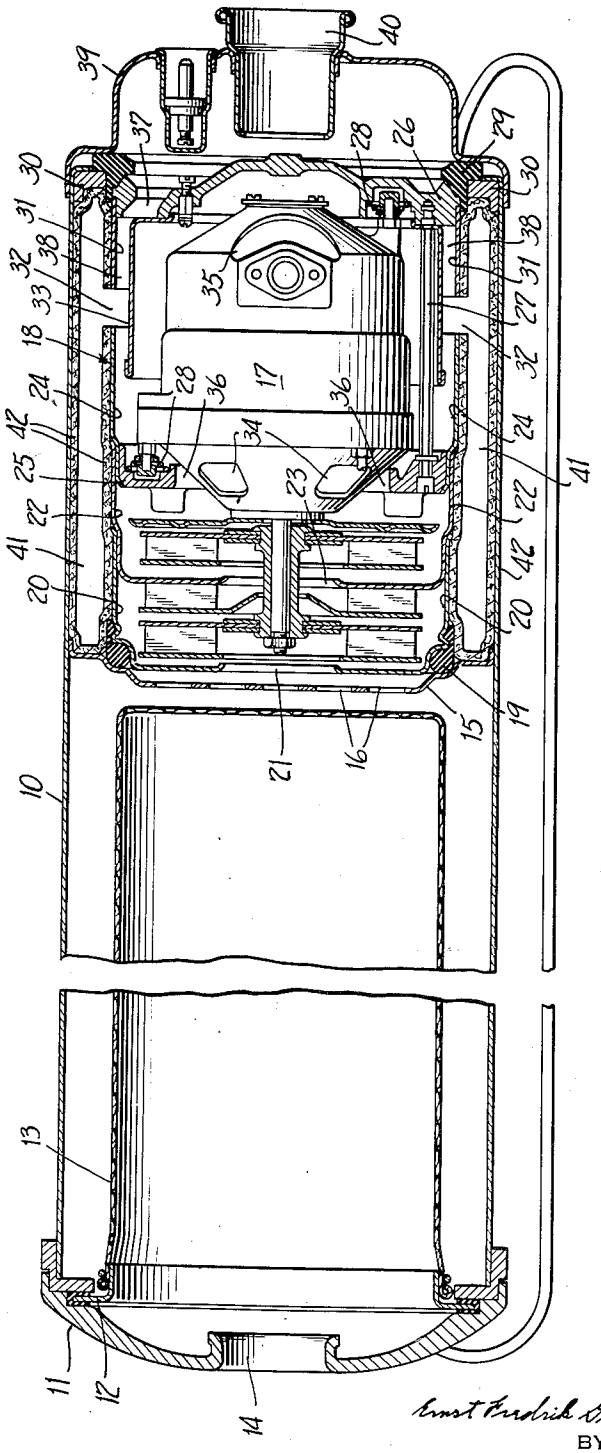
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VACUUM CLEANER

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VACUUM CLEANER

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My invention relates to vacuum cleaners and more particularly to means for reducing noise produced by the operation of the vacuum cleaner.

In order to do this I make use of the principles employed in a Helmholt resonator. In accordance with my invention the vacuum cleaner is constructed with one or more spaces which are entirely closed except for a passage connecting them with the channel through which the air propelled by the fan of the vacuum cleaner is flowing. Such space or spaces and the passages are so dimensioned with respect to each other and to said channel that the natural resonant frequency of the space falls within the range of the dominant frequencies of the air which flows through the channel, that is, the frequencies which have the greatest intensity. If this is done, it has been determined that the effect is to dampen the sound waves present in the air flowing through the channel and thus the noise transmitted by the air is greatly reduced.

Among the objects of my invention, is to provide means for accomplishing the above result, which means may be incorporated in a vacuum cleaner without increasing the size thereof. Another object is to provide such an arrangement which at the same time does not increase the resistance of flow of air through the cleaner.

Further objects and advantages of my invention considered in connection with the accompanying drawing, which forms part of this specification and shows a cross-sectional view of a preferred embodiment of my invention.

Referring to the drawing, reference character 10 designates the outer casing of a vacuum cleaner. Removably secured to one end of the casing 10 is a cover member 11 which, when in place, clamps a dust bag ring 12 between itself and the end of the casing. Ring 12 carries a dust bag 13 which is pervious with respect to air but imperverious with respect to dust. Cover 11 is formed with an opening 14 to which may be secured a hose or the like leading to a cleaning nozzle.

Mounted within casing 10 to the right of the dust bag as viewed in the figure, is a transverse partition 15, the more central part of which is formed with perforations 16. Partition 15 serves as a support for one end of a motor-fan unit which consists of a motor 17 mounted in a hollow cylindrical structure designated generally by reference character 18. A ring 19 of rubber or other resilient material engages one end of structure 18 and a groove formed in partition 15 to support the structure. That portion of partition 15 radially beyond the ring 19 is imperforate. Structure 18 includes a cup shaped member 20 formed with an intake 21 for the fan. This member telescopes with a similar member 22 formed with an intake 23 for the second stage of the fan. Member 22 in turn telescopes over a cylindrical member 24. The members 20, 22 and 24 are secured together in air-tight relationship. Fixed within the member 24 is a motor suspension ring 25 which is rigidly secured to a motor suspension wall 26 by means of tie bolts 27. The motor 17 is resiliently supported from ring 25 and wall 26 by means of coil springs 28. Wall 26 is supported within the casing 10 by means of a resilient ring 29 carried by a rigid ring 30.

