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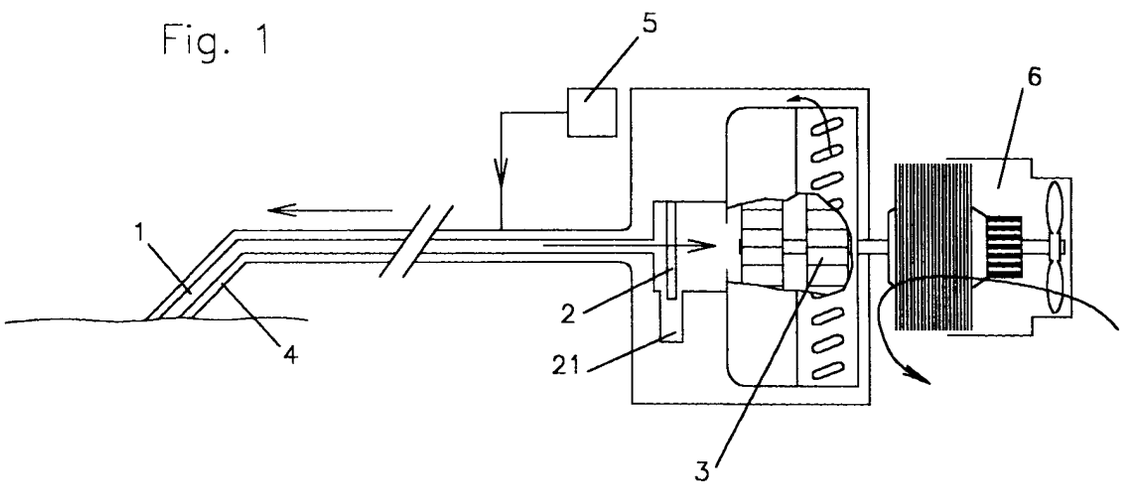
(54) A dustproof vacuum cleaner

(57) In a vacuum cleaner, the air is not expelled into the environment but is recirculated into the suction region; this prevents the dispersal of any traces of dust into the environment. The vacuum cleaner has advantages with regard to power, energy, and noise and enables the air to be treated with physical/chemical aids. A "robot" structure benefits particularly from this innovation.

Fig. 1



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Description

[0001] The subject of the present invention is a vacuum cleaner which is dustproof, in the sense that it does not disperse the dust of the expelled air since the air is recirculated.

[0002] All vacuum cleaners known up to now use more or less efficient filtration systems which lead to disadvantages of various types; they require units with high power, they consume a large amount of energy and emit noise, they return air which is not completely clean, and they have various practical disadvantages. In particular, given the large quantity of air set in motion (30 - 70 l/sec.), filtration quality is connected with energy consumption and with the need to use very powerful units, and therefore has a practical limitation. The invention avoids these disadvantages by arranging for the expelled air to be returned into the suction region of the vacuum cleaner in order to be recirculated; the atmosphere is thus not affected by the air-flow containing dust residues. In an advantageous embodiment of the invention, the vacuum cleaner comprises a special opening which takes in the dust/air mixture, a filter which retains and collects the dust, a turbine with radial/tangential discharge, a duct which conveys the discharge air to the output opening which injects the air into the suction region, and a dispenser for modifying the physical/chemical characteristics of the air without superfluous dispersal of additives into the atmosphere.

