DISC DRIVE GAS FILLING SYSTEM

Related Applications

This application claims priority of United States provisional application Serial Number 60/338,802, filed November 13, 2001.

Field of the Invention

This application relates generally to disc drives and more particularly to a system for filling a disc drive with a gas other than air.

Background of the Invention

A disc drive typically includes a base to which various components of the disc drive are mounted. A top cover cooperates with the base to form a housing that defines an internal, sealed environment for the disc drive. Filling the sealed environment of disc drives with gases other than air can enhance their performance. For example, low-density inert gases such as helium can reduce the aerodynamic drag between the discs and their associated read/write heads by a factor of approximately five-to-one compared to operating in air. This reduced drag results in reduced power requirements for the spindle motor. A helium filled drive thus uses substantially less power than a comparable disc drive that operates in an air environment. At the same time, the helium gas conducts away heat generated during operation of the disc drive more effectively than air.

Despite the advantages of helium filled drives, such drives have not been commercially successful. This is mainly due to problems associated with the helium leaking from the disc drives over time. As the helium leaks out, air leaks in causing undesirable effects in the operation of the disc drives and possibly causing the disc drives to fail. For example, the increased concentration of air may increase the forces on the read/write head due to turbulent airflow within a drive and it may cause noise and/or the heads to fly at too great a distance above the discs. Thus, helium filled drives must be filled when they are first operated. Additionally, after helium has leaked from such drives they must be either discarded or refilled with helium. Filling disc drives with helium to a desired pressure and concentration can be time-consuming and difficult.

Accordingly there is a need for an improved system that can effectively fill a disc drive with a gas other than air, such as helium, to a desired concentration. The present invention provides a solution to this and other problems, and offers other advantages over the prior art.

Summary of the Invention

Against this backdrop the present invention has been developed. One embodiment of the invention is a system for filling an enclosed environment of a disc drive with a gas other than air. The filling system includes a filling system connection apparatus that can be connected to a corresponding disc drive connection apparatus that is in turn connected to the enclosed environment of the disc drive. By way of example, the connection apparatus could be a Schrader-type valve. A vacuum source, such as a vacuum pump, and a source of gas other than air, such as a pressurized gas tank, can be connected to the filling system connection apparatus. The filling system also includes a pressure sensor that can produce a pressure signal representative of the pressure within the enclosed environment of the disc drive. A control module receives the pressure signal and directs one of the vacuum source and the source of gas other than air through the filling system connection apparatus to the enclosed environment of the disc drive.

Another embodiment of the present invention is a method of filling an enclosed environment of a disc drive with a gas other than air. The enclosed environment is connected to a vacuum source. After the enclosed environment has reached a predetermined low pressure range of from about 5 torr to about 100 torr, it is disconnected from the vacuum source, such as by closing a valve. The enclosed environment is then connected to a source of gas other than air, such as by opening a valve. After the enclosed environment has reached a predetermined high pressure, the vacuum source is disconnected from the enclosed environment, such as by closing the valve.

These and various other features as well as advantages which characterize the present invention will be apparent from a reading of the following detailed description and a review of the associated drawings.

Brief Description of the Drawings

FIG. **1** is a plan view of a disc drive incorporating a preferred embodiment of the present invention showing the primary internal components.

FIG. **2** is a schematic diagram of a disc drive gas filling system in accordance with a preferred embodiment of the present invention.

FIG. **3** is a schematic diagram of a disc drive gas filling system in accordance with an alternative embodiment of the present invention.

FIG. 4 is a flow chart of a general method of filling a disc drive with helium according to the present invention.

FIG. 5 is a flow chart of a preferred embodiment of the method of FIG. 4.

Detailed Description

A disc drive **100** constructed in accordance with a preferred embodiment of the present invention is shown in FIG. 1. The disc drive **100** includes a base **102** to which various components of the disc drive **100** are mounted. A top cover **104**, shown partially cut away, cooperates with the base **102** to form a housing that defines an enclosed, sealed environment **105** for the disc drive in a conventional manner. The enclosed environment **105** of the disc drive **100** is filled with helium to enhance the performance of the disc drive **100**.

