An air transfer device for transferring compressed air from a source volume to a recipient volume. The air transfer device is an assembly that includes a hose with couplings at each end to releasably connect to the source and recipient volumes, and has a variable volume flow control valve between the couplings. An air transfer device is also provided with an ergonomic flow control valve having a variety of interchangeable attachments for connecting to inflatable objects. The air transfer device has many applications, including transferring air between vehicle tires by use of air chucks as the couplings on the ends of the hose.
TIRE AIR TRANSFER DEVICE

BACKGROUND

[0001] This invention relates to a device for pressurizing inflatable objects, and, more particularly, relates to a hose assembly and appurtenances for transferring compressed air from a source volume to a recipient volume.

[0002] The concept of providing relatively unrestricted pressurized airflow through a hose assembly from a properly inflated tire to an under-inflated tire is known in the art. Under-inflated tires are both inconvenient and potentially hazardous. For a driver who has a flat tire on a highway, transferring air from an inflated tire to a deflated tire may be preferable to changing the tire. This preference may be the result of inclement weather conditions, an unsafe roadside, the lack of the driver’s physical ability or mechanical inclination to change a tire, the driver’s desire to not get dirty, or merely a desire to achieve a temporary remedy in a minimum amount of time. For this technique to be effective, the under-inflated tire must be able to hold an amount of air pressure that will allow the vehicle to be driven for a short time, such as the time it takes to get to a service station or at least to an improved roadside stopping location.

[0003] A hose assembly for transferring air between tires has a fitting at each end that attaches to the respective tire. For example, a self-latching, clip-on ball foot air chuck may be attached at one end of the assembly, and a standard press-on ball foot air chuck may be attached at the other end. These air chucks have built-in shutoff valves that remain closed except when the chuck is fitted over a Schrader valve, the standard valve that is provided for inflation on the valve stems of most tires. In use, the self-latching ball foot chuck is connected to the Schrader valve of the properly inflated tire, and a person presses and holds the standard ball foot chuck on the Schrader valve of the under-inflated tire.

[0004] Hose assemblies may also include a valve in the hose that provides for a complete shutoff of the hose. Conventional valves used inline do not provide for variable flow control of air through the hose, and would need to be actuated intermittently to restrict flow to intermittent spurts to slow the release of air, as might be desired to avoid excessive discharge of air from the compressed air source, or if the hose were used to fill objects with a lower pressure requirement than the source.

[0005] Conventional hose assemblies are provided with end couplings that are suited only for connecting to Schrader valves, severely limiting the use of the assemblies. The air chucks provided are also relatively lacking in ergonomic design. Features for identifying the pressure in the source and the recipient volumes are not provided. Without pressure gauging, the hose assembly must be disconnected to check the pressure, for example, in the properly inflated tire to verify the pressure remains adequate and is not reduced too much, as well as in the under-inflated tire to verify the pressure is adequate for driving at least a short distance.

[0006] For the reasons mentioned above, there is a need for an air transfer device that can provide control and variation of airflow. There is also a need for a device that gauges pressure in the compressed air source without disconnecting the hose assembly, alternatively or in combination with provisions for gauging pressure in the object to be inflated. The device should also be comfortable to use and allow attachment to a variety of objects to be pressurized, with these objects possibly having lower pressure ratings than the source volume pressure.

SUMMARY

[0007] Accordingly, it is an object of the present invention to provide an air transfer device allowing variable degrees of flow from a compressed air source volume, such as a properly inflated tire, to a recipient volume, such as an under-inflated tire or other inflatable object.

[0008] Another object of the present invention is to provide an air transfer device that includes improved ergonomic features for comfort of use, as well as additional features that facilitate the activity performed.

[0009] Yet another object of the present invention is to provide an air transfer device that readily allows attachment to a variety of connection types at the recipient volume, and allows customization by the user to include preferred features inline with a hose of the air transfer device.

[0010] According to the present invention, an air transfer device is provided for transferring compressed air from a source volume to a recipient volume. The air transfer device is an assembly that includes a hose with couplings at each end to releaseably connect to the source and recipient volumes, and has a variable volume flow control valve between the couplings. The air transfer device has a variety of applications, including transferring air between vehicle tires by use of air chucks as the couplings on the ends of the hose.