[0003] The invention will now be explained with reference to the appended drawings showing a non-limiting embodiment of the vacuum cleaner according to the invention:

[0004] Figure 1 shows the principle of operation of the invention; the air and the dust are drawn in from the opening 1 and pass through the filter 2 which retains a large portion of the dust. In the system of the invention, the filtering of the air can be coarse; this permits a considerable reduction in the power of the suction unit and hence in its consumption and noise. The noise connected with the emerging air-flow is attenuated owing to the fact that the discharge air-flow is no longer admitted freely to the atmosphere. The filter 2, which may be equipped with a dust-collection box 21, is cleaned periodically, manually or automatically, by the methods known in the prior art. After the air has left the filter 2, it is drawn in and compressed by the turbine 3 and is not expelled to the exterior (as in the prior art) but is conveyed to the output opening 4 where its mechanical energy renders the dust removal more efficient since it acts in the manner of a rotating brush, helping to remove the dirt and, finally, the mechanical compression energy of the discharge air is recovered. As a result of the recirculation, in addition to the recovery of the mechanical compression energy, there is a further advantage due to the recovery of the thermal energy of the process air which thus tends to be heated considerably. The fact that, in the present invention, the expelled air is conveyed back into the region to be cleaned, provides the opportunity for the air to be treated by a device 5 which is constituted by any dispenser known in the art which enables the output air to be enriched with liquid or solid detergents and disinfectants, water, steam, ozone, foam, ions, heat, etc. As a result of the recirculation of the air, the additives are not dispersed and both the perceptible heat and the latent heat contained in the steam are recovered. The motor 6 which drives the turbine 3 is not affected by the treated air but has its own independent cooling system. Figures 2 and 3 show embodiments of the suction and output openings; before the compressed air is expelled into the working region, it undergoes a reduction in cross-section and, for the same air subsequently drawn in, the cross-section then increases progressively. In practice, in the dust-removal region, in which the cross-section is smallest, a large increase in the air speed is brought about in the same manner as in a Venturi tube and in the suction openings of currently available vacuum cleaners. Again with reference to Figures 2 and 3, the suction duct, indicated 1, is the diverging portion of the Venturi tube which has its smallest cross-section in the dust-removal region, with the purpose of recovering the kinetic energy of the air-flow coming from the duct 4 which constitutes the converging portion; the diverging portion must be designed in a manner such as to favour the conversion of the kinetic energy into pressure energy with great efficiency in order thus to achieve energy and noise advantages. Figure 4 shows another advantageous application of the invention and indicates, by way of example, a possible configuration of the suction and output openings which operate effectively on a battery-operated "robot" vacuum cleaner. This device takes advantage particularly of the reduction in power absorbed and in noise permitted by the invention. The "robot" structure also helps to reduce flow resistance since it avoids the long hoses of the conventional structure. Moreover, the expulsion of air into the atmosphere is prevented according to the present invention; in practice, the "robot" vacuum cleaner takes in dusty air from the opening 1, conveys it directly, that is, without long connecting hoses, through the filter to the turbine and, from there, discharges it again directly, under pressure, from the opening 4 where it contributes to the exertion of a mechanical dirt-removal action. In practice, the details of construction may vary without, however, departing from the scope of the invention and hence from the scope of the patent of invention.

Claims

1. A cleaning machine, in particular, a vacuum cleaner in which the discharge air returns to the suction region, characterized in that the recirculating air can be treated in order to confer thereon particular physical, chemical or bacteriological characteristics, including the addition or removal of odours, the ma-

chine also being useful for the treatment of fabrics or other objects without dispersing the additives into the atmosphere.

2. A cleaning machine, in particular, a vacuum cleaner in which the discharge air is not dispersed into the atmosphere but is conveyed into the region of the suction opening, characterized by a filtration system with low flow resistance and by a diverging portion, which have the objective of a reduction in the power of the compressor unit, in energy and in noise.

3. A robot vacuum cleaner, characterized in that the discharge air is not dispersed into the atmosphere but is conveyed into the region of the suction opening.

4. A robot vacuum cleaner which, by benefiting from the advantages resulting from Claim 2, that is, reduced power and energy absorbed and low noise, permits greater autonomy of the structure, greater compactness, shorter recharging times and the ability to operate in particularly noise-sensitive situations.

