IMPROVED VACUUM CLEANING SYSTEM

BACKGROUND

This application relates to a vacuum cleaning system.

A conventional vacuum cleaner 100, referring to Figure 1, includes a suction nozzle 110, a flexible hose 120 connected to the suction nozzle 110, a pipe 130 connected to the flexible hose 120, a dirt collection chamber 140 connected to the pipe 130, and an exhaust pipe 170 connected to the dirt collection chamber 140. A filter 150 is mounted on a wall on the down stream side of the direct collection chamber 140. An electric blower 160 coupled to the exhaust pipe 170 is configured to create exhaust vacuum behind the dirt collection chamber 140 and to produce a suction air stream. Air carrying dirt can be suctioned into the suction nozzle 110, flowing through the hose 120 and the pipe 130, into the dirt collection chamber 140. A majority of the dirt 145 is filtered by the filter 150 and collected in the dirt collection chamber 140. Air is exhausted through the exhaust pipe 170 and out of the vacuum cleaner 100.

A drawback for the above described conventional vacuum cleaner is that it is often ineffective in removing dirt hidden behind objects, in narrow spaces, or non-flat surfaces such as computer keyboard, computer vent, car dashboard, or non-flat filters. In these situations, the air current drawn into the suction nozzle often cannot reach some areas where the dirt is located. A narrow suction nozzle tip is usually not small enough for it to reach some of these narrow spaces (e.g. in the case of a computer key board) and cannot cover enough area (e.g. in the case of a car dashboard).

Another drawback for the above described conventional vacuum cleaner is that it is often ineffective in removing dirt adhered to a surface. The suction force at the suction nozzle is often not strong enough to detach the dirt from the underlying surface in these situations.

Another drawback for the above described conventional vacuum cleaner is that any residual dirt that is not stopped by the filter is blown right back into the air, which not only results in incomplete cleaning, but can also cause allergy problems to people residing in the ambient environment.

There is therefore a need to provide a more effective vacuum cleaning system to overcome the above described drawbacks.

SUMMARY

In a general aspect, the present invention relates to a vacuum cleaning system that includes a nozzle assembly comprising a first nozzle and a second nozzle, a first air conduit in communication with the first nozzle, an air blower that can produce a suction air stream into the first nozzle and through the first air conduit and produce an exhaust air stream out of the second nozzle, a dirt separation member that can stop dirt in the suction air stream and to allow the exhaust air stream to pass through the dirt separation member, a dirt collection chamber that can collect the dirt in the suction air stream, and a second air conduit that can guide the exhaust air stream to the second nozzle.

In another general aspect, the present invention relates to a vacuum cleaning system that includes a first nozzle that can receive a suction air stream, a first air conduit in communication with the first nozzle, a second nozzle that can output an exhaust air stream, a second air conduit that can guide the exhaust air stream to the second nozzle, an air blower that can produce the suction air stream in the first air conduit and to produce the exhaust air stream in the second air conduit, an exhaust air regulator that can exhaust at least a portion of the exhaust air stream and to vary the amount of the exhaust air stream exiting the second nozzle, a dirt separation member that can stop dirt in the suction air stream and to allow the exhaust air stream to pass through the dirt separation member, and a dirt collection chamber that can collect the dirt in the suction air stream.

Implementations of the system may include one or more of the following. At least one of the first nozzle or the second nozzle is moveable to allow the distance between the first nozzle and the second nozzle to be adjusted. The vacuum cleaning system can further include an exhaust air regulator that can exhaust at least a portion of the exhaust air stream, wherein the exhaust air regulator can vary the amount of the exhaust air stream exiting the second nozzle. The vacuum cleaning system can further include a hose through which the first air conduit and the second conduit are disposed. The first air conduit and the second conduit are separable. At least one of the first air conduit and the second conduit comprises a flexible

hose. The vacuum cleaning system can further include a first pipe in connection with the first air conduit in the hose and the dirt collection chamber; and a second pipe in connection with the second air conduit in the hose and the dirt collection chamber, wherein the air blower is coupled to the second pipe. The first pipe, the second pipe, and the dirt collection chamber in part form a close loop. The vacuum cleaning system can further include an exhaust air regulator coupled to the second pipe and that can exhaust at least a portion of the exhaust air stream, wherein the exhaust air regulator can vary the amount exhaust air stream exiting the second nozzle. The exhaust air regulator can include one or more openings along the second pipe, wherein the one or more opening can exhaust at least a portion of the exhaust air stream and a cover can cover the one or more openings to regulate the amount of the exhaust air stream exhausted through the one or more openings.