[0011] Also according to the present invention, an air transfer device is provided with an ergonomic flow control valve. This valve has a handle with a substantially axial opening through which air may flow, an actuator pivotally connected to the handle, an inlet at one end that connects to one end of the hose, and an outlet at the other end of the handle that releasably connects to interchangeable end portions for connecting to a variety of inflatable objects.

[0012] The present invention features pressure gauges for measuring the pressure in the source volume, recipient volume, or both. Interchangeable attachments are provided to allow connection of the ergonomic flow control valve to a variety of inflatable objects. Examples of some attachments include nozzles for inflating balloons or beach balls, flexible hose assemblies with clip-on air chucks, and adapters with ball inflation needles.

[0013] The present invention is simple to construct and yet is an effective air transfer device with features previously not used in such an assembly, facilitating transfer of air from a compressed air source volume. The present invention also provides for ease of use by its ergonomic design.

[0014] The foregoing and other features and advantages of the present invention will become more apparent in light of the following detailed description of the embodiments thereof, as illustrated in the accompanying figures. As will be realized, the invention is capable of modifications in various respects, all without departing from the invention. Accordingly, the drawings and the description are to be regarded as illustrative in nature, and not as restrictive.
BRIEF DESCRIPTION OF THE DRAWINGS

[0015] For a more complete understanding of this invention reference should now be had to the embodiments illustrated in greater detail in the accompanying drawings and described below.

[0016] FIG. 1 is a side elevation view of a vehicle, schematically showing the present invention in use on the vehicle;

[0017] FIG. 2 is a perspective view of an embodiment of the present invention;

[0018] FIG. 3 is an enlarged elevation view of a valve of the embodiment of FIG. 2;

[0019] FIG. 4 is an elevation view of an alternative valve to the valve of the embodiment of FIG. 2;

[0020] FIG. 5 is a perspective view of another embodiment of the present invention;

[0021] FIG. 6 is a partially exploded elevation view of an alternative interchangeable end for the embodiment of FIG. 5;

[0022] FIGS. 7-8 are elevation views of further alternative interchangeable ends for the embodiment of FIG. 5;

[0023] FIG. 9 is a perspective view of another embodiment of the present invention;

[0024] FIG. 10 is a perspective view of another embodiment of the present invention;

[0025] FIG. 11 is a partially exploded perspective view of another embodiment of the present invention; and

[0026] FIG. 12 is a partially schematic perspective view of another embodiment of the present invention.

DESCRIPTION

[0027] A tire air transfer device 30 having features of the present invention is schematically shown in FIG. 1. The air transfer device 30 comprises a hose 32, fittings 34, 36 at ends of the hose, and a valve 38 between the fittings 34, 36. The air transfer device 30 is shown in use, transferring air between tires 40, 42 on a vehicle 44, depicted as a car. An inlet fitting 34 is connected to a valve stem on the compressed air source volume 40, here a properly inflated and mounted tire, and is the inlet of the device 30. An outlet fitting 36 is connected to a valve stem on the recipient volume 42, here an under-inflated tire, and is the outlet of the device 30. The valve 38 provides control of airflow through the device 30.

[0028] In the Figures herein, unique features receive unique numbers, while features that are the same in more than one drawing receive the same numbers throughout. Where a feature is modified between figures, a letter is added or changed after the feature number to distinguish that feature from a similar feature in a previous figure. In addition, although reference is made to an inlet fitting 34 to be connected to a source compressed air volume, and to an outlet fitting 36, to be connected to a recipient volume, these designations as inlet and outlet are merely for the purposes of illustration, and the respective fittings could be connected to either source or recipient volumes. Likewise, references to tires and air are for illustrative purposes, and the source and recipient volumes are not intended to be limited to tires, nor is the compressed gas required to be limited to air.

[0029] One embodiment of the tire air transfer device 30 of the present invention is shown in FIG. 2. A self-latching, clip-on ball foot air chuck 34a is provided to attach to the compressed air source volume. A standard angle-faced, press-on ball foot air chuck 36a is provided as an outlet at the other end of the hose 32a to connect to the recipient volume. A variable volume flow control valve 38a is shown to be proximate to the outlet air chuck 36a, but could be located anywhere inline between the air chucks 34a, 36a. An axial flow air chuck is an alternative to the ball foot air chuck 36a, and can allow access to valve stems that are inaccessible to the ball foot air chuck 36a.

