A sanding system includes a wood sander that produces dust, a portable vacuum system, and a vacuum hose extending therebetween. The vacuum system includes a canister having a chamber configured to hold a liquid, a transfer conduit coupled to the canister and defining an inlet port into the chamber, means for coupling a fluid line to the vacuum hose or the transfer conduit so that a liquid can be delivered thereto, and means for producing a vacuum within the chamber. During operation, dust is drawn from the sander through the vacuum hose and a liquid is inserted into the dust in the vacuum hose or the transfer conduit. The dust and liquid mixture is drawn into the chamber through the inlet port.
SANDING SYSTEM WITH WATER BASED DUST COLLECTION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not applicable.

BACKGROUND OF THE INVENTION

[0002] 1. The Field of the Invention

[0003] The present invention relates to sanding systems that include dust collection means and, more specifically, to floor sanding systems with built-in portable wet/dry vacuum systems.

[0004] 2. The Relevant Technology

[0005] Conventional wood floor sanders have long been used for sanding wood floors before finishing the floor. This sanding process can occur either after the floor has been initially installed or, for existing floors, when the floor is refinished. The floor sanders are effective in removing unwanted build-up and smoothing out and leveling the wood floor in preparation for the finishing or refinishing process. During the sanding process, a large amount of dust is necessarily generated by the sander. This dust must be removed before a finish can be applied to the wood floor.

[0006] This dust can also cause significant problems. For example, the dust can get into the eyes and lungs of the floor sander operator, potentially causing serious health problems. A mask can be worn by the operator to help alleviate this problem. Even if this is done, however, the dust can coat the surroundings, leaving a large amount of dust that must be cleaned up and removed. This dust coating is also a potential health hazard to others, especially during the refinishing process. Families typically occupy the house during the refinishing process. Because of this, the furniture, carpeting, and other personal items that are typically present become covered by the dust produced by the sanding process.

[0007] In one approach to overcoming the problem of dust generated by conventional wood floor sanders, a vacuum has been connected to the floor sander. The vacuum suction the dust away from the floor as the dust is being generated. These systems are commonly referred to as “dustless,” “dust control,” “dust collection,” or “dust containment” sanding systems, and these phrases can be used interchangeably. The vacuum associated with a conventional dust collection system includes a canister which is typically mounted on a portable unit or within a truck or trailer. A flexible hose removable extends between the conventional wood floor sander and the canister. The canister has a chamber that is configured to hold and collect the dry dust particles generated by the floor sander. Coupled with the canister is a vacuum motor which produces a relative vacuum or negative pressure within the chamber. The relative vacuum draws air into the canister through the hose. The air is then filtered and expelled out through a vent line.

[0008] During use, a floor sander operator couples one end of the hose to a corresponding port on the floor sander and the other end to a vacuum air inlet port on the canister and turns the vacuum motor on. This causes air to be suctioned into the chamber through the hose. Then, as the operator commences sanding of the wood floor, the suctioning of the air also causes dust that is generated by the sanding process to be suctioned through the hose and into the chamber of the canister. This dust is very fine and loosely fills the canister. In this manner, much of the dust that is generated by sanding the floor is removed from the premises, alleviating many of the problems mentioned above.

[0009] Although conventional dust collection systems solve many of the aforementioned problems, they still maintain several shortcomings. For example, the fineness of the dust requires great measures to be taken in sealing the container and filtering the dust out of the air. As a result, conventional dust collection systems are typically very expensive. Also, the dust tends to coat and clog the filter medium, requiring frequent cleaning or replacement of the filters. Another shortcoming associated with conventional dust collection systems is that, because the collected dust only loosely fills the canister, the canister either must be emptied often or is very large. Additionally, the dust tends to loosely coat the inner surface of the canister. When emptying the canister, this dust can shake loose, requiring additional clean up near and around the canister.

[0010] Another shortcoming of existing systems is potential fire hazard. Since the dust is collected in a dry state, a spark may be generated by the sanding process when the sander hits a nail or staple in the hardwood. The spark may travel down the hose to the dust collection bin and smolder until the dust bursts into flame possibly causing serious fire and smoke damage to the equipment or other property.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Various embodiments of the present invention will now be discussed with reference to the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope.

[0012] FIG. 1 is a front view of an inventive sanding system that incorporates a portable wet/dry vacuum system;

[0013] FIG. 2 is a cross sectional front view of a canister of the portable wet/dry vacuum system shown in FIG. 1;

[0014] FIG. 3 is a cross-sectional top view of the canister shown in FIG. 2 taken along section lines 3-3;

[0015] FIG. 4 is a side perspective view of the canister shown in FIG. 2 mounted onto a hand truck;

[0016] FIG. 5 is an alternative embodiment of the portable wet/dry vacuum system shown in FIG. 1 having two canisters; and