Embodiments may include one or more of the following advantages. The disclosed vacuum cleaning system can overcome some drawbacks in conventional vacuum cleaners. An advantage of the disclosed vacuum cleaning system is that it is effective in removing dirt hidden behind objects, in narrow spaces, and non-flat surfaces. The disclosed vacuum cleaning system is also more effective in removing dirt adhered to a surface.

Another advantage of the disclosed vacuum cleaning system is that it provides additional air blowing function in additional to the vacuum cleaning function, which makes it effective for removing dirt as well as collecting dirt.

Yet another advantage of the disclosed vacuum cleaning system is that it is energy efficient. Part of the energy in the exhaust air stream can be recycled to assist the movement of the suction air current. The improved energy efficiency may lead to smaller motor size for the air blower and weight reduction for the vacuum system.

Still another advantage of the disclosed vacuum cleaning system is that it can re-collect the residual dirt that passes through the filter and thus is more effective in dirt collection. The exhaust air can thus be cleaner and the dirt removal more comprehensive than some conventional vacuum cleaners.

Although the invention has been particularly shown and described with reference to multiple embodiments, it will be understood by persons skilled in the relevant art that various

changes in form and details can be made therein without departing from the spirit and scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The following drawings, which are incorporated in and form a part of the specification, illustrate embodiments of the present invention and, together with the description, serve to explain the principles of the invention.

Figure 1 is a schematic diagram of a conventional vacuum cleaner.

Figure 2A is a schematic diagram of an implementation of a vacuum cleaning system in accordance with the present invention.

Figure 2B is a schematic diagram of the vacuum cleaning system of Figure 2A wherein the exhaust air regulator is in a different position.

Figure 2C is a schematic diagram of the vacuum cleaning system of Figure 2A wherein the exhaust air regulator is in yet another different position.

Figure 3 is a schematic side view of the vacuum cleaning system of Figure 2A in a vacuum cleaning operation.

Figure 4 is a schematic top view of the vacuum cleaning system of Figure 2A showing the flow directions of the suction air and the blown air.

Figure 5 is a schematic diagram of the vacuum cleaning system of Figure 2A wherein the air suction nozzle and the air blowing nozzles are positioned apart.

Figure 6 is a schematic diagram of another implementation of a vacuum cleaning system in accordance with the present invention.

DETAILED DESCRIPTION

Referring to Figure 2A, a vacuum cleaning system 200 includes a suction nozzle 210, a flexible hose 220, a suction pipe 230, a dirt collection chamber 240 connected to the suction pipe 230, and an exhaust pipe 270 connected to the dirt collection chamber 240. A dirt separation member 250 such as a filter is mounted on the down stream side of the direct collection chamber 240. The flexible hose 220 includes two air conduits 221 and 222. The air conduit 221 connects the suction nozzle 210 and the suction pipe 230. The exhaust pipe 270

connects to the air conduit 222 via a turn-around path 278. The air conduit 222 is connected to an exhaust nozzle 290. The suction nozzle 210 is connected to the air conduit 221 via a connection member 211 while the exhaust nozzle 290 is connected to the air conduit 222 via connection member 291. The ends of the air conduits 221, 222 are closed. The suction nozzle 210, the exhaust nozzle 290, and their connections to the hose 220 form a nozzle assembly 215.

An electric blower 260 is coupled to the exhaust pipe 270 at the downstream side of the dirt collection chamber 240. The electric blower 260 is configured to create exhaust vacuum behind the dirt collection chamber 240 to create a suction air stream 235 along the suction pipe 230 and an exhaust air stream 275 along the exhaust pipe 270. Air carrying dirt is suctioned into the suction nozzle 210, flowing through the air conduit 221 and the suction pipe 230, into the dirt collection chamber 240. Majority of the dirt 245 in the suction air is stopped by the dirt separation member 250 and collected in the dirt collection chamber 240. The exhaust air stream 275 is guided by the turn-around path 278 to the air conduit 222, and blown out of the exhaust nozzle 290. The suction pipe 230, the exhaust pipe 270, and the dirt collection chamber 240 in part form a close loop. In one implementation, the close loop forms a circular path.

The vacuum cleaning system 200 is capable of suctioning air into the suction nozzle 210 and collecting the dirt carried by the suction air stream in the dirt collection chamber 240. The vacuum cleaning system 200 can also blow exhaust air using the exhaust nozzle 290. The air blowing function can help blow out dirt hidden behind objects, in narrow spaces, and non-flat surfaces, which can be subsequently suctioned into the suction nozzle 210.