[0030] The variable volume flow control valve 38a of FIG. 2 is shown in FIG. 3. This valve 38a allows graduated degrees of flow over the range between fully open, where there is full flow, and fully closed, where there is no flow. The valve 38a is shown as a quarter turn valve, such as a ball valve, that restricts airflow depending on the position of the actuator 46. As shown, this valve 38a has an actuator that is a turnable knob 46, preferably with an indicator arrow 48 to show the valve position and writing indices 50 to indicate the fully-open (“MAX”) and fully-closed (“OFF”) positions.

[0031] An alternative variable volume flow control valve 38b is shown in FIG. 4. This valve 38b has an actuator that is a turnable lever 46b, and incorporates a pressure gauge 52. The valve 38b may be oriented with the pressure gauge 52 on either side of the valve portion 54, so that when it is closed it measures the static pressure in either the source or recipient volumes 40, 42, depending on the gauge 52 location relative to the valve portion 54. Other valves that provide variable levels of flow may be selected by one of ordinary skill in the art.

[0032] Connections of all of the components noted herein to each other and to the hose 32 may be made in accordance with methods and materials known to those of ordinary skill in the art. For example, such connection methods may include, but are not limited to, threaded connections, crimped rings and clips that compress the hose around stems that extend from other parts, and quick-connect type couplings. Connections should be pneumatically made, in that air may flow through the connections and in general they should be substantially leak-free and tight seals. Where reference is made to pneumatic connections, such connections do not require that the pneumatically connected parts be physically adjacent to each other, though the pneumatically connected parts may be adjacent.

[0033] Another embodiment of a tire air transfer device 30b is shown in FIG. 5. A dusting gun is modified to provide a flow control valve 38c with an ergonomic handle 56 and trigger-style actuator 58. This valve 38c opens when force is applied to the actuator 58 to cause it to pivot towards the handle 56. The valve 38c automatically closes when the actuator 58 is released. Although the valve 38c is shown as a pistol-grip style, other styles of dusting or blow guns known to those of ordinary skill in the art may be similarly modified for use in the present invention.

[0034] The valve 38c has an inlet 60 connected to the hose 32a and an outlet 62 that is modified from the outlet of a standard dusting gun to connect to an adapter 64, allowing
connection to a variety of components that mate with the recipient volume 42. The valve 38c and adapter 64 form a valve assembly. The valve assembly can have a variety of ends, including but not limited to a threaded nipple, a threaded socket, a male quick-connect fitting, and a female quick-connect fitting. As shown, the valve 38c is threadedly connected to a quick-connect fitting female end 68, which receives a quick-connect male fitting 82, shown with examples of end components in FIGS. 6-8.

[0035] FIG. 6 shows a removable dusting nozzle assembly 36b, including a dusting nozzle 80 with a fitting 82 at the inlet for releaseably connecting to the adapter 64 outlet 68. Commonly, dusting guns do not have detachable nozzles. A separate attachment 84 is provided that fits over the outlet 86 of the nozzle 80 to allow insertion and appropriate restriction of airflow into balloons, beach balls, and other inflatable items.

[0036] FIG. 7 shows a flexible hose and air chuck assembly 36c. A European-style clip-on air chuck 90 is attached to one end of a flexible hose 92, allowing use of the air transfer device on recipient volumes 42 with Schrader valves. The flexible hose 92 provides flexibility that may be required to access Schrader valves in hard to reach places, and may be any length, but an example length is approximately 6-inches.

[0037] FIG. 8 shows a ball inflation adapter 36d, having a hollow body 94 and a ball inflation needle 96 at one end of the body 94.