[0017] FIG. 6 is another alternative embodiment of the portable wet/dry vacuum system shown in FIG. 1 in which the vacuum is generated externally.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] The present invention relates to sanding systems for use in sanding floors and any other desired structure or surface. The sanding systems include a sander and a dust collection system that employs the use of wet/dry vacuum systems in removing dust generated by the sanding process. The dust collection system includes means for injecting a liquid into the suctioned dust to help in removing and compacting the dust, and means for then removing the liquid from the dust mixture. By mixing a liquid with the dust and then removing the liquid, the moist dust is more compacted than with conventional sanding systems. The moist dust also tends to clump together and not spill out of the vacuum when emptying the vacuum system. Finally, by adding moisture to the dust the potential for fire hazard is greatly reduced.
Depicted in FIG. 1 is one embodiment of an inventive sanding system 8 used in sanding wood floors and incorporating features of the present invention. Sanding system 8 comprises a wood floor sander 9, a portable wet/dry vacuum system 10, and a flexible vacuum hose 11 connecting floor sander 9 to vacuum system 10.

Floor sander 9 includes a motorized sanding unit 90 with an elongated handle 92 extending therefrom. Sanding unit 90 includes an electrically operated motor 91 that controls a sanding medium 93. Sanding medium 93 is the component that contacts the wood floor to cause the floor to be sanded. Many types of sanding medium 93 can be used. For example, sanding medium 93 can comprise a roughened belt, a drum, a disk or any other type of sanding medium known in the art. Motor 91 is configured to cause sanding medium 93 to move in a manner that sanding of the wood floor occurs as a result. For example, motor 91 can cause sanding medium 93 to vibrate or rotate (e.g., if sanding medium 93 is a disk), or provide looping motion (e.g., if sanding medium 93 is a belt). Other types of motion can alternatively be provided, as is known in the art.

A shroud 160 surrounds sanding medium 93 and forms a chamber 162. Shroud 160 is used to confine the dust that is generated by the sanding process so the dust can be collected by the system. Shroud 160 can be made of plastic, metal, or other material known in the art. A tube 164 extends from shroud 160, the tube 164 communicating with chamber 162 of shroud 160 at a first end 166 of tube 164. The second end 168 of tube 164 contains a coupling 170 that forms an outlet port 94. Alternatively, coupling 170 (and therefore outlet port 94) can be formed directly on shroud 160 and tube 164 can be eliminated. Coupling 170 and outlet port 94 are configured such that when first end 96 of vacuum hose 11 is attached thereto, open fluid communication is established between vacuum hose 11, coupling 170, and chamber 162 of shroud 160. In the depicted embodiment, coupling 170 is a standard coupling known in the art for receiving a commercially available dust collection system vacuum hose.

Sanding unit 90 is typically mounted on wheels 172 to allow for easy movement of floor sander 9. The foregoing discussion regarding sanding unit 90 is exemplary only. Virtually any commercially available floor sanding units that can accept a vacuum hose for dust collection can be used. For example, American 8 Drum Sander by Clarke American Sanders can be used. It is also appreciated that stationary sanders, hand sanders, commercial sanders, and other types of sanders can also be used in association with the present invention.

Vacuum hose 11 comprises a flexible hose that extends between a first end 96 and a spaced apart second end 98. First end 96 is configured to selectively couple with coupling 170 on floor sander 9 so as to communicate with chamber 162 of shroud 160. In one embodiment a first coupling 97 is included at first end 96 to aid in coupling to floor sander 9. In other embodiments, first end 96 couples to floor sander 9 directly without using a first coupling 97. As detailed below, second end 98 of vacuum hose 11 is configured to selectively couple with a hose coupling 39 or a transfer conduit 28 of vacuum system 10. In one embodiment, second end 98 of vacuum hose 11 includes a second coupling 99 for selectively coupling to vacuum system 10. In other embodiments, second end 98 selectively couples to vacuum system 10 without using second coupling 99. In one embodiment of the current invention, flexible vacuum hose 11 is a conventional vacuum hose currently used with commercially available vacuums, dust collection systems or the like.

Vacuum system 10 includes a canister 12 having a top section 14, a bottom section 16, and two middle sections 18 disposed therebetween. Sections 14, 16, and 18 are removable coupled together using conventional clamping members 19. In one embodiment, sections 14, 16, and 18 are coupled together so as to produce a liquid tight seal therebetween. In some embodiments vacuum system 10 has only have one middle section 18. In some embodiments canister 12 is mounted on a portable cart 13 having wheels 15 on which vacuum system 10 is rolled around during set-up and use.

Depicted in FIG. 2, canister 12 has an interior surface 24 bounding a chamber 26. Chamber 26 includes a top end 27 and an opposing bottom end 29. Chamber 26 communicates with the exterior through an inlet port 20, an air outlet port 22, and a liquid outlet port 23.