Referring to Figures 3 and 4, air blown out of the exhaust nozzle 290 can be directed to push the dirt 245 in a cleaning area 310 on a surface 300. The direct 245 is moved toward the suction nozzle 210. The suction nozzle 210 suctions air to draw the dirt 245 into the suction nozzle 210. The combination “pushing and moving” force and the “suction” force make the disclosed vacuum cleaning system more effective than some conventional vacuum cleaner systems.

The air blowing function is effective for cleaning objects such as computer keyboard, car dash board, car seat, and carpets, etc. The vacuum cleaning system 200 can also be used

to assist removing dirt adhered to a surface. Some dirt is stuck to a surface too strongly to be detached by vacuum suction alone. The blown air out of exhaust nozzle 290 can help detach the dirt from the underlying surface, and then removed by suction by the suction nozzle 210.

Another advantageous feature of the vacuum cleaning system 200 is that the exhaust air is recycled to the vicinity of the suction nozzle 210. At least a portion of the residual dirt that passed through the dirt separation member 250 can be re-collected to go through a second and a third filtering event. The exhaust air is thus cleaner and dirt removal more exhaustive than some conventional vacuum cleaners.

The vacuum cleaning system 200 can be more energy efficient. As shown in Figures 3 and 4, part of the momentum of the blown air (i.e. the exhaust air) can be recycled to accelerate the suction air into the suction nozzle 210. The improved energy efficiency can also lead to smaller motor size in the blower 260 and potentially reduce weight for the vacuum cleaning system.

In some embodiments, referring to Figures 2A-2C, the vacuum cleaning system 200 can further include an air regulation system 280 that is configured to regulate the exhaust of the exhaust air stream 275 along the exhaust pipe 270. The air regulation system 280 can be implemented in many forms, and can be operated manually or with electric power. For example, the air regulator can include holes 285 that allow air to be exhausted out of the exhaust pipe 270. The holes 285 can be clear or installed with secondary air filters. A sliding cover 282 can be manually moved along a direction 288 to different positions along the pipe 270 to expose the holes 285, or cover some or all the holes 285. The air blowing strength is at maximum when all the holes 285 are blocked (Figure 2C), and is the least strong when all holes are exposed to let some exhaust air out. The amount and the strength of the exhausted air out of the exhaust nozzle 290 can thus be adjusted by allowing different amount of the air to be exhausted through the holes 285.

In some embodiments, referring to Fig. 3, the exhaust nozzle 290 can be mounted to the connection member 291 in rotatable joint. The suction nozzle 210 can also be mounted to the connection member 211 in rotatable joint. The exhaust nozzle 290 can thus be positioned apart from the suction nozzle 210 so that air blowing can be performed at a distance away the air suction.

Referring to Figs. 2A-3, the exhaust nozzle 290 can exist in different shapes to maximize blowing intensity. For example, the exhaust nozzle 290 can have a narrower opening than that of the suction nozzle 210 to produce strong air blowing power. The suction nozzle 210 and the exhaust nozzle 290 can be replaceable to allow different nozzles to be mounted for different cleaning situations.

In some embodiments, referring to Figure 3, a vacuum cleaning system 300 includes two separate air conduits 221 and 222 respectively connected to the suction nozzle 210 and the exhaust nozzle 290. The air conduits 221 and 222 can be formed by flexible hoses, which allows a user to flexibly position and orient the exhaust nozzle 290 for blow exhaust air and to position the suction nozzle 210 to remove dust without being constrained by the position of the exhaust nozzle 290.

It is understood that the present invention is described above with reference to exemplary embodiments. It will be apparent to those skilled in the art that various modifications may be made and other embodiments can be used without departing from the broader scope of the present invention. Therefore, these and other variations upon the exemplary embodiments are intended to be covered by the present invention. For example, the exhaust air regulator can be implemented in forms different from the example illustrated above. Moreover, the disclosed vacuum cleaning system is compatible with different configurations of the air conduits for the suction air and the exhaust air. For example, the exhaust air can be guided to the exhaust nozzle by a separate hose or pipe instead of sharing the same hose with the suction air as illustrated in the drawings of the present application.

What is claimed is:

1. A vacuum cleaning system, comprising:

a nozzle assembly comprising a first nozzle and a second nozzle;

a first air conduit in communication with the first nozzle;

an air blower configured to produce a suction air stream into the first nozzle and through the first air conduit, and to produce an exhaust air stream out of the second nozzle;

a dirt separation member configured to stop dirt in the suction air stream and to allow the exhaust air stream to pass through the dirt separation member;

a dirt collection chamber configured to collect the dirt in the suction air stream; and

a second air conduit configured to guide the exhaust air stream to the second nozzle.