The components of the disc drive **100** include a spindle motor **106**, which rotates one or more discs **108** at a constant high speed. Information is written to and read from tracks on the discs **108** through the use of an actuator assembly **110**, which rotates during a seek operation about a bearing shaft assembly **112** positioned adjacent the discs **108**. The actuator assembly **110** includes a plurality of actuator arms **114**, which extend towards the discs **108**, with one or more flexures **116** extending from each of the actuator arms **114**. Mounted at the distal end of each of the flexures **116** is a head **118**, which includes an air bearing slider enabling the head **118** to fly in close proximity above the corresponding surface of the associated disc **108**.

During a seek operation, the track position of the heads **118** is controlled through the use of a voice coil motor **124**, which typically includes a coil **126** attached to the actuator assembly **110**, as well as one or more permanent magnets **128**, which establish a magnetic field in which the coil **126** is immersed. The controlled application of current to the coil **126** causes magnetic interaction between the permanent magnets **128** and the coil **126** so that the coil **126** moves in accordance with the well-known Lorentz relationship. As the coil **126** moves, the actuator assembly **110** pivots about the bearing shaft assembly **112**, and the heads **118** are caused to move across the surfaces of the discs **108**.

The spindle motor **106** is typically de-energized when the disc drive **100** is not in use for extended periods of time. The heads **118** are moved over park zones **120** near the inner diameter of the discs **108** when the drive motor is de-energized. The heads **118** are secured over the park zones **120** through the use of an actuator latch arrangement, which prevents inadvertent rotation of the actuator assembly **110** when the heads are parked.

A flex assembly **130** provides the requisite electrical connection paths for the actuator assembly **110** while allowing pivotal movement of the actuator assembly **110** during operation. The flex assembly includes a printed circuit board **132** to which head wires (not shown) are connected; the head wires being routed along the actuator arms **114** and the flexures **116** to the heads **118**. The printed circuit board **132** typically includes circuitry for controlling the write currents applied to the heads **118** during a write operation and a preamplifier for amplifying read signals generated by the heads **118** during a read operation. The flex assembly terminates at a flex bracket **134** for communication through the base deck **102** to a disc drive printed circuit board (not shown) mounted to the bottom side of the disc drive **100**.

Referring now to FIG. **2**, a system **200** in accordance with an embodiment of the present invention includes a filling system **202** and a disc drive **100**. The filling system **202** fills the enclosed environment **105** of the disc drive **100** with a gas other than air, such as helium. The disc drive **100** includes a disc drive connection apparatus **210**. The disc drive connection apparatus **210** preferably includes a normally closed valve **212** and a disc drive fitting **214**. The valve **212** and the fitting **214** together are preferably part of a Schrader-type valve or other similar valve-fitting combination where the valve is normally closed until connected to a pressure/vacuum source fitting. Thus, the disc drive connection apparatus **210** is preferably a single Schrader-type valve fitting installed on the drive housing.

The filling system **202** preferably includes a filling system connection apparatus **216**, which preferably includes a single filling system fitting **218**, which mates with the disc drive fitting **214**. When the filling system fitting **218** mates with the disc drive fitting **214**, the filling system fitting **218** preferably opens the valve **212** of the disc drive connection apparatus **210**. For example, where the disc drive connection apparatus **210** includes a Schrader-type valve, the filling system fitting **218** preferably includes a valve depressor that depresses the stem of the Schrader-type valve to open the valve **212**.

A universal gas pressure and vacuum line **220** extends from the filling system connection apparatus **216** and splits into two lines. A pressure sensor **222** preferably senses the pressure within the universal line **220** and produces a pressure signal **224** that represents the pressure within the universal line **220**. The pressure sensor **222** may be any of the many pressure sensors known to those skilled in the art that will sense pressures between 0 torr and at least about 1000 torr.

