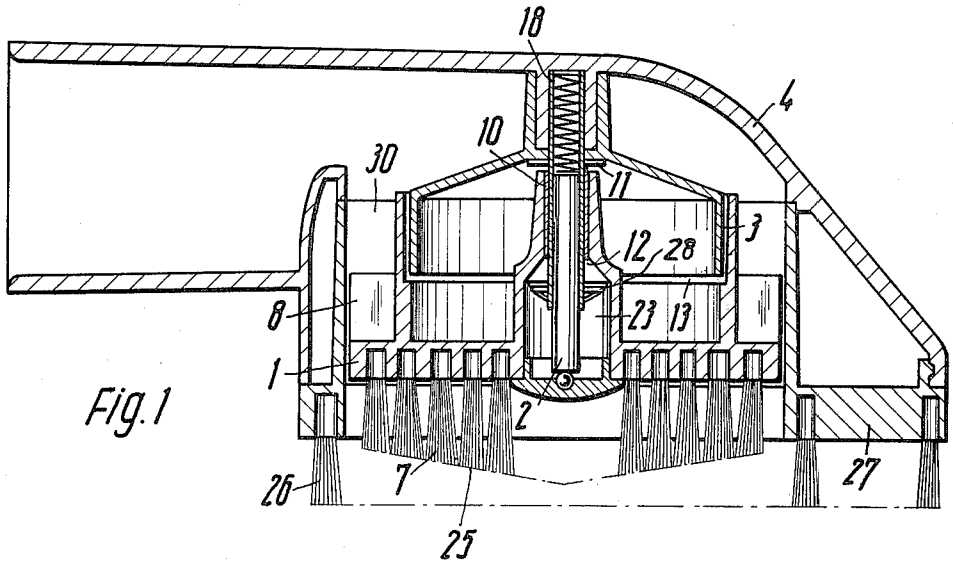


Fig. 1

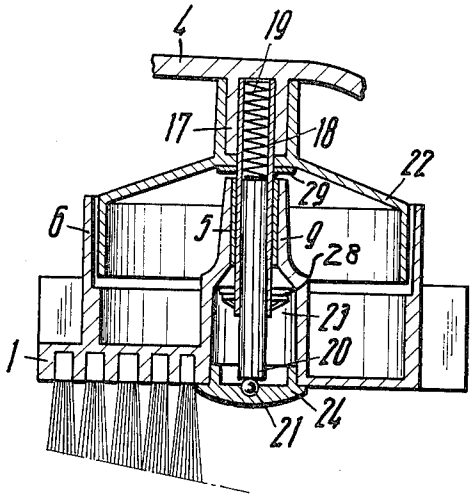


Fig.3

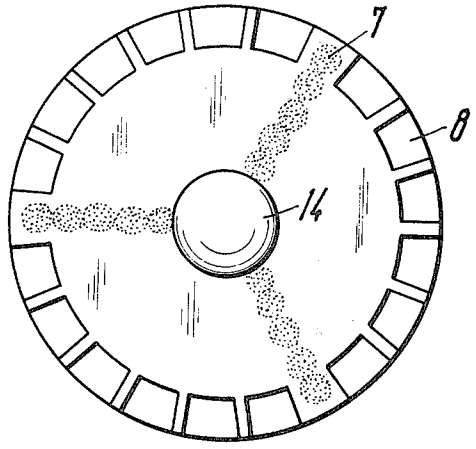


Fig.4

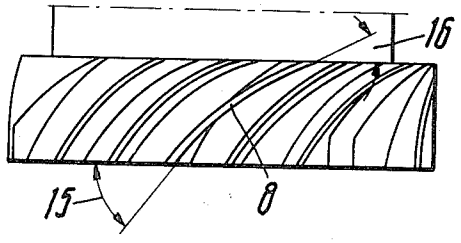


Fig.5

VACUUM CLEANER CONSTRUCTION

BACKGROUND OF THE INVENTION

The present invention relates generally to a vacuum cleaner construction, and more particularly to a nozzle unit for such a vacuum cleaner construction.

It is known to provide vacuum cleaners with nozzle units which are especially suitable for cleaning upholstery, garments or the like. In these items to be cleaned, special problems are encountered which must be taken into account in the construction of the nozzle unit. In particular, the dust or other contaminants to be removed frequently adhere so strongly, or are located in crevices, that mere suction is not sufficient to dislodge them. Therefore, it is known to provide such a nozzle unit with a rotating brush so that the moving bristles dislodge the dust or contaminants, which can then be picked up by the suction of the vacuum cleaner. Of course, the contaminants which have been dislodged by the bristles of the brush must be completely withdrawn by suction in order to obtain a satisfactory cleaning action. At the same time, it is desirable that the rotation of the brush be carried out without requiring a special drive, and it is therefore known from the prior art to provide the brush with turbine vanes which are so positioned that the air which is drawn in through the opening of the nozzle unit impinges upon the vanes and causes the brush to rotate.