2. The vacuum cleaning system of claim 1, wherein at least one of the first nozzle or the second nozzle is moveable to allow the distance between the first nozzle and the second nozzle to be adjusted.

3. The vacuum cleaning system of claim 1, further comprising an exhaust air regulator configured to exhaust at least a portion of the exhaust air stream, wherein the exhaust air regulator is configured to vary the amount of the exhaust air stream exiting the second nozzle.

4. The vacuum cleaning system of claim 1, further comprising a hose through which the first air conduit and the second conduit are disposed.

5. The vacuum cleaning system of claim 1, wherein the first air conduit and the second conduit are separable.

6. The vacuum cleaning system of claim 1, wherein at least one of the first air conduit and the second conduit comprises a flexible hose.

7. The vacuum cleaning system of claim 1, further comprising:

a first pipe in connection with the first air conduit in the hose and the dirt collection chamber; and

a second pipe in connection with the second air conduit in the hose and the dirt collection chamber, wherein the air blower is coupled to the second pipe.

8. The vacuum cleaning system of claim 7, wherein the first pipe, the second pipe, and the dirt collection chamber in part form a close loop.

9. The vacuum cleaning system of claim 1, further comprising an exhaust air regulator coupled to the second pipe and configured to exhaust at least a portion of the exhaust air stream, wherein the exhaust air regulator is configured to vary the amount exhaust air stream exiting the second nozzle.

10. The vacuum cleaning system of claim 9, wherein the exhaust air regulator comprises:

one or more openings along the second pipe, wherein the one or more opening are configured to exhaust at least a portion of the exhaust air stream; and

a cover configured to cover the one or more openings to regulate the amount of the exhaust air stream exhausted through the one or more openings.

11. A vacuum cleaning system, comprising:

a first nozzle configured to receive a suction air stream;

a first air conduit in communication with the first nozzle;

a second nozzle configured to output an exhaust air stream;

a second air conduit configured to guide the exhaust air stream to the second nozzle;

an air blower configured to produce the suction air stream in the first air conduit and to produce the exhaust air stream in the second air conduit;

an exhaust air regulator configured to exhaust at least a portion of the exhaust air stream and to vary the amount of the exhaust air stream exiting the second nozzle;

a dirt separation member configured to stop dirt in the suction air stream and to allow the exhaust air stream to pass through the dirt separation member; and

a dirt collection chamber configured to collect the dirt in the suction air stream.

12. The vacuum cleaning system of claim 11, wherein at least one of the first nozzle or the second nozzle is moveable to allow the distance between the first nozzle and the second nozzle to be adjusted.

13. The vacuum cleaning system of claim 11, further comprising a flexble hose through which the first air conduit and the second conduit are disposed.

14. The vacuum cleaning system of claim 11, wherein the first air conduit and the second conduit are separable.

15. The vacuum cleaning system of claim 11, further comprising:

a first pipe in connection with the first air conduit in the hose and the dirt collection chamber; and

a second pipe in connection with the second air conduit in the hose and the dirt collection chamber, wherein the air blower is coupled to the second pipe.

16. The vacuum cleaning system of claim 15, wherein the first pipe, the second pipe, and the dirt collection chamber in part form a close loop.

17. The vacuum cleaning system of claim 11, further comprising an exhaust air regulator coupled to the second pipe and configured to exhaust at least a portion of the exhaust air stream, wherein the exhaust air regulator is configured to vary the amount exhaust air stream exiting the second nozzle.

18. The vacuum cleaning system of claim 17, wherein the exhaust air regulator comprises:

one or more openings along the second pipe, wherein the one or more opening are configured to exhaust at least a portion of the exhaust air stream; and

a cover configured to cover the one or more openings to regulate the amount of the exhaust air stream exhausted through the one or more openings.

19. The vacuum cleaning system of claim 11, wherein at least a portion of the first air conduit and the second conduit is flexible

ABSTRACT

A vacuum cleaning system includes a nozzle assembly comprising a first nozzle and a second nozzle, a first air conduit in communication with the first nozzle, an air blower that can produce a suction air stream into the first nozzle and through the first air conduit and produce an exhaust air stream out of the second nozzle, a dirt separation member that can stop dirt in the suction air stream and to allow the exhaust air stream to pass through the dirt separation member, a dirt collection chamber that can collect the dirt in the suction air stream, and a second air conduit that can guide the exhaust air stream to the second nozzle.