One line splitting from the universal line **220** is a vacuum line **230** that extends to a vacuum valve **232**, which is actuated by a vacuum valve actuator **234**. Preferably, the combination of the vacuum valve **232** and the vacuum valve actuator **234** together is a two-way solenoid valve combination that is normally closed and that can handle pressures from 0 torr to at least about 1000 torr. In an embodiment of the present invention, the solenoid valve combination may be a two-way normally closed S51 solenoid valve combination available from GC valves of Simi Valley, California, which is designed to handle pressures from 0 torr to about 13,000 torr (250 psi).

The vacuum line **230** extends from the vacuum valve **232** to a vacuum source **236**. The vacuum source **236** is generally a vacuum pump that is capable of pulling a vacuum of less than about 100 torr. In a preferred embodiment, the vacuum pump is capable of creating a vacuum of less than about 5 torr. The vacuum pump is also preferably capable of being activated and deactivated remotely, such as by sending a pneumatic or electrical signal to the vacuum pump control circuitry.

The other line splitting from the universal line **220** is a gas pressure line **250**, which preferably extends to a gas valve **252** that is actuated by a gas valve actuator **254**. In a preferred embodiment, the gas valve **252** and the gas valve actuator **254** together are the same as the vacuum valve **232** and the vacuum valve actuator **234**, described above. The gas line **250** is connected between the gas valve **252** and a gas source **256**. The gas source **256** is preferably capable of supplying gas, such as helium, to the gas line **250** to a pressure of at least about 1000 torr. In a preferred embodiment, the gas source **256** is a pressurized tank containing helium.

A control module **270** preferably receives the pressure signal **224** from the sensor **222** and produces control signals to perform the method described below with reference to FIGS. **4-5**. More specifically, the control module **270** produces a vacuum source signal **272** that activates and deactivates the vacuum source **236**, a vacuum valve signal **278** that prompts the vacuum valve actuator **234** to open and close the vacuum valve **232**, and a gas valve signal **280** that prompts the gas valve actuator **254** to open and close the gas valve **252**. The control module **270** may incorporate a microprocessor and operate under software control to receive and produce many other signals in addition to those discussed. For example, the control module **270** may receive input signals from a user to prompt the control to begin performing the filling method

described below. The control module may also output display signals that provide information regarding the status of the filling system **202** to a user display.

The universal line **220**, the vacuum line **230**, and the gas line **250** are all preferably standard gas-carrying fluid lines that are capable of withstanding repeated pressure from 0 torr to at least about 1000 torr. Such fluid lines may be flexible hoses or rigid lines, such as metal lines. Preferably, these lines are made of copper.

Referring now to FIG. **3**, an alternative system **300** in accordance with an embodiment of the present invention includes a filling system **302** and the disc drive **100**. The filling system **302** fills the enclosed environment **105** of the disc drive **100** with a gas other than air. The fluid lines, fittings, valves, sensors, actuators, sources, signal carriers, and the control module are all preferably similar to those described above with reference to the filling system **202**. The filling system **302** differs from filling system **202** primarily in that it is adapted to have two entry ports into the disc drive **100**, one for vacuum and one for gas.

The disc drive connection apparatus **310** includes a vacuum valve **312**, a gas valve **313**, a disc drive vacuum fitting **314**, and a disc drive gas fitting **315**. The combination of the vacuum valve **312** and the vacuum fitting **314** together is preferably similar to the valve-fitting combination **212, 214** described above. Likewise, the combination of the gas valve **313** and the gas fitting **315** together is preferably similar to the valve-fitting combination **212, 214** described above.

A filling system connection apparatus **316** includes a filling system vacuum fitting **318**, which mates with the disc drive vacuum fitting **314** and opens the disc drive vacuum valve **312**. The filling system connection apparatus **316** also includes a filling system gas fitting **319** that mates with the disc drive gas fitting **315** and opens the disc drive gas valve **313**.

A vacuum line **320** extends from the filling system gas fitting **319** and a gas pressure line **321** extends from the filling system vacuum fitting **318**. A vacuum pressure sensor **322** produces a signal that is representative of the pressure within the vacuum line **320**, and a gas pressure sensor **323** produces a signal that is representative of the pressure within the vacuum line **320**. The signal from the vacuum pressure sensor **322** and the gas pressure sensor **323** together form a pressure signal **324** that represents the pressure within the enclosed environment **105**.