Coupled with chamber 26 through inlet port 20 is transfer conduit 28. As depicted in FIGS. 1 and 2, transfer conduit 28 extends from an attachment end 30 disposed outside of canister 12 to an opposing discharge end 32 coupled with chamber 26 through inlet port 20. Secured to attachment end 30 is a hose coupling 39 that forms a vacuum port 34. Alternatively, vacuum port 34 can be formed directly on attachment end 30 of transfer conduit 28 and hose coupling 39 can be omitted. As noted above, second end 98 of vacuum hose 11 is configured to selectively couple with hose coupling 39, or transfer conduit 28 if hose coupling 39 is omitted. Hose coupling 39, transfer conduit 28, and vacuum port 34 are configured such that when vacuum hose 11 is attached to hose coupling 39 or transfer conduit 28, open fluid communication is established between vacuum hose 11, transfer conduit 28, and canister 12. It is appreciated that second end 98 of vacuum hose 11 alternatively can be permanently attached to hose coupling 39 or attachment end 30 of transfer conduit 28.

Depicted in FIG. 2, transfer conduit 28 includes a mixing tube 37 positioned at discharge end 32. Mixing tube 37 is horizontally disposed within chamber 26 and extends from interior surface 24 of chamber 26 to a terminus 41. As depicted in FIG. 3, mixing tube 37 is oriented at an angle that is offset from alignment with a central longitudinal axis 43 of chamber 26. In the embodiment depicted, terminus 41 is disposed adjacent to interior surface 24. In this configuration, mixing tube 37 is oriented so that air exits mixing tube 37 through terminus 41 at an orientation substantially tangential to interior surface 24. As discussed below in greater detail, this orientation of mixing tube 37 optimizes the cyclonic flow of air within chamber 26.

Means are provided for coupling a fluid line to the vacuum hose or the transfer conduit so that a liquid can be delivered thereto. By way of example and not by limitation, depicted in FIG. 2, a hose coupling 39 is attached to transfer conduit 28. Alternatively, hose coupling 39 can be attached to vacuum hose 11. As discussed below in greater detail, hose coupling 39 is configured to selectively receive a fluid line 80 so that fluid communication between fluid line 80 and transfer conduit 28 or vacuum hose 11 can take place. In alternative embodiments for the means for coupling a fluid line, hose coupling 39 can have a variety of different configurations. For example, hose coupling 39 can be permanently attached to transfer conduit or be removable.

The present invention further includes a vacuum system 10 including a flexible vacuum hose 11 disposed within a canister 12, a flexible vacuum hose 11 and a vacuum system 10. A flexible vacuum hose 11 is provided having a vacuum port 34 which is configured to connect with a transfer conduit 28 or an external vacuum hose. The flexible vacuum hose 11 is configured to selectively couple to a vacuum system 10 including a transfer conduit 28 and a vacuum port 34. The flexible vacuum hose 11 further includes a coupling 39 configured to selectively couple with a vacuum system 10 including a transfer conduit 28 and a vacuum port 34.
attached. The type of connecting mechanism used in hose coupling 39 can include a conventional hose bib, a push on connection, a bayonet-style mount, and the like. Other means for coupling a fluid line can include a manual or electronically operated valve 88, as discussed below in greater detail. It is appreciated that other means for coupling a fluid line can also be used.

In one embodiment of the present invention, means are provided for producing a relative vacuum or relative negative pressure within chamber 26 such that dry matter and liquid can be drawn into chamber 26 through transfer conduit 28. By way of example and not by limitation, depicted in FIG. 2, a conventional vacuum motor 36 is disposed within top end 27 of chamber 26. A vent line 38 couples with one side of vacuum motor 36 and exits through air outlet port 22. In alternative embodiments for the means for producing a vacuum, vacuum motor 36 can have a variety of different configurations and can be placed at a variety of different locations both within and outside of chamber 26. As discussed later in greater detail, in embodiments where vacuum motor 36 is disposed outside of chamber 26, vacuum motor 36 communicates with and draws air out of chamber 26 through a conduit.

A cyclonic separator 40 is attached to the opposing side of vacuum motor 36. In the embodiment depicted, separator 40 has a frustraconical configuration and includes a constricted upper end 42 coupled with vacuum motor 36 and a radially outwardly flared lower end 44. In alternative embodiments, the exterior of separator 40 need not be frustraconical, but preferably has a lower end having a diameter greater than the diameter of the upper end. Lower end 44 is freely disposed within chamber 26 and bounds an opening 46. Separator 40 has an interior surface 48 that bounds a passageway 50 extending from opening 46 to vacuum motor 36. Separator 40 is disposed such that mixing tube 37 of transfer conduit 28 is disposed above lower end 44 of separator 40. Transversely extending across passageway 50 is a filter 52. In one embodiment, filter 52 comprises a plastic mesh screen having a pore diameter in a range between about 0.1 inches to about 0.5 inches with about 0.1 inches to about 0.3 inches being more common. Other pore sizes can also be used.