In one known prior-art construction, such a nozzle unit uses a flattened suction conduit the peripheral wall of which is provided with a number of air intake openings. A coupling is provided at the open end of the flattened conduit to permit mounting of the rotating brush, and the coupling is turned by a drive shaft which extends centrally and longitudinally through the flattened conduit. A turbine is mounted on the shaft in the region intermediate the coupling and the suction conduit, in an airflow channel which guides the air to the turbine. At the suction side, the turbine has stationary air guide vanes through the center of which the drive shaft extends. The drive shaft is surrounded by a planetary gear and carries at its free end which extends outwardly beyond the stationary vanes a vane wheel. The shaft drives the brush which is mounted on the conduit by means of the coupling, due to the action of the aspirated flowing air as it impinges upon the vane wheel.

The dust which is loosened by the rotation of the brush, which latter rotates about the longitudinal axis of the nozzle, is drawn in through the aforementioned apertures in the wall of the conduit and is supplied to the dust collecting receptacle of the vacuum cleaner.

This prior-art arrangement has certain disadvantages. On the one hand, the construction is rather complicated and therefore expensive, especially when one considers that only a single specific operation can be carried out with it. Moreover, a horizontal surface cannot be properly cleaned with this construction because the dust is dislodged by the brush forwardly of the intake of the nozzle, so that only a part of the dislodged dust or contaminants is picked up by suction whereas the rest remains and settles back.

A concomitant disadvantage of this prior-art construction, being an outflow of the complexity of the construction, is the fact that it is rather subject to malfunction. This is particularly true in view of the fact that the brush rotates on a single relatively thin shaft which must not be permitted to be out-of-round because otherwise the brush will not properly operate. Should the shaft be out-of-round, the imbalance created thereby could be sufficient to counteract the rotational motion produced by the turbine and the brush could come to a standstill.

It is evident, therefore, that further improvements are highly desirable. In fact, industry has long sought such an improved construction without, however, heretofore having been able to provide it.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide such an improved construction.

More particularly, it is an object of the present invention to provide a nozzle unit for a vacuum cleaner which is not possessed of the disadvantages outlined above.

Another object of the invention is to provide such an improved nozzle unit which permits a simple but highly effective cleaning of upholstery, garments and the like.

Another object of the invention is to provide such a nozzle unit which is capable of providing thorough cleaning even in crevices, recesses, the base of the nap of a fabric and the like.

An additional object of the invention is to provide such a nozzle unit wherein a rotary brush is provided which will always rotate properly and uniformly, and which will provide a uniform cleaning operation at all times.

In keeping with the above objects, and with others which will become apparent hereafter, one feature of the invention resides in a vacuum cleaner, and in particular in a nozzle unit in such a vacuum cleaner. The nozzle unit comprises a housing having an opening, and a brush disc which is located in the housing and which has bristles extending outwardly through the opening. Mounting means mounts the disc for rotation about an axis which extends substantial normal to the plane of the opening. The disc is displaceable inwardly of the opening along this axis, and biasing means yieldably resists such displacement. Sealing means seals the mounting means and the biasing means with reference to the ambient atmosphere.

It is clear that with this construction pressure exerted upon the bristles of the brush as the bristles come in contact with an article to be vacuumed, will permit the brush to yield inwardly of the housing. Since this yielding movement is resisted by the biasing means, a constant engagement of the bristles with the object to be cleaned, is assured.

Moreover, the brush disc according to the present invention is turbine driven, that is it is provided with turbine vanes which drive it in response to impingement of the vanes by the air which is being aspirated by the vacuum cleaner.

To avoid interference with the rotation of the brush disc, either by dust or by aspirated long and flexible objects such as pieces of thread and the like, the mounting means and the biasing means must be protected against contact with such objects, which is done by providing the sealing means in accordance with the present invention.

It is advantageous in accordance with the present invention that the brush disc be provided with rows of tufts composed of bristles, with the arrangement being such that in any operating position (including any displaced position) the brush disc will accommodate itself

to the particular operating condition and will always exert the same pressure upon the object to be cleaned. Moreover, the brush is surrounded by the housing in the construction according to the present invention, so that the inlet to the suction conduit with which the housing is connected is in fact constituted by the interior of the housing, meaning that suction is applied directly above the surface portion which is being brushed by the rotating brush.