Fig. 1

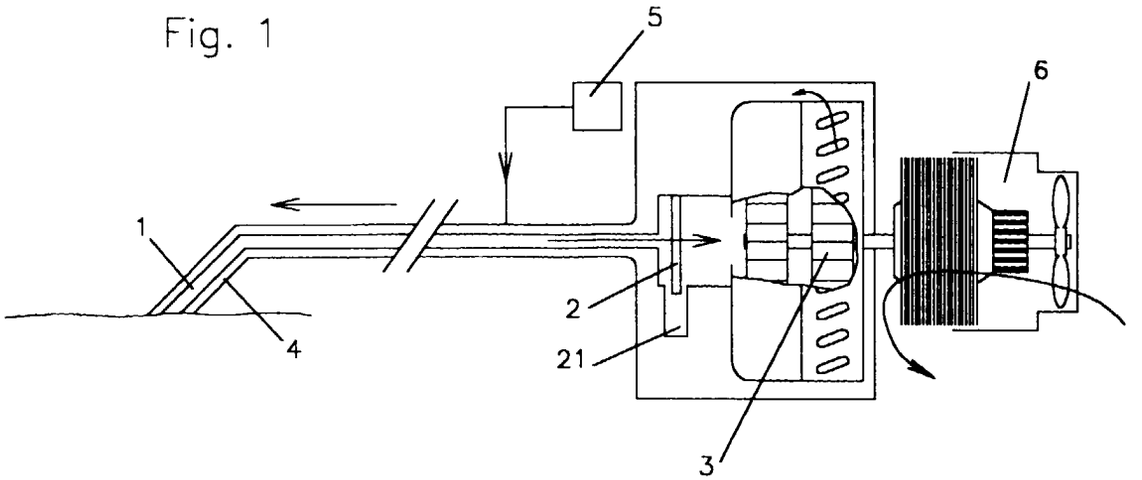


Fig. 2

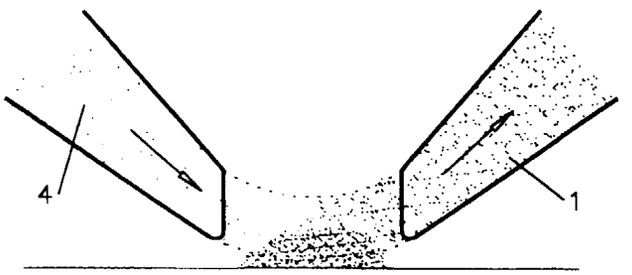
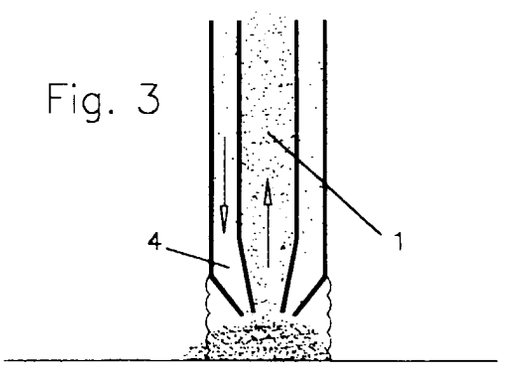


Fig. 3



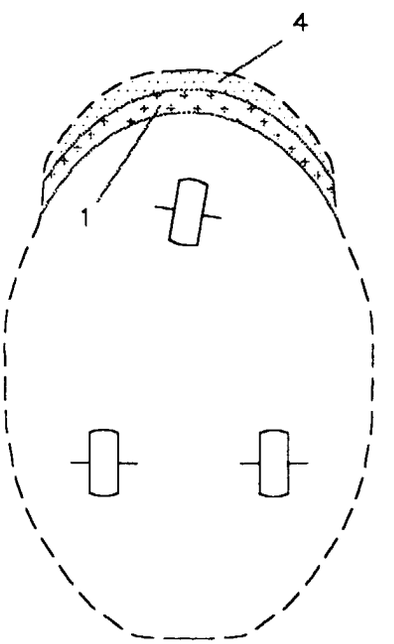


Fig. 4