Also disposed within chamber 26 is a frustraconical collecting cone 54. Collecting cone 54 includes a radially enlarged upper end 56 that is secured to interior surface 24 of canister 12. Collecting cone 54 also includes a constricted lower end 58. An interior surface 60 bounds a passageway 62 extending between ends 56 and 58. Collecting cone 54 is concentrically disposed below separator 40 with a gap 63 formed therebetween. Secured to lower end 58 of collecting cone 54 is an enlarged filter apparatus 64. Filter apparatus 64 is removably secured to collecting cone 54 using conventional means for connecting such as hooks, snaps, ties, Velcro®, clamps, or the like. Filter apparatus 64 is configured to allow liquids to pass through but to retain dust and other particles therein. In one embodiment, filter apparatus 64 is a filter bag made from mesh netting. In one embodiment, filter apparatus 64 is a rigid basket with a metal mesh attached thereto. Other types of filtering apparatuses can also be used. In an alternative embodiment, collecting cone 54 can be removed and filter apparatus 64 can be configured to removably attach directly to interior surface 24 of canister 12. In one embodiment, filter apparatus 64 has a pore diameter in a range between about 0.0357 inches to about 0.006 inches with about 0.03125 inches to about 0.012 inches being more common. Other pore sizes can also be used. In one embodiment, filter apparatus 64 has a capacity in a range between about 4.5 gallons to about 5.5 gallons with about 4 gallons to about 6 gallons being more common. Other capacities can also be used.

Disposed below filter apparatus 64 is a support member 100. Support member 100 is configured to help support or fully support the weight of filter apparatus 64 when compacted dust becomes collected therein. Support member 100 also helps to prevent rupturing of filter apparatus 64. Support member 100 is secured to interior surface 24 of canister 12 using conventional means for connecting, such as welding, clamps, fasteners, or other methods. Alternatively, support member 100 can be self-standing on the floor of canister 12. In some embodiments, support member 100 is removable. Support member 100 can be configured to allow liquids to pass therethrough or therearound. Support member 100 can be made of a variety of different materials and can have a variety of different configurations. By way of example and not by limitation, support member 100 can comprise a screen, grate, mesh, fabric, filter material, plate with holes extending therethrough, wires or bars extending across chamber 26, or any other structure that can support filter apparatus 64 and still allow liquid that passes through filter apparatus 64 to travel down to the bottom of chamber 26. One specific example of support member 100 comprises a 1 inch x 1 inch x 0.08 inch wire mesh grill.

In one embodiment, a porous basket 101 is disposed on support member 100 below filter apparatus 64. Basket 101 has a floor with upstanding sides which form a bucket-like or bowl-like interior to constrain the bottom end of filter apparatus 64. Basket 101 has a plurality of holes extending therethrough to allow liquids to pass through basket 101. Various types of structures can be used as basket 101. By way of example and not by limitation, basket 101 can comprise a bowl, a basket, a bucket, or any bowl-like container with holes extending therethrough or made with wires or bars, or any other structure that can constrain filter apparatus 64 and still allow liquid that passes through filter apparatus 64 to travel down to the bottom of chamber 26. As depicted, the bottom end of filter apparatus 64 is placed within basket 101. The height of basket 101 can be a few inches or the entire height of filter apparatus 64, or anywhere in between. Basket 101 can be free standing on support member 100 or removably attached to support member 100 using conventional means for attaching, such as clamps, fasteners, or other methods. Alternatively, basket 101 can be permanently attached to support member 100 to, along with support member 100, help support filter apparatus 64 as it fills up.

In one embodiment of the present invention means are provided for removing waste liquid collected within bottom end 29 of chamber 26 through fluid outlet port 23 when the waste liquid rises above a certain level. By way of example and not by limitation, depicted in FIG. 2, a conventional pump 102 is disposed within bottom end 29 of chamber 26. A drain line 66 couples with an outlet port 104 of pump 102 and exits through fluid outlet port 23. In alternative embodiments for the means for removing waste liquid, pump 102 can have a variety of different configurations and can be placed at a variety of different locations both within and outside of chamber 26. By using a pump, the means for vacuuming can continue to produce a relative
vacuum or relative negative pressure within chamber 26 even when the pump is removing waste liquid from chamber 26.

[0035] As previously mentioned, drain line 66 functions to discharge the waste liquid collected within bottom end 29 of chamber 26. In one embodiment, a conventional hose bib 106 is attached to drain line 66. This allows a conventional flexible drain hose 108 (FIG. 1) to be removably attached to bib 106. Hose 108 is directed away from canister 12 toward a gutter or wastewater storage means or other water disposal system. In other embodiments, drain line 66 or hose 108 feeds directly to a sewage line, septic tank, or disposal container.

[0036] When vacuum motor 36 is turned on, a relative vacuum is produced within chamber 26. This relative vacuum produces a suction which is used to draw air, dry matter (including sanding dust), and/or liquid into chamber 24 through transfer conduit 28. Because of the orientation of mixing tube 37, the air and other matter enters chamber 26 at an orientation substantially tangential with interior surface 24 of canister 12. As a result, a substantially cyclonic flow is created within chamber 24 wherein the air and other matter swirls in a circular and downward path within chamber 24. As the circling air moves downward, the space between the exterior surface of separator 40 and interior surface 24 of canister 12 decreases. As this space decreases, the speed of the air traveling within this space increases. The centrifugal force created by the increased air speed causes the liquid and particulate suspended within the air to move outward toward interior surface 24 of canister 12. As the air and other matter passes below lower end 44 of separator 40, the relatively clean air passes through gap 63 where it is drawn up into passageway 50, through motor 26, and out vent line 38. Filter 52 functions to catch any additional material that is accidentally drawn in with the air.

