TURBINE FOR VACUUM DRIVEN TOOLS

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ABSTRACT

An improved turbine for vacuum driven tools provides higher speed and power output while reducing problems such as the clogging and stopping of the turbine due to dust and debris. The turbine has a closed bottom and open sides and top, and draws air in through the sides and out through the top of the turbine.
FIG. 1
(Prior Art)
TURBINE FOR VACUUM DRIVEN TOOLS

BACKGROUND OF THE INVENTION

[0001] The Field of the Invention

[0002] The present invention relates to vacuum driven tools, such as sanders or the like. More specifically, the present invention relates to an improved turbine for vacuum driven tool.

[0003] State of the Art

[0004] A variety of vacuum driven tools are currently manufactured and used. Instead of using an electric motor or compressed air as a power source, vacuum driven tools use a vacuum to move air through and rotate a turbine. Rotation of the turbine drives the operative part of the tool. Although there are many different vacuum driven tools, the present application will discuss a vacuum driven sander as an example of such a tool.

[0005] U.S. Pat. No. 6,347,985 to Loveless shows an existing turbine design as used in a vacuum driven sander, and is incorporated herein to the extent that it is not inconsistent with the present application for describing the operation of vacuum tools including vacuum sanders.

[0006] It is desirable for any tool to have sufficient power for operation of the tool. For many types of tools, the power supply may simply be increased to provide greater power. Electric tools may be simply provided with a larger motor. Compressed air tools may be operated at a higher pressure, and are often operated at pressures of about 100 psi. Vacuum driven tools, however, are limited in the available power to drive the tool. Vacuums, such as canister vacuums, are typically capable of producing a vacuum pressure of about 5 psi. The operator is unable to simply increase the driving pressure, as the vacuum simply cannot maintain a higher pressure differential. Additionally, vacuum driven tools are limited by the conduit drawing air to the vacuum, which is typically a 1.25 inch hose. It will be appreciated that vacuum driven tools may be provided with greater power by providing a tool with a turbine which is more efficient and more powerful.

[0007] There is thus a need for an improved turbine. Specifically, there is a need for an improved turbine which is more efficient and which provides greater power and improved operation over existing turbines.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to provide an improved turbine for vacuum driven tools to thereby provide vacuum driven tools with a higher power output.

[0009] According to one aspect of the invention, a vacuum driven tool and turbocharger is provided where air flows through the side of the turbine and out the top of the turbine. The turbine may be formed with a solid bottom layer, a center portion, and a plurality of vanes. Air flowing in the open sides of the turbine, through the vanes, and out the top of the turbine causes the turbine to spin and drive the tool.

[0010] These and other aspects of the present invention are realized in a vacuum driven tool and improved turbine as shown and described in the following figures and related description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Various embodiments of the present invention are shown and described in reference to the numbered drawings wherein:

[0012] FIG. 1 shows a side view of a turbine known in the prior art;

[0013] FIG. 2 shows a top view of a prior art vacuum driven sander body;

[0014] FIG. 3 shows a partially cut-away perspective view of a prior art vacuum driven sander;

[0015] FIG. 4 shows a turbine for a vacuum driven tool according to the present invention;

[0016] FIG. 5 shows a top view of the body of a vacuum driven sander according to the present invention; and

[0017] FIG. 6 shows a partially cut-away side view of a vacuum driven sander according to the present invention.

[0018] It will be appreciated that the drawings are illustrative and not limiting of the scope of the invention which is defined by the appended claims. The embodiments shown accomplish various aspects and objects of the invention. It is appreciated that it is not possible to clearly show each element and aspect of the invention in a single FIGURE, and as such, multiple figures are presented to separately illustrate the various details of the invention in greater clarity.

DETAILED DESCRIPTION

[0019] The invention and accompanying drawings will now be discussed in reference to the numerals provided therein so as to enable one skilled in the art to practice the present invention. The drawings and descriptions are exemplary of various aspects of the invention and are not intended to narrow the scope of the appended claims.