The vacuum line **320** extends to a vacuum valve **332** that is actuated by a vacuum valve actuator **334**. The vacuum line **320** extends from the vacuum valve **332** to a vacuum source **336**.

The gas line **321** extends to a gas valve **352** that is actuated by a gas valve actuator **354**. The gas line **321** then extends from the gas valve **352** to a gas source **356**.

A control module **370** receives the pressure signal **324** from the pressure sensors **322, 323** and produces a vacuum source signal **372** that activates and deactivates the vacuum source **336**, a vacuum valve signal **378** that prompts the vacuum valve actuator **334** to open and close the vacuum valve **332**, and a gas valve signal **380** that prompts the gas valve actuator **354** to open and close the gas valve **352**.

Referring now to FIG. **4**, a general method **410** of filling a disc drive **100** will be described. In operation **412** the enclosed environment **105** of the disc drive **100** is evacuated, preferably to a predetermined low pressure. In operation **414**, the evacuated enclosed environment **105** of the disc drive is filled with a gas other than air, such as helium, preferably to a predetermined high pressure. By first evacuating the gas other than air so that the enclosed environment **105** reaches a predetermined low pressure and then filling the disc drive with a gas other than air, such as helium, this method assures that the enclosed environment **105** of the disc drive **100** is filled to a desired concentration of helium. Preferably, the low pressure is from about 5 torr to about 100 torr. Low pressures below about 5 torr are difficult to attain with standard equipment, while low pressures above about 100 torr will not yield a sufficiently high concentration of helium. The high pressure is preferably slightly above ambient pressure to prevent leakage of air into the enclosed environment **105** of the disc drive. For example, the high pressure might be about 760 torr. For example, by evacuating a disc drive to a low pressure of about 76 torr and then filling with helium to a high pressure of about 760 torr, it is believed that the concentration of helium in the disc drive will be at least about 95%.

Filling systems **202, 302** could be included at the site of a user of helium filled disc drives. Thus, if the disc drive **100** reached an unacceptably low level of helium concentration, the user could simply refill the disc drive **100** with a filling system **202, 302**. The disc drive **100** could then resume operation. Alternatively, such filling systems **202, 302** could be included at suppliers' facilities and drives with unacceptably low levels of helium could be brought to the suppliers' facility to refill the disc drive with helium. Of course, the filling systems **202, 302** could also be used in filling new disc drives with helium before use.

Referring now to FIG. **5**, a more specific method **500** will be described with reference to how the filling systems **202** and **302** would perform the operations of the method. Thus, reference will be made to similar features of both FIGS. **2** and **3**.

In operation **510**, the vacuum source is connected to the disc drive **100**. This is preferably done by connecting the disc drive connection apparatus **210, 310** to the filling system connection apparatus **216, 316**. This may physically be done either automatically or manually. The control module **270, 370** preferably prompts the vacuum valve actuator **234, 334** to open the vacuum valve **232, 332**. Thus, the vacuum source **236, 336** is connected to the enclosed environment **105** through the filling system connection apparatus **216, 316** and the disc drive connection apparatus **210, 310**.

In operation **512** the vacuum source is activated. This is preferably done by the control module **270, 370**, which sends a vacuum source signal **272, 372** to the vacuum source **236, 336**. In operation **514**, the pressure within the enclosed environment **105** then drops to the predetermined low pressure value. The pressure sensor **222, 322**, which produces a pressure signal **224, 324** that is received by the control module **270, 370**, senses the pressure drop in the enclosed environment **105**.

In operation **516**, after the pressure signal **224, 324** indicates that the pressure within the enclosed environment **105** has reached the low pressure, the control module **270, 370** produces a vacuum valve signal **278, 378** that prompts the vacuum valve actuator **234, 334** to close the corresponding vacuum valve **232, 332**. Thus, the vacuum source **236, 336** is disconnected from the enclosed environment **105**.