A further advantage is obtained by the possibility of mounting the novel nozzle unit on a flexible suction hose, so that the nozzle unit can be used in the same manner as a conventional dust brush, making its use simple and assuring a reliable pickup of dust which has been loosened by the disc.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the following drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical section through a nozzle unit according to the present invention;

FIG. 2 is a bottom-plan view of FIG. 1, with the bristles being shown diagrammatically;

FIG. 3 is a fragmentary vertical sectional detail view, showing a detail of FIG. 1;

FIG. 4 is a bottom-plan view of the brush disc in FIG. 1, showing the arrangement of the turbine air guide vanes; and

FIG. 5 is a perspective fragmentary enlarged detail view, showing the turbine guide vanes with the associated inlet and outlet angles.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail, wherein a single exemplary embodiment has been illustrated, it will be seen that the drawing (especially FIG. 1) shows a nozzle unit for a vacuum cleaner, having a brush disc 1 which is mounted in a housing 4 having an open side through which the bristles of the brush disc extend. Located in the interior of the housing is a mounting portion or socket 17, advantageously of one piece with the wall of the housing 4. A cupped member 22 of annular configuration, having an open side which faces the opening of the housing 4, is mounted on the socket 17, being press-fitted on the latter in the illustrated embodiment. Of course, other ways of fitting are conceivable, for instance a connection by adhesive means or the like. A tubular guide 18 is also mounted in the socket 17, again being press-fitted in the same in the illustrated embodiment. The tubular guide 18 has two functions, on the one hand to accommodate a biasing spring 19 and on the other hand to support a metallic sleeve 10 of a central slide bearing 5, which sleeve 10 is accommodated in turn at its lower end in a mounting portion 9 of the brush disc 1. A space 23 is provided within the portion 9 and assures that the brush disc 1 with the bristles 7 thereon can be shifted inwardly and outwardly of the open side of the housing 4 along its axis of rotation which is defined by a journalling pin 2 and extends normal to the plane of the opening of the housing 4. The extent to which the brush disc 1 can be displaced inwardly and outwardly of the open side of the housing 4 is dictated by the length of the space 23 in the direction of the journalling pin 2, and by the location of two abutments constituted by an upper washer 29 and a lower washer 28 which are both clamped onto the tubular guide 18. A cap 24 is press-fitted into the lower open end of the portion 9 and constitutes a part of the disc 1. A bearing ball 21 engages the inner side of the cap 24 and the axial end face of the pin 2 which faces this inner side, in line contact with both of them. The cap 24 is, of course, located at the center 14 of the disc 1.

One side of the disc 1, that is the one which faces inwardly of the housing 4, is provided with an annular collar 6, the open end of which faces inwardly of the housing 4 and is recessed to form a shoulder at 13. The length of this recess is slightly greater than the length of the recess 23 in axial direction of the pin 2. The portion provided with the recess forming the shoulder 13 surrounds the cupped portion 22 so that the overlapping parts of these two portions together constitute the sealing means 3 which is effective even though the disc 1 moves upwardly and inwardly (with reference to its orientation in the drawing) against the spring action of the spring 19. The provision of the sealing means 3 assures that the inner components which mount the disc 1, and in particular the slide bearing 5, are protected against dust and the entry of other contaminants such as threads or the like, as is particularly clearly shown in FIG. 3.

FIGS. 1 and 3 show the disc 1 displaced inwardly of the housing 4 to the maximum possible extent. Normally, however, that is when no inward pressure is exerted upon the bristles 7 of the disc 1, the spring 19 will urge the disc 1 outwardly of the housing 4, so that normally the lower end 12 of the metallic sleeve 10 is in engagement with the washer 28. In this position, the recessed portion of the collar 6 and the portion 22 overlap one another in axial direction to only a small extent. If in operation a pressure is exerted upon the bristles of the disc 1, in a sense counter to the biasing force of the spring 19, then the bearing ball 21 will press against the pin 20 and will thus cause the latter and the disc 1 to be displaced inwardly of the housing 4 against the force of the spring 19. This causes an increasing overlapping of portions 22 and the portion above the shoulder 13, until finally the upper end of the sleeve 10 comes into engagement with the washer 29 and prevents further inward movement. However, in neither end position and in none of the intermediate positions will there be any contact between the portion 22 and that portion of the collar 6 which surrounds it, so that the rotation of the disc 1 is never jeopardized.