[0020] Turning now to FIG. 1, a prior art turbine for a vacuum driven sander is shown. The turbine 10 includes a closed upper surface 14, a closed lower surface 18, and a plurality of vanes 22 radiating outwardly from a central spindle (not shown). Air moving around the circumference of the turbine 10, indicated by arrow 24, engages the vanes 22 and causes the turbine to spin. The turbine 10 is shown in the body 26 of a vacuum driven sander as shown in FIG. 2. Air is drawn up through openings 30 in the body 26. The air is drawn around the sanding pad (not shown) before passing through the openings 30 and thus carries sanding dust away from the surface being sanded.

[0021] After moving through the openings 30, the air moves through passages 34 which direct the air into a circular motion tangential to the turbine 10, as shown by arrows 38. The closed upper surface 14 and closed lower surface 18 (FIG. 1) of the turbine 10 cause the air to intermix with the turbine vanes 22, causing the turbine 10 to rotate in a clockwise direction with the air flow.

[0022] The turbine 10 thus functions in a manner similar to a waterwheel. As the air moves towards the distal ends 42 of the passages 34, it moves upwardly (out of the page) through a top cover (not shown) and into a vacuum hose. Although the turbine 10 functions relatively well, the sander could benefit from an improved turbine which provides additional power and operates the sander at a higher speed.

[0023] FIG. 3 shows another prior art vacuum driven sander 46 and turbine 50. The turbine 50 utilizes a center spindle 54, vanes 58, and a shroud 62 to channel air through an open bottom (indicated at 66), up through the turbine 50, and out an open top (indicated at 70). The turbine 50 is problematic in that it tends to clog easily and cease to function. Sanding debris tends to accumulate between the vanes 58, the shroud 62, and the sander body 44 and prevent the rotation of the
turbine 50. The close tolerances required for good turbine operation allow the turbine 50 to easily become clogged even by small pieces of debris.

[0024] Turning now to FIG. 4, a side view of an improved turbine of the present invention is shown. The turbine 82 has a spindle 86 with a plurality of vanes 90 extending outwardly therefrom. The turbine 82 has a closed bottom plate 94 which prevents airflow through the bottom of the turbine. In operation, air is drawn into the turbine vanes 90 (as the sides of the turbine are open) tangentially to the circumference of the turbine and then upwardly through the open top (indicated at 98) of the turbine 82, as indicated by arrow 102. According to a present configuration, the diameter of the spindle 86 may be between about 25 percent and 75 percent of the diameter of the turbine 82. More preferably, the diameter of the spindle 86 may be between about 25 percent and 50 percent of the diameter of the turbine 82.

[0025] FIG. 5 shows a top view of the body 106 of a vacuum driven sander having the turbine 82 mounted therein. The top view of the turbine 82 illustrates how the vanes 90 extend outwardly from the spindle 86 in a radial pattern. The vanes 90 often have a curved shape, but the number and shape of the vanes may be varied according to the particular application. The turbine 82 is mounted to a shaft 110, such as by nut 114, which allows the turbine to rotate and also couples the turbine to the sanding pad.

[0026] Air is drawn from around the sanding pad and up through openings 118 in the body 106. After passing through the openings 118, the air moves into air passages 122 which direct the air towards the turbine 82 in a direction generally tangential to the turbine. The turbine 82 spins as the air engages the vanes 90. As the air moves towards the distal ends 130 of the passages 122, the air is drawn towards the center of the turbine 82 and passes through the open upper surface 98 of the turbine.

[0027] FIG. 6 shows a partially cut-away side view of a vacuum driven sander with an improved turbine according to the present invention. The sander 134 includes the sander body 106 and turbine 82 as previously discussed, and is also shown with a top cover 138, vacuum port 142, and sanding pad 146. The turbine 82 is connected to the sanding pad 146 via the shaft 110.