In operation **518**, the vacuum source **336** is deactivated. This is preferably done by the control module **270, 370** producing a vacuum source signal **272, 372** that deactivates the vacuum source **236, 336**.

In operation **520**, the enclosed environment **105** within the disc drive **100** is connected to the helium source **256, 356**. The control module **270, 370** preferably does this by producing a gas valve signal **280, 380** that prompts the gas valve actuator **254, 354** to open the gas valve **252, 352**. Thus, the gas source **256, 356** is connected to the enclosed environment **105** through the filling system connection apparatus **216, 316** and the disc drive connection apparatus **210, 310**.

In operation **522**, with the high pressure helium source **256, 356** connected to the low pressure enclosed environment **105**, helium will flow from the high pressure helium source **256,**

356 and fill the enclosed environment **105** with helium. The pressure sensor **222, 322**, which produces a pressure signal **224, 324** that is received by the control module **270, 370**, senses the pressure increase in the enclosed environment **105**.

In operation **524**, after the pressure signal **224, 324** indicates that the pressure within the enclosed environment **105** has reached the high pressure, the control module **270, 370** produces a gas valve signal **280, 380** that prompts the gas valve actuator **254, 354** to close the corresponding gas valve **252, 352**. At this time, the enclosed environment **105** is preferably filled to a predetermined concentration of helium. Preferably, the disc drive connection apparatus **210, 310** is also disconnected from the filling system connection apparatus **216, 316**. Thus, the gas source **256, 356** is disconnected from the enclosed environment **105**.

A user with little expertise can easily implement the method **500**. The user merely needs to connect the disc drive **100** to the filling system **202, 302** using the filling system connection apparatus **216, 316** and the disc drive connection apparatus **210, 310**. In a preferred embodiment, this will merely require the user to connect one or more Schrader-type valves. The user then preferably prompts the control module **270, 370** to begin the automated portion of the filling method, and disconnects the disc drive **100** from the filling system **202, 302** after the automated portion of the filling method is complete.

In summary, an embodiment of the present invention is a system (such as **202** or **302**) for filling an enclosed disc drive environment (such as **105**) with a gas other than air. The system includes a filling system connection apparatus (such as **216** or **316**), which is sized to releasably connect to a corresponding disc drive connection apparatus (such as **210** or **310**). The disc drive connection apparatus is in turn connected to the enclosed environment of the disc drive. The system further includes a vacuum source (such as **236** or **336**) and a source of gas other than air (such as **256** or **356**) that are each selectively connected to the filling system connection apparatus. A pressure sensor (such as **222, 322,** or **323**) is able to produce a pressure signal (such as **224** or **324**) representative of a pressure within the enclosed environment of the disc drive. A control module (such as **270** or **370**) receives the pressure signal (such as **224** or **324**) and directs one of the vacuum source and the source of gas other than air through the filling system connection apparatus to the enclosed disc drive environment.

The control module may be able to disconnect the filling system connection apparatus from the vacuum source and connect it to the source of gas other than air when the pressure

signal indicates that the pressure is within a predetermined low pressure range. The low pressure range is preferably from about 5 torr to about 40 torr. The control module may also be able to disconnect the filling system connection apparatus from the source of gas other than air when the pressure signal subsequently indicates that the pressure has reached a predetermined high pressure. That high pressure may be above ambient pressure. It is preferably above 760 torr.

The system can further include a first valve (such as **232** or **332**) between the vacuum source and the filling system connection apparatus and a second valve (such as **252** or **352**) between the source of gas other than air and the filling system connection apparatus. The control module may control both of those valves. Also, the gas other than air may be helium.

The disc drive connection apparatus may include a disc drive fitting (such as **214**, **314**, or **315**) and a disc drive valve (such as **212**, **312**, or **313**), and the filling system connection apparatus may include a filling system fitting (such as **218**, **318**, or **319**) for mating with the disc drive fitting, such that the disc drive valve opens when the filling system fitting mates with the disc drive fitting.