A cylindrical member 31 is supported by wall 26 and is axially in alignment with cylindrical member 24 but is spaced therefrom so as to form an annular gap 32. The outer casing 10, partition 15, cylindrical structure 18 and ring 30 thus form a space 41 which is entirely closed except for the gap 32, which connects this space with the interior of the hollow structure 18. A cylindrical member 33 is carried by wall 26 within the hollow structure 18 and extends from the wall to a point beyond the gap 32.

The housing of motor 17 is formed at the end adjacent to the fan with openings 34, while the other end of the housing is formed with openings 35. These openings permit the flow of air within the housing for the purpose of cooling the motor. A comparatively narrow annular space 36 is provided between the motor suspension ring 25 and the motor housing, whereby some of the air may flow around the outside of the housing. The motor suspension wall 26 is provided with openings 37 which communicate with the channel 38 formed between the hollow structure 18 and the cylindrical member 33.

An end cap 39 is secured to the casing and is provided with an exhaust opening 40, through which the air entering the cap 39 by the openings 37 may escape to the atmosphere. If it is desired to use the device for blowing purposes, a hose or the like may be connected to the exhaust opening 40.

The above described device operates as follows:

Upon rotation of the fan by means of motor 17, air is caused to be drawn in through the inlet opening 14 in the cover member 11. If a hose and cleaning nozzle is connected to the inlet 14 and the nozzle is passed over a dusty surface, the air will carry with it dust picked

up from the surface. The dust is deposited within the dust bag 13, the air passing therethrough to the inlet of the fan 21. This air is acted upon by the first impeller and flows through the inlet 23 to the second stage of the fan and is discharged at the periphery of the second impeller.

The air discharged from the fan passes chiefly through the openings 34 to within the housing 17 from whence it passes through the openings 35 to within the space enclosed by the wall 26 and the cylindrical member 33. The air then passes around the left hand end of the member 33 and thence to the right as viewed in the figure, through the passage 38 formed between the member 33 and the hollow structure 18. This air passes from this channel through the openings 37 to within the end cap 39 and is finally discharged to the atmosphere through the exhaust opening 40.

Sound waves are present in the air flowing through channel 38, being caused by the rotation of the impeller, the rotation of the motor, and the movement of the air through the various passages. The natural resonant frequency of the space 41 is dependent upon its dimensions and upon the dimensions of the gap 32. If this frequency is the same as the frequency of the sound waves of major intensity in the air passing through the channel 38 it will dampen such sound waves and greatly reduce their intensity. Of course, the sound waves are not all of the same frequency, but measurements are taken to determine the range of the frequencies of the sound waves in the air passing through the channel 38, and the space 41 and the gap 32 are then dimensioned so that the natural resonant frequency of the space 41 falls within this range and preferably within the range of the most intense or dominant sound waves, with the result that the sound waves are dampened and practically eliminated.

Moreover, the ability of the space 41 to dampen sound waves increases with an increase in its volume, and therefore it is desirable to have it as large as possible, while maintaining the proper natural resonant frequency by suitably dimensioning the gap 32. As a general rule, the cross-sectional area of this gap should be at least as great as the cross-sectional area of the channel 38.

Due to the provision of the annular space 36 between the motor suspension ring 25 and the motor housing, a portion of the air discharged by the fan flows directly therethrough to the channel 38, thus reducing the back pressure of the fan. Sound waves present in the air passing through this space 36 are dampened as the air passes through the channel 38 in the same manner as are the waves present in the air which passes first through the motor housing and then to the channel 38 around the end of cylindrical member 33.

Due to the fact that the outer diameter of the motor housing is less than the outer diameter of the fan impellers, space is provided for the channel 38 without increasing the diameter of the motor-fan unit. Thus, a maximum volume is obtained for the space 41 between the motor-fan unit and the casing 10.

If desired, the space 41 may be lined with a sound insulating material 42 in order to further reduce the noise emitted by the vacuum cleaner.

While I have illustrated and described one more or less specific embodiment of my invention, it is to be understood that this has been done for the purpose of illustration only and that the scope of my invention is not to be limited thereby, but is to be determined by the appended claims.

What I claim is:

1. In a vacuum cleaner, a casing, hollow structure within and spaced from said casing to form a space therebetween, a hollow member within and spaced from said hollow structure to form a channel therebetween, an electric motor within said hollow member, and a fan driven by said motor for producing flow of air through said channel, said hollow structure being formed with an opening connecting said space with said channel and said space being otherwise closed, said opening and said space being so dimensioned with respect to each other and to said channel that the natural resonant frequency of said space is within the range of dominant frequencies of the air flowing through said channel.

2. In a vacuum cleaner, a casing, hollow cylindrical structure within and spaced from said casing to form a space therebetween, a motor mounted within one end of said structure and spaced from said structure to form a channel therebetween, and a fan impeller mounted on the shaft of said motor within the other end of said structure, said structure serving as a fan housing, said one end of said structure being formed with a passage connecting said channel with said space, said space being otherwise closed, said opening and said space being so dimensioned with respect to each other and to said channel that the natural resonant frequency of said space is within the range of dominant frequencies of the air flowing through said channel.

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