The periphery of the disc 1 is provided with substantially radially extending air vanes vandes 8 which are most clearly shown in FIGS. 2 and 4. The underside 25 of the disc 1, that is the side which faces the material to be cleaned, is provided with rows of tufts each of which is composed of bristles, and these rows are identified with reference numeral 7 and extend, as most clearly shown in FIGS. 2 and 4, outwardly from the axis of rotation defined by the pin 2. The rows are straight and, in the illustrated embodiment, the length of their bristles varies in such a manner as to increase the direction from the disc periphery towards the center 14, that is towards the axis of rotation. The purpose of this is to

assure that the torque which develops in operation is no greater than that produced by the disc **1** itself. In order to maintain the torque constant even if the surface to be cleaned is uneven, and to assure that always the same number of bristle tufts will be in contact with the surface, the invention provides for the capability of the disc **1** to yield inwardly of the housing against the force of the spring **19.** Thus, the cleaning pressure with which he bristles engage the surface to be cleaned is determined only by the spring **19** via the pin **20** and the bearing ball **21.**

Although a vacuum cleaner has not been illustrated in the drawing, it will be understood that the unit according to the present invention forms a part of such a vacuum cleaner and is to be used with the same. For this purpose the left-hand tubular portion of the housing **4** (see FIG. **1**) is connected with the inlet of a vacuum cleaner conduit or hose to produce suction in the housing **4.** This suction picks up any dust and other dirt which is drawn from the exterior of the housing through the vanes **8** in axial direction of the pin **20.** Since the vanes **8** are so arranged, as shown in FIG. **5,** that the inlet angle **15** is greater than the outlet angle **16** which they include, a high torque will be generated and the disc **9** will be rotated at relatively high speed. After passing through and between the vanes **8,** the air with the entrained dust and other dirt will move in a spiral pass upwardly in the annular clearance **30,** and will then pass through the lefthand tubular portion of the housing **4** (see FIG. **1**) and on into the vacuum cleaner itself.

FIGS. **1** and **2** show particularly clearly that there is also provided an annulus **26** of bristles, which includes a number of bristles mounted on a projecting portion **27** of the housing **4.** This projecting portion **27** with the bristles thereon serves to provide for the preliminary loosening of dust and dirt so that the same can be picked up more readily by the bristles of the rows **7** on the rotating disc **1.** Moreover, the projection **27** with the bristles thereon greatly facilitates the cleaning in folds of materials, in corners of upholstered furniture, and in removing dust and dirt from other crevices or spaces which are not readily accessible for the disc **1.**

With the construction according to the present invention the disadvantages of the prior art, outlined in the introductory portion of this specification, are overcome and a unit is created which is simple in its construction, reliable in its operation and superior in its cleaning performance.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the type described above.

While the invention has been illustrated and described as embodied in a nozzle unit of a vacuum cleaner, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. In a vacuum cleaner, a nozzle unit comprising a housing having an inlet opening for particle-carrying air, and an outlet communicating with the suction source of the vacuum cleaner; a brush disc located in said housing and having bristles extending outwardly through said opening, and a plurality of circumferentially spaced inclined vanes extending radially of the disc periphery and arranged to be impinged by air flowing from said inlet opening to said outlet so that such air drives said disc in rotation; mounting means mounting said disc for rotation about an axis which extends substantially normal to the plane of said opening, and for displacement inwardly of said opening along said axis; biasing means yieldably resisting said displacement; and sealing means sealing said mounting means and biasing means against contact with the particle-carrying air flowing through said housing.

2. A nozzle unit as defined in claim **1,** said disc having a side facing said opening and provided with a plurality of tufts of said bristles arranged in straight rows which extend outwardly from said axis.

3. A nozzle unit as defined in claim **2,** wherein said bristles of said tufts of bristles in each of said row have a length which increases with increasing proximity of the respective tuft towards said axis.

4. A nozzle unit as defined in claim **2,** said sealing means including an annular collar on an other side of said disc opposite to said one side, and said mounting means including a slide bearing located within the confines of said collar.

5. A nozzle unit as defined in claim **4,** wherein said slide bearing comprises a metallic sleeve extending longitudinally of said axis.

6. A nozzle unit as defined in claim **4,** said collar having an open end facing inwardly of said housing and being provided with a circumferentially extending step; and said sealing means further comprising an annular portion provided on said housing axially adjacent said open end and having an edge portion which partly extends into said step.

7. A nozzle unit as defined in claim **1,** said mounting means including a portion of said housing extending towards said opening, and wherein said sealing means comprises an extension of said portion, said extension being cupped in direction towards said disc and said disc having a tubular part telescoped over said extension.

8. A nozzle as defined in claim **1,** said mounting means comprising a tubular guide mounted in said housing and having an open end facing said opening, a journal pin slidably received in said guide and having a free end portion extending from said open end, said biasing means urging said pin outwardly of said guide, a bearing ball intermediate and in engagement with an inwardly directed surface of said disc and an axial end face of said end portion, and means mounting said disc on said tubular guide slidable axially of the same against the action of said biasing means.

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