[0037] The liquid and particulate continue under gravitational force to travel down into passageway 60 of collecting cone 54 and into filter apparatus 64. The particulate and dust are retained and compressed within filter apparatus 64. The liquid and smaller particles suspended therein passes through filter apparatus 64 and are collected at bottom end 29 of chamber 26.

[0038] In one embodiment, vacuum system 10 can be designed such that when vacuum hose 11 is coupled with vacuum port 34, vacuum motor 36 can be automatically turned on. Likewise, vacuum motor 36 is automatically turned off when hose 11 is removed from vacuum port 34. In alternative embodiments, vacuum motor 36 can be turned on and off manually by using a switch located on or adjacent to vacuum port 34 or any other portion of canister 12 or a switch located on floor sander 9. Various types of switches can be used. For example, toggle switches, push buttons, dials or other types of switches known in the art can be used. Alternatively, vacuum motor 36 can be turned on and off automatically when floor sander motor 90 is turned on and off, respectively.

[0039] To prevent over filling chamber 26 with liquid, the present invention also includes means for automatically turning on the means for removing waste liquid when the waste liquid within chamber 26 rises to a predetermined upper level and for automatically turning off the means for removing waste liquid when the waste liquid within chamber 26 drops to a predetermined lower level. By way of example and not by limitation, depicted in FIG. 2, a float switch 68 is disposed within the bottom of chamber 26. One example of float switch 68 is the SoloFloat model D10N0 115 available from Anchor Scientific Inc. out of Long Lake, Minn.

[0040] Float switch 68 is in electrical communication with pump 102. In one embodiment float switch 68 is attached directly to pump 102 so that float switch 68 rotates upward as waste liquid fills chamber 26 and rotates downward as waste liquid exits chamber 26. Alternatively, a tie, such as a clamp or other structure, can be used to secure float switch 68 to canister 12 at a short distance from float switch 68. The tie functions to tether float switch 68 so that float switch 68 rotates upward and downward about the tie.

[0041] Accordingly, as liquid collects and rises within the bottom of chamber 24, float switch 68 rotates upward about pump 102. When float switch 68 is rotated upward to a predetermined angle based on the elevation of the waste liquid, float switch 68 automatically moves to a first activation state which turns pump 102 on. This causes pump 102 to remove the waste liquid from the bottom end 29 of chamber 26 and expel the liquid through drain line 66. As liquid drains from chamber 26, float switch 68 rotates downward about pump 102. When float switch 68 is rotated downward to a predetermined angle based on the elevation of the water, float switch 68 automatically moves to a second activation state which turns pump 102 off, thereby stopping the removal of waste water from chamber 26. As noted above, this process continues independent of whether vacuum motor 36 is turned on or off. By selectively adjusting the distance between pump 120 and float switch 68, the level of the waste liquid at which float switch 68 moves between the activation states can be controlled.

[0042] The present invention also envisions a variety of alternative embodiments for the means for turning the means for removing waste liquid on and off. By way of example, float switch 68 can be replaced with sensors vertically spaced apart within chamber 26. When the waste liquid rises to the upper sensor, pump 102 is turned on. When the waste liquid drops below the lower sensor, pump 102 is turned off. As another example, a sliding switch can be attached to the wall of chamber 26 with a float ball attached. As with the previous example, when the waste liquid rises to the upper sensor, pump 102 is turned on. When the waste liquid drops below the lower sensor, pump 102 is turned off.

[0043] Returning to FIG. 1, to facilitate removal of particulate suspended within the air drawn into chamber 26, fluid line 80 has a first end 82 selectively fluid coupled with a water line 84 and an opposing second end 86 fluid coupled with transfer conduit 28. Second end 86 of fluid line 80 is coupled to transfer conduit 28 at or adjacent to mixing tube 37 (FIG. 2). Alternatively, second end 86 of fluid line 80 can be coupled to vacuum hose 11. In one embodiment, fluid line 80 is coupled to transfer conduit 28 via removable attachment to hose coupling 39 (FIG. 2). In one embodiment, fluid line 80 comprises a conventional flexible garden hose having standard hose connectors 110 and 112 on hose ends 82 and 86, respectively. In this embodiment, hose coupling 39 comprises a conventional hose bib and hose connector 110 on first end 82 of fluid line 80 is removably attached to a conventional hose bib 114 on a faucet 116 and hose connector 112 on second end 86 is removably attached to hose coupling 39 on transfer conduit 28, vacuum hose 11, or mixing tube 37.
Valve 88, such as a manual valve or an electronically operated solenoid valve, can be coupled with fluid line 80 to control the flow of water into transfer conduit 28. In one embodiment, valve 88 is electrically coupled with vacuum motor 36 such that when vacuum motor 36 is turned on, valve 88 is opened allowing water to be dispensed or injected into transfer conduit 28. If valve 88 is used, second end 86 of fluid line 80 can alternatively be attached directly to valve 88 or valve 88 can have hose bib 118 for removable attachment of a conventional hose if fluid line 80 comprises a hose, as described above. In an alternative embodiment valve 88 can be eliminated.