The disc drive connection apparatus may include a vacuum disc drive fitting (such as **314**), a vacuum disc drive valve (such as **312**), a gas disc drive fitting (such as **315**) and a gas disc drive valve (such as **313**). The filling system connection apparatus may include a vacuum filling system fitting (such as **318**) for mating with the vacuum disc drive fitting, such that the vacuum disc drive valve opens when the vacuum filling system fitting mates with the vacuum disc drive fitting. The vacuum disc drive fitting is connected to the vacuum source. The filling system connection apparatus may also include a gas filling system fitting (such as **319**) for mating with the gas disc drive fitting, such that the gas disc drive valve opens when the gas filling system fitting mates with the gas disc drive fitting. The gas disc drive fitting is connected to the source of gas other than air.

Alternatively, an embodiment of the present invention may be summarized as a method (such as **410** or **500**) of filling an enclosed environment (such as **105**) of a disc drive (such as **100**) with a gas other than air. The method includes connecting (such as **510**) the enclosed environment to a vacuum source (such **236** or **336**). After the enclosed environment has reached a predetermined low pressure range of from about 5 torr to about 40 torr, the method includes disconnecting (such as **516**) the vacuum source from the enclosed environment. The method also includes connecting (such as **520**) the enclosed environment to a source of gas other than air

(such as **256** or **356**) and disconnecting (such as **524**) the source of gas other than air from the enclosed environment after the enclosed environment has reached a predetermined high pressure.

The disc drive may be connected to a filling system (such as **202** or **302**) comprising the vacuum source and the source of gas other than air while connecting the enclosed environment, disconnecting the vacuum source from the enclosed environment, connecting the enclosed environment to a source of gas other than air in, and disconnecting the vacuum source from the enclosed environment. The method may further include disconnecting the disc drive from the filling system after disconnecting the vacuum source from the enclosed environment.

Connecting the enclosed environment to the vacuum source may include opening a first valve (such as **232** or **332**) and disconnecting the vacuum source from the enclosed environment may include closing the first valve. Furthermore, connecting the enclosed environment to the source of gas other than air may include opening a second valve (such as **252** or **352**), and disconnecting the vacuum source from the enclosed environment may include closing the second valve.

An embodiment of the present invention may also be summarized as a system. The system includes a disc drive (such as **100**) defining an enclosed environment (such as **105**). The system also includes means (such as **202** or **302**) for evacuating the enclosed environment to a pressure within a predetermined low pressure range in the enclosed environment and subsequently filling the enclosed environment with the gas other than air to produce a predetermined high pressure in the enclosed environment. The means for evacuating and filling is responsive to a pressure signal (such as **224** or **324**) that is representative of the pressure within the enclosed environment.

It will be clear that the present invention is well adapted to attain the ends and advantages mentioned as well as those inherent therein. While embodiments have been described for purposes of this disclosure, various changes and modifications may be made which are well within the scope of the present invention. For example, pressure sensors could be located at any of various alternative locations, such as between the gas source and the gas valve and between the vacuum source and the vacuum valve. Numerous other changes may be made which will readily suggest themselves to those skilled in the art and which are encompassed in the scope of the invention disclosed and as defined in the appended claims.

What is claimed is:

1. A filling system for filling an enclosed disc drive environment with a gas other than air, the filling system comprising:

a disc drive connection apparatus connected to the enclosed environment of the disc drive;

a filling system connection apparatus sized to releasably connect to the disc drive connection apparatus;

a vacuum source selectively connected to the filling system connection apparatus;

a source of gas other than air selectively connected to the filling system connection apparatus;

a pressure sensor operable to produce a pressure signal representative of a pressure within the enclosed environment of the disc drive; and

a control module receiving the pressure signal and directing one of the vacuum source and the source of gas other than air through the filling system connection apparatus to the enclosed disc drive environment.

2. The filling system of claim 1, wherein the control module is operable to disconnect the filling system connection apparatus from the vacuum source and connect the filling system connection apparatus to the source of gas other than air when the pressure signal indicates that the pressure is within a predetermined low pressure range.