[0028] Typically, the shaft 110 is connected to a drive member 150 which includes an off-centered (eccentric) drive pin 154 which engages the sanding pad 146 and causes the sanding pad to move in a small circular or orbital motion as the drive member 150 rotates. The drive member 150 may also include a counter weight 158 which offsets the moving weight of the sanding pad 146 and helps to reduce vibration. The sanding pad 146 is typically attached to the body 106 by flexible mounts (not shown) such as elongate standoffs which allow the sanding pad to move relative to the body.

[0029] The vacuum port 142 is connected to a vacuum, typically to the vacuum hose or to an extension wand, to draw air through the sander. The air is drawn into the base of the sander body 106 around the sanding pad 146 and possibly through holes in the sanding pad. As such, the air flow captures the sanding dust and debris. The air is drawn through the openings 118 and passages 122 as shown by arrows 126, and as discussed above.

[0030] As discussed above, the passages 122 direct the air tangentially towards the turbine 82. The turbine 82 rotates as the air engages the vanes 90 (not numbered for clarity). The air moves into the sides of the turbine 98 and curves upwardly to exit the open top 98 (see FIG. 4) of the turbine. The air passes from the turbine 82 into a passage 162 in the top cover 138 and into the vacuum port 142, as shown by arrow 166. As shown, the vacuum port 142 may include a ball end 170 or the like to allow the vacuum port to pivot in the top cover 138, allowing the vacuum port to be oriented as desired.

[0031] The improved turbine 82 of the present invention is advantageous over prior art turbines 10, 50. The turbine 82 is able to achieve a higher speed and power output than existing turbines 10, 50 when driven by the same vacuum source. Additionally, the turbine 82 avoids problems such as the clogging and stopping of the turbine from dust and debris.

[0032] There is thus disclosed an improved turbine for vacuum driven power tools. It will be appreciated that numerous changes may be made to the present invention without departing from the scope of the claims.

1. A vacuum driven power tool comprising:
   a. a turbine mounted in the body, the turbine comprising a base, a central spindle connected to the base and extending upwardly therefrom so as to prevent air from passing to the inside of the spindle, and a plurality of vanes extending between the base and spindle and connected to the base and the spindle, the turbine having sides which are open along the height thereof above the base and a top which is open along the width thereof outside of the spindle such that the vanes are exposed along the outside sides and top thereof;
   b. a power tool output operatively connected to the turbine;
   c. a vacuum port attached to the body and configured for connection to a vacuum; and
   d. at least one passage for directing air through the body, into the sides of the turbine and out of the top of the turbine by flowing between the sides of the plurality of vanes and out of the turbine between the tops of the plurality of vanes to thereby rotate the turbine, and through the vacuum port and into a vacuum.

2. The power tool of claim 1, further comprising a top cover attached to the body, and wherein the vacuum port is attached to the top cover.

3. The power tool of claim 1, wherein the vacuum tool is a sander and comprises a sanding pad attached to the body via an eccentric drive.

4. The power tool of claim 3, wherein the turbine is disposed in the middle of the body, and wherein the at least one passage comprises at least two passages extending inwardly from opposing sides of the body and extending around a portion of the perimeter of the turbine such that the sides of the turbine are generally open to at least two passages.

5. The power tool of claim 1, wherein the turbine base comprises a closed bottom plate so as to prevent the passage of air therethrough.