In one embodiment a nozzle 89 (see FIG. 2) is attached to second end 86 of fluid line 80 such that it diffuses or sprays the fluid, creating a fine mist. If valve 88 is used, nozzle 89 can alternatively be attached to valve 88. In any case, nozzle 89 can be configured to create a mist or diffusion of fluid as the fluid is injected into transfer conduit 28. As detailed below, this will allow the incoming dust to be evenly coated with the injected liquid. In an alternative embodiment nozzle 89 can be eliminated.

As noted above, canister 12 can be mounted on a portable cart 13. Cart 13 can comprise a base 72 having a top surface 73 on which bottom section 16 of canister 12 is mounted. Mounting can be by any conventional means, including but not limited to welding, screws, bolts, friction engagement, and the like. Projecting down from a bottom surface 74 of base 72 are a plurality of wheels 75, which allow vacuum system 10 to be portable. Wheels 75 are typically attached to base 72 or close to an outer edge 76 of the bottom surface 74 of base 72 to provide a large wheel base to prevent tipping of the canister. Wheels 75 can come in a variety of different sizes and shapes. Extending up from top surface 73 of base 72 at the outer edge 76 is a lip 78. Lip 78 is used to help keep canister 12 in position and prevent canister 12 from slipping off of base 72. Lip 78 can completely surround top surface 73 of base 72, or can be divided into many spaced apart lips.

It is appreciated that cart 13 can come in a variety of different sizes, shapes, and configurations that equally function to enable easy transport of vacuum system 10. For example, depicted in FIG. 4 the cart can comprise a conventional hand truck 180 on which canister 12 is mounted. Hand truck 180 comprises a back frame 181 that extends from an upper end 182 to a spaced apart lower end 184. Canister 12 can be mounted on the front face of back frame 181 by straps, clamps, bolts, fasteners or other mounting technique such that canister 12 can be used while mounted onto hand truck 180. A base plate 186 projects from the front face of back frame 181 at lower end 184 so as to extend below canister 12. In part, base plate 186 is used as a resting platform to keep hand truck 180 upright when hand truck 180 rests on base plate 186. A pair of spaced apart wheels 188 and 190 are also coupled to back frame 181 at lower end 184 on the side of base plate 186. Wheels 188 and 190 are configured to be able to move canister 12 when canister 12 is tilted backwards about wheels 188 and 190. Such tilting causes bottom plate 186 to be raised, allowing hand truck 180, and thus canister 12, to then be moved.

Referring to FIG. 1, an exemplary method of using the current invention is now discussed. Before sanding, the operator attaches vacuum system 10 to floor sander 9 or other type of sander via vacuum hose 11. This is done by connecting first end 96 of flexible vacuum hose 11 to outlet port 94 of wood floor sander 9 and second end 98 of flexible vacuum hose 11 to vacuum port 34. The operator also attaches vacuum system 10 to water line 84 using fluid line 80, as discussed above. For example, where a wood floor in a house or other building is being sanded, vacuum system 10 can be easily transported using the cart to just outside of the building. One end of a garden hose or other flexible line can then be coupled to a water bib on the outside of the building while the opposing end of the hose is coupled with transfer conduit 28. The operator turns on the vacuum motor 36 by using a switch, as discussed in detail above, to create a relative vacuum within canister chamber 26 and to create a suctioning action within vacuum hose 11. The operator also turns on the water to begin dispensing the water into transfer conduit 28 through nozzle 89.

The operator then turns on wood floor sander 9 and begins sanding, generating dust with the sanding action. As a result of the relative vacuum created by vacuum motor 36 within chamber 26 and vacuum hose 11, dust that is produced by floor sander 9 is suctioned into vacuum system 10 through vacuum hose 11, thereby creating a dust stream.

As the water, air, and dust stream enter transfer conduit 28 and travel along mixing tube 57, the water mixes with the surrounding air so that the dust and other particles become suspended within the water, thereby creating a liquid/dust mixture. Once the liquid/dust mixture enters chamber 26, as previously discussed, the water and suspended particles are driven outward against inner surface 24 of canister 12 and downward toward bottom end 29 of chamber 26. Because the dust is now within a liquid/dust mixture, the weight of the mixture improves the flow of the dust downward. As the liquid/dust mixture falls downward, it is directed by collecting cone 54 into filter apparatus 64.

As the liquid/dust mixture presses against filter apparatus 64, most of the water within the liquid/dust mixture separates from the mixture and passes through filter apparatus 64. The remaining portion of the mixture, including most of the dust, is prevented from passing through filter apparatus 64 and thus is retained therein. As a result, the waste liquid collects in the bottom of chamber 26 while the dust is compacted within filter apparatus 64. Support member 100 supports the weight of filter apparatus 64 as filter apparatus 64 fills up with compacted moistened dust. It is noted that the water from fluid line 80 not only helps to collect and remove dust and other particulate from the air, it also functions to help wash the particulate matter down the length of chamber 26 to bottom end 29 and to compact the collected dust.