[0038] FIG. 9 shows another embodiment of the air transfer device 30c of the present invention. A pressure gauge 100 is provided between the valve 38c and inlet air chuck 34a, and is shown to be connected to the hose 32a using a tee fitting 102, although other connection types are known to those of ordinary skill in the art. The pressure gauge 100 measures the pressure in the hose 32a, and when the valve 38c is closed, the pressure gauge 100 measures the static pressure in the source volume 40. In the air transfer device 30d of FIG. 10, the pressure gauge 100 is instead connected directly into the flow control valve 38d. This connection is shown to be made with an angled threaded fitting 104 through a tapped hole in the valve 38d, but the connection may be cast into the valve 38d or made by other methods known to those of skill in the art.

[0039] FIG. 11 shows yet another embodiment of an air transfer device 30e according to the present invention. The air transfer device 30e has a hose 32a with a fitting 112 that is one half of a releasable coupling on one end. This fitting 112 is shown as a female quick-connect fitting for connecting to a mating releasable fitting 114, shown as male, on a dusting gun 38e with an affixed nozzle 80c. The coupling 110, 112 may be quick-connect or any other type of coupling known to one of ordinary skill in the art. Couplings may be used with this embodiment 30e and pressure gauges, fittings such as tees, variable flow control valves, and dusting or blow gun type valves to allow a user to build any custom arrangement of components desired.

[0040] Another embodiment 30f of the present invention is shown in FIG. 12. Therein each of the previously disclosed embodiments 30a-30e is modified by use of a self-coiling hose 32b.

[0041] A range of sizes and rated pressures may be used for the components described herein, and the present invention should not be limited to any particular size or pressure range. Such criteria may be selected by one of ordinary skill in the art. An example of one readily available size that is appropriate is ¼-inch inside diameter hose and appurtenant parts. Pressure ratings selected should equal or exceed the pressure of the compressed air source volume for the particular application.

[0042] Examples of some suitable components for use in the present invention is noted below, but again, different parts may be specified and modified in accordance with the present invention by a person of ordinary skill in the art. For applications used with conventional automotive vehicle tires as the compressed air source, usually having a manufacturer's recommended maximum inflation pressure of between 35 and 45 pounds per square inch, the following parts are suitable, and parts with greater or lesser pressure ratings may also be appropriate. One suitable hose 32e is general service air and water hose item 7092-25200 from Dayco Products, Inc. of Dayton, Ohio. For use on automobiles, a length should be provided that allows connection between any two tires; approximately 20 feet is generally adequate. A suitable self-latching, clip-on ball foot air chuck 34r is item A809-Y75 from Acme Automotive of East Brunswick, N.J. A dusting gun suitable for modification to provide the flow control valve 38c, 38d, 38e is item A1454 from AmPro Tool Corp. of Los Angeles, Calif. A European-style clip-on air chuck 90 suitable for use on the flexible hose and air chuck assembly 36c is item 14-3100 from Alligator Ventilfabrik GmbH of Geingen/Brenz, Germany.

[0043] The tire air transfer device 30 design can be modified by those skilled in the art to provide many different features in a variety of applications. Additional features may be permanently or releasably incorporated into the embodiments shown in the Figures. For example, pressure gauges may be added on either or both sides of the variable volume flow control valve 38a, or any valve 38 used. Such gauges allow static pressure readings of the source and recipient volumes 40, 42 by merely closing the flow control valve 38, without disconnecting the air transfer device 30.

[0044] The present invention has many advantages, including providing variable volume flow control that is particularly helpful in restricting airflow when it is uncertain that the recipient volume is able to maintain increased air pressure, when the recipient volume has lower pressure requirements than the source volume, and when the recipient volume is relatively small. The dusting gun-style flow control valve provides comfort and ease of use in many applications with its interchangeable end connections. The use of pressure gauges further facilitates use. Available customization provides a user with many new opportunities to exploit the present invention.

What is claimed is:

1. An air transfer device for transferring compressed air from a source volume, defined by a source enclosure, to a recipient volume, defined by a recipient enclosure, the air transfer device comprising:
   a hose having a first end and a second end;
   a coupling at the first end adapted to pneumatically and releasably connect to the source volume;
   means for pneumatically and releasably connecting to the recipient volume at the second end; and
a valve for restricting airflow in the hose to provide variable flow from the source volume to the recipient volume, the valve interposed between the coupling and the connecting means.