6. The power tool of claim 5, wherein the plurality of vanes are curved.

7. The power tool of claim 5, wherein the spindle diameter is between 25 percent and 75 percent of the turbine diameter.

8. The power tool of claim 5, wherein the spindle diameter is between 25 percent and 50 percent of the turbine diameter.

9. A vacuum driven power tool comprising:
   a. body;
a sanding pad mounted to the body;  
a turbine operatively connected to the sanding pad such  
that rotation of the turbine causes an orbital motion of  
the sanding pad, the turbine comprising a plurality of  
vanes extending outwardly from a spindle and a base  
which is attached to the bottom of the plurality of vanes  
and attached to the bottom of the spindle, such that  
the inside sides of the vanes are connected to the spindle  
and the bottom of the vanes are connected to the base to  
prevent the passage of air therethrough, and such that the  
outside sides and top of the vanes being open and un-  
obscured to allow air flow between the sides and tops of  
the vanes;  
a vacuum port configured for connection to a vacuum;  
an airflow passage for directing airflow into the body,  
through the turbine, and through the vacuum port when  
a vacuum is connected to the vacuum port, the airflow  
causing rotation of the turbine, the airflow passage being  
configured to direct airflow into the side of the turbine  
between the plurality of vanes, and the turbine being  
configured such that the airflow exits the top of the  
turbine between the plurality of vanes and outside of the  
turbine spindle.  

10. The tool of claim 9, wherein the turbine comprises an  
axis of rotation, a closed bottom plate perpendicular to the  
axis of rotation, and a plurality of vanes extending upwardly  
from the closed bottom plate and outwardly from the axis of  
rotation, and wherein the airflow passage comprises an air  
passage disposed in the body and oriented so as to extend in  
a horizontal direction towards a side of the turbine and  
extending around the sides of the turbine such that the sides of  
the turbine are generally open and are without obstruction.  

11. The tool of claim 10, wherein the airflow passages are  
disposed in a plane which is generally perpendicular to the  
axis of rotation so that air moves horizontally towards the  
turbine and wherein the body comprises a cavity disposed  
avove the turbine and in communication with the vacuum port  
so that air exits the tops of the turbine blades and exits the  
body in a generally vertical direction.  

12. The tool of claim 10, wherein the vanes are curved.  

13. The tool of claim 11, wherein the spindle is attached to  
the base and extends upwardly therefrom to prevent the flow  
of air from between the vanes to the rotational axis of the  
turbine.  

14. The tool of claim 10, wherein the turbine is generally  
cylindrical.  

15. The tool of claim 9, wherein the airflow passage draws  
air from around the sanding pad.  

16. The tool of claim 9, wherein the turbine is generally  
cylindrical, and wherein the airflow passage is configured to  
introduce airflow to the turbine at the side of the turbine in a  
direction generally tangential to the turbine sides and perpen-
dicular to the axis of rotation of the turbine, and wherein the  
passage is configured to extract airflow from the turbine at  
the open top of the turbine in a direction generally parallel to the  
axis of rotation of the turbine.  

17. A vacuum driven tool comprising:  
a working member;  
a housing;  
a turbine disposed in the housing and coupled to the working  
member such that rotation of the turbine moves the  
working member, the turbine having a plurality of vanes  
extending outwardly from a central spindle and a base  
attached to the bottom of the vanes and the bottom of the  
spindle, the turbine having open sides and an open top  
such that the sides and tops of the vanes are not covered,  
the turbine being configured for receiving air between  
the plurality of vanes on the open sides thereof and for  
passing said air between the plurality of vanes and out  
the open top of the turbine on the outside of the spindle;  
anda  

at least one channel disposed in the housing configured for  
directing air into the open sides of the turbine, the portion  
of the channel adjacent the turbine being disposed in a  
plane perpendicular to the axis of the turbine so as to  
direct air towards the side of the turbine.  

18. The tool of claim 17, further comprising a vacuum port  
configured for extracting air from the open top of the turbine,  
the vacuum port being disposed in communication with a  
cavity formed in the body above the turbine.  

19. The tool of claim 17, wherein the at least one channel  
draws air into the housing from adjacent the working  
member.  

20. The tool of claim 17, wherein the working member  
comprises a sanding pad.  

21. The power tool of claim 17, wherein the central spindle  
is attached to a bottom plate and wherein the central spindle  
extends upwardly therefrom to prevent the flow of air from  
between the vanes to a rotational axis of the turbine.  

22. The power tool of claim 17, wherein the vanes have  
generally vertical sides and generally horizontally top  

surfaces.  

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