Basket 101, if used, also helps in supporting the structure of filter apparatus 64 as filter apparatus 64 fills up. Filter apparatus 64 can become very heavy when full of wet dust and difficult to handle if filter apparatus 64 is a non-rigid apparatus, such as a mesh bag. If basket 101 is unattached or detachable from support structure 100, basket 101 can be removed with filter apparatus 64 disposed within basket 101. The rigid structure of basket 101 supports filter apparatus 64 during removal, thus making removal of filter apparatus 64 much easier.

As waste liquids collects in the bottom of chamber 26, float switch 68 rotates up to the first activation state, as discussed above, thereby turning on pump 102. The collected waste liquid is subsequently pumped out through drain line 66 until float switch 68 rotates downward to the second activation state. At that point, the pump turns off and
waste liquid begins collecting again in the bottom of chamber 26. This cycle continues until the system is turned off. As noted above, the removal of waste liquid can occur independent of the vacuuming action. Thus, sanding can be done continuously without worry of vacuum motor 36 stopping while the liquid is being removed from canister 12. Filter apparatus 64 is periodically emptied or replaced by the operator as needed.

[0054] It is appreciated that some of the above steps may be altered or omitted depending on the options available. For example, if vacuum system 10 automatically turns on when sander 9 turns on, then the step of manually turning vacuum motor 36 on can be omitted. It is also appreciated that while the current method has been described using an exemplary wood floor sanding system, the methods of containing dust produced by sanding described above can also be used for other types of sanding systems, such as shop sanding (wood and metal). The methods described above can also be used in non-sanding systems which also produce dust, such as wood sawing systems or the like. Examples of saws that can be used with the present invention include radial arm saws, table saws, various commercial saws, and the like. In these embodiments, the vacuum hose is connected to the saw where the saw dust is generated or collected. In view of the foregoing, the inventive vacuum system 10 can be used in association with any number dust generated machines such as saws, sanders, and the like.

[0055] Although the following flow rates and dimensions can vary based on the size and number of vacuum motors used, in one embodiment, mixing tube 37 typically has a diameter in a range between about 1.5 inches to about 2.5 inches. The length of mixing tube 37, i.e., the distance between where fluid line 80 intersects transfer conduit 28 and terminus 41, is typically in a range between about 11 inches to about 5 inches. The flow rate of water entering mixing tube 37 through fluid line 80 is typically in a range between about 0.15 gallons/minute to about 0.35 gallons/minute. Other dimensions and flow rates can also be used. The present invention also envisions that mixing tube 37 can be fully positioned within chamber 26, fully positioned outside canister 12, or can extend both inside and outside of chamber 26.

[0056] Depicted in FIG. 5 is an alternative embodiment of an inventive wet/dry vacuum system that can be used with the sanding system. Like elements between the embodiments depicted in FIGS. 2 and 5 are identified by like reference characters. As depicted in FIG. 5, a wet/dry vacuum system 122 includes canister 12 having collecting cone 54, filtering bag 64, and float switch 68 disposed therein. Also disposed within canister 12 is separator 40. In contrast to the embodiment depicted in FIG. 2, however, vacuum motor 36 is removed from canister 12. An adjacent second canister 124 is provided having a first vacuum motor 126 and a second vacuum motor 128. Each of the vacuum motors 126 and 128 are fluid coupled with separator 40 through a conduit 130. Each of motors 126 and 128 vent to the exterior through corresponding vent lines 132 and 134.

[0057] Vacuum system 122 is also distinguished over vacuum system 10 in that a preliminary collecting cone 136 is disposed between collecting cone 54 and separator 40. The use of second canister 124 and vacuum motors 126 and/or 128 are alternative embodiment to the means for vacuuming as previously discussed.

[0058] Depicted in FIG. 6 is another alternative embodiment of an inventive wet/dry vacuum system that can be used with the sanding system. The wet/dry vacuum system 150 depicted in FIG. 6 is similar to wet/dry vacuum system 122 depicted in FIG. 5. Like elements between the embodiments depicted in FIGS. 5 and 6 are identified by like reference characters. As in vacuum system 122, vacuum motor 36 is removed from canister 12 in vacuum system 150 and a conduit 130 that is fluid coupled with separator 40 extends outward from canister 12. Instead of coupling with vacuum motors housed in a second canister, however, conduit 130 simply ends in a coupling 152 that allows an external vacuum system 200 to be coupled to the system. The external vacuum system can comprise any commercially available system that allows an external hose hook up. The vacuum system can be rigidly mounted or portable. Examples of such systems include mobile in-home central vacuum systems, portable canister-type vacuums, and many upright vacuums. Other types of vacuums can also be used.

[0059] As mentioned previously, although the discussion set forth herein has been directed toward a wood floor sander, it is appreciated that the portable wet/dry vacuum system according to various embodiments of the current invention can also be used to remove dust generated by other types of sanding known in the art, such as shop sanding, metal sanding, and the like. The portable wet/dry vacuum system can also be used for cutting systems that produce dust.