2. The air transfer device of claim 1, wherein the valve is a quarter turn valve.

3. The air transfer device of claim 2, wherein the coupling and the connecting means are air chucks.

4. The air transfer device of claim 1, further comprising a pressure gauge pneumatically connected to the hose.

5. The air transfer device of claim 4, wherein the pneumatic connection of the pressure gauge to the hose is made between the valve and the coupling.

6. The air transfer device of claim 4, wherein the pneumatic connection of the pressure gauge to the hose is made between the valve and the connecting means.

7. The air transfer device of claim 1, further comprising:
   a first pressure gauge with a pneumatic connection to the hose made between the valve and the coupling; and
   a second pressure gauge with a pneumatic connection to the hose made between the valve and the connecting means.

8. An air transfer device according to claim 1, wherein the hose is self-coiling.

9. An air transfer device for transferring air compressed air from a source tire to a recipient tire initially having a lower pressure than the source tire, the air transfer device comprising:
   a hose having a first end and a second end;
   a clip-on air chuck at the first end adapted to pneumatically connect to the source tire;
   an air chuck at the second end adapted to pneumatically connect to the recipient tire; and
   a valve for restricting airflow in the hose to provide variable flow from the source tire to the recipient tire, the valve interposed between the clip-on air chuck and the air chuck.

10. An air transfer device for transferring compressed air from a source volume, defined by a source enclosure, to a recipient volume, defined by a recipient enclosure, the air transfer device comprising:
   a hose having a first end and a second end;
   a coupling at the first end adapted to pneumatically and releasably connect to the source volume;
   a valve at the second end, the valve having a handle with two ends and a substantially axial opening therebetween, an actuator pivotally connected to the handle, an inlet at one end of the handle adapted to pneumatically connect to the second end of the hose, and an outlet at the other end of the handle, wherein the valve is open when the actuator is engaged and the valve is closed when the actuator is released; and
   means for pneumatically and releasably connecting to the recipient volume, the connecting means having a first end and a second end, the first end of the connecting means being adapted to pneumatically and releasably connect to the outlet of the valve and the second end of the connecting means being adapted to pneumatically and releasably connect to the recipient volume.

11. The air transfer device of claim 10, further comprising a pressure gauge pneumatically connected to the hose.

12. The air transfer device of claim 11, wherein the pneumatic connection of the pressure gauge to the hose is made between the valve and the coupling.

13. The air transfer device of claim 11, wherein the pneumatic connection of the pressure gauge to the hose is made along the handle of the valve.

14. The air transfer device of claim 10, wherein the connecting means comprises a nozzle with the second end adapted to inflate balloons and beach balls.

15. The air transfer device of claim 10, wherein the connecting means comprises a connection hose having a clip-on air chuck at the second end.

16. The air transfer device of claim 10, wherein the connecting means comprises an adapter fitting having a ball inflation needle at the second end.

17. The air transfer device of claim 10, wherein the outlet of the valve comprises a fitting that is one half of a releasable coupling, adapted to mate with the other half of the coupling that is attached to the connecting means.

18. The air transfer device of claim 10, wherein the outlet of the valve is selected from the group consisting of a threaded nipple, a threaded socket, a male quick-connect fitting, and a female quick-connect fitting.

19. An air transfer device according to claim 10, wherein the hose is self-coiling.

20. An air valve for controlling flow of compressed air from a hose to an inflatable object having a connection point for flow of air into the object, the air valve comprising:
   a handle with two ends and a substantially axial opening therebetween;
   an actuator pivotally connected to the handle;
   an inlet at one end of the handle adapted to pneumatically connect to the second end of the hose;
   an outlet at the other end of the handle, the outlet adapted to pneumatically and releasably connect to interchangeable end portions for connecting to a variety of connection point types, wherein the valve is open when the actuator is engaged and the valve is closed when the actuator is released.

21. The air valve of claim 20, further comprising a pressure gauge pneumatically connected to the valve, with the pneumatic connection between the pressure gauge and the valve made along the handle of the valve.

22. The air valve of claim 20, wherein the outlet of the valve comprises one half of a releasable coupling.

23. The air valve of claim 20, wherein the outlet of the valve is selected from the group consisting of a threaded nipple, a threaded socket, a male quick-connect fitting, and a female quick-connect fitting.