3. The filling system of claim 2, wherein the low pressure range is from about 5 torr to about 40 torr.

4. The filling system of claim 2, wherein the control module is operable to disconnect the filling system connection apparatus from the source of gas other than air when the pressure signal subsequently indicates that the pressure has reached a predetermined high pressure.

5. The filling system of claim 4, wherein the high pressure is above ambient pressure.

6. The filling system of claim 4, wherein the high pressure is above 760 torr.

7. The filling system of claim 1, further comprising a first valve between the vacuum source and the filling system connection apparatus and a second valve between the source of gas other than air and the filling system connection apparatus.

8. The filling system of claim 7, wherein the first and second valves are controlled by the control module.

9. The filling system of claim 1, wherein the gas other than air is helium.

10. The filling system of claim 1, wherein:

the disc drive connection apparatus comprises a disc drive fitting and a disc drive valve; and

the filling system connection apparatus comprises a filling system fitting for mating with the disc drive fitting, such that the disc drive valve opens when the filling system fitting mates with the disc drive fitting.

11. The filling system of claim 1, wherein the disc drive connection apparatus comprises:

a vacuum disc drive fitting;

a vacuum disc drive valve;

a gas disc drive fitting; and

a gas disc drive valve.

12. The filling system of claim 11, wherein the filling system connection apparatus comprises:

a vacuum filling system fitting for mating with the vacuum disc drive fitting, such that the vacuum disc drive valve opens when the vacuum filling system fitting mates with the vacuum disc drive fitting, the vacuum disc drive fitting being connected to the vacuum source; and

a gas filling system fitting for mating with the gas disc drive fitting, such that the gas disc drive valve opens when the gas filling system fitting mates with the gas disc drive fitting, the gas disc drive fitting being connected to the source of gas other than air.

13. A method of filling an enclosed environment of a disc drive with a gas other than air, the method comprising:

(a) connecting the enclosed environment to a vacuum source;

(b) disconnecting the vacuum source from the enclosed environment after the enclosed environment has reached a predetermined low pressure range of from about 5 torr to about 40 torr;

(c) connecting the enclosed environment to a source of gas other than air; and

(d) disconnecting the source of gas other than air from the enclosed environment after the enclosed environment has reached a predetermined high pressure.

14. The method of claim 13, wherein connecting the enclosed environment in step (a) comprises connecting the enclosed environment to a filling system that is operable to selectively connect the vacuum source and the source of gas other than air to the enclosed environment.

15. The method of claim 14, further comprising:

(e) disconnecting the disc drive from the filling system after disconnecting the vacuum source from the enclosed environment in step (d).

16. The method of claim 13, wherein the high pressure is above about 760 torr.

17. The method of claim 13, wherein:

connecting the enclosed environment to the vacuum source in step (a) comprises opening a first valve;

disconnecting the vacuum source from the enclosed environment in step (b) comprises closing the first valve;

connecting the enclosed environment to the source of gas other than air in step (c) comprises opening a second valve; and

disconnecting the vacuum source from the enclosed environment in step (d) comprises closing the second valve.

18. The method of claim 13, wherein the gas other than air is helium.

19. A system comprising:

a disc drive defining an enclosed environment; and

means for evacuating the enclosed environment to a pressure within a predetermined low pressure range and subsequently filling the enclosed environment with a gas other than air to produce a predetermined high pressure in the enclosed environment, the means being responsive to a pressure signal representative of the pressure within the enclosed environment.

20. The system of claim 19, wherein the low pressure range is from about 5 torr to about 100 torr.

21. The system of claim 19, wherein the means for evacuating and filling comprises:

a disc drive connection apparatus connected to the enclosed environment of the disc drive;

a filling system connection apparatus sized to releasably connect to the disc drive connection apparatus;

a vacuum source selectively connected to the filling system connection apparatus;

a source of gas other than air selectively connected to the filling system connection apparatus;

a pressure sensor operable to produce a pressure signal representative of a pressure within the enclosed environment of the disc drive; and

a control module receiving the pressure signal and directing one of the vacuum source and the source of gas other than air through the filling system connection apparatus to the enclosed disc drive environment.