[0060] As noted in the discussion above, the sander system and methods described herein provide a number of unique benefits over current wood sanding systems. For example, by adding fluid into the incoming dust, the dust is more compacted and tends to clump together. This leads to smaller systems and/or the canister needing to be emptied less often. Filters also last longer and require less cleaning. Additionally, the dust tends to clump together, the dust does not spill out of the canister when the canister is emptied. Also, the fire hazard encountered with dry dust systems is virtually eliminated.

[0061] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

1. A sanding system comprising:
   a wood sander that produces dust;
   a vacuum hose extending between a first end and a spaced apart second end, the first end of the vacuum hose being connected to the sander; and
   a portable vacuum system comprising:
   a first canister having a chamber configured to hold a liquid;
   a transfer conduit coupled to the first canister, the transfer conduit having a first end and an opposing second end, the second end of the transfer conduit being disposed within the chamber, the second end of the vacuum hose being connected to the first end of the transfer conduit and the transfer conduit defining an inlet port into the chamber;
   means for coupling a fluid line to the vacuum hose or the transfer conduit so that a liquid can be delivered thereto; and
   means for producing a vacuum within the chamber.
2. A sanding system as recited in claim 1, wherein the wood sander comprises a wood floor sander.

3. A sanding system as recited in claim 1, wherein the means for coupling a fluid line comprises a hose coupling mounted on the vacuum hose or the transfer conduit.

4. A sanding system as recited in claim 1, further comprising a fluid line fluid coupled to the means for coupling a fluid line, the fluid line being configured to dispense the liquid into the transfer conduit or the vacuum hose.

5. A sanding system as recited in claim 1, wherein the means for producing a vacuum comprises a motor disposed within the chamber of the first canister.

6. A sanding system as recited in claim 1, wherein the portable vacuum system further comprises a collecting cone disposed within the chamber, the collecting cone having a radially enlarged upper end configured to receive dust and liquid entering the chamber and an opposing constricted lower end.

7. A sanding system as recited in claim 6, wherein the portable vacuum system further comprises a filter apparatus coupled with the lower end of the collecting cone, the filter apparatus being configured to allow liquid to pass therethrough.

8. A sanding system as recited in claim 1, wherein the first canister has an air outlet port, and wherein the portable vacuum system further comprises a tubular cyclonic separator disposed within the chamber and bounding an internal passageway, the separator having an exterior surface extending from an upper end to an opposing lower end, the lower end having a maximum outer diameter greater than a maximum outer diameter of the upper end, the upper end of the separator being in communication with the means for producing a vacuum such that air within the chamber exits the chamber by passing through the passageway from the lower end to the upper end.

9. A sanding system as recited in claim 1, wherein the portable vacuum system further comprises: a filter apparatus disposed within the chamber of the first canister, the filter apparatus being positioned below the inlet port such that liquid entering the chamber through the inlet port subsequently passes through the filter apparatus; and a support member disposed within the chamber of the first canister such that the support member supports at least a portion of the filter apparatus when the filter apparatus is at least partially filled with a collected material.

10. (canceled)

11. A sanding system as recited in claim 1, further comprising: a liquid outlet port formed on the first canister; and a pump disposed within the first canister and fluid coupled with the liquid outlet port.

12. A sanding system as recited in claim 1, further comprising a flexible hose connected to the liquid outlet port and extending away from the first canister.

13. A sanding system as recited in claim 11, wherein the portable vacuum system further comprises: means for automatically turning on the pump when the liquid within the chamber rises to a predetermined upper level and for automatically turning off the pump when the liquid within the chamber drops to a predetermined lower level.

14. A sanding system as recited in claim 13, wherein the means for automatically turning on and off the pump comprises a float switch disposed within the chamber of the first canister.

15. A sanding system as recited in claim 1, wherein the first canister is mounted on a portable cart.

16. A sanding system as recited in claim 15, wherein the portable cart comprises a hand truck.

17-33. (canceled)

34. A sanding system comprising: a wood sander that produces dust; a vacuum hose extending between a first end and a spaced apart second end, the first end of the vacuum hose being coupled to the sander; and a portable vacuum system comprising: a first canister having a chamber configured to hold a liquid; a transfer conduit coupled to the first canister, the transfer conduit having a first end and an opposing second end, the second end of the transfer conduit being disposed within the chamber, the second end of the vacuum hose being connected to the first end of the transfer conduit and the transfer conduit defining an inlet port into the chamber; means for coupling a fluid line to the vacuum hose or the transfer conduit so that a liquid can be delivered thereto; means for producing a vacuum within the chamber; a filter apparatus disposed within the chamber of the first canister, the filter apparatus being positioned below the inlet port such that liquid entering the chamber through the inlet port subsequently passes through the filter apparatus; a support member disposed within the chamber of the first canister such that the support member supports at least a portion of the filter apparatus when the filter apparatus is at least partially filled with a collected material; and a basket disposed on the support member within the chamber of the first canister such that the basket constrains at least a portion of the filter apparatus.