

REGULATED GAS SUPPLY SYSTEM

Background Art

[0001] Because small pneumatically operated devices require a supply of pressurized gas at constant pressure, current technology requires the use of external tanks or compressors in conjunction with a separate gas pressure regulator. In order to supply the regulated gas to the device, either a hose is required from the regulated supply to the inlet port of the device, or the tank and regulator must be externally attached to the device. This requirement limits both usability and portability.

[0002] For devices that only require a small volume of gas, a miniature, self-contained, regulated gas supply is desired. Current high-pressure regulators are large and bulky, and require a means of attaching them to a high-pressure gas reservoir. Further, current reservoirs themselves are too large to be practical for use with portable and small pneumatically operated systems.

Disclosure Of The Invention

[0003] The present invention is a regulated gas supply containing both a pressurized gas reservoir and a high-pressure regulator. The system is miniature and self-contained to fit inside any number of small pneumatically operated devices. Furthermore, the regulated gas supply can be designed to facilitate rapid replacement of the entire assembly in order to replenish the gas supply once the reservoir is depleted, and the gas reservoir is easily replenish with gas after being emptied.

[0004] The combination of all of the above features has not been previously accomplished in a portable regulated gas supply.

Brief Description Of The Drawing

[0005] An apparatus embodying features of the claimed invention are depicted in the accompanying drawing which form a portion of this disclosure and wherein:

[0006] Figure 1 is a sectional view of the regulated gas supply system comprising a high-pressure reservoir and a balanced regulator assembly including a piston and piston chamber;

[0007] Figure 2 is a sectional view of the regulated gas supply system as illustrated in Figure 1, with the piston being forced proximate the chamber seat; and

[0008] Figure 3 is a sectional view of the regulated gas supply system of the present invention used in a firearm simulator.

Description Of The Best Mode

[0009] Referring to Figure 1, the regulated gas supply 100 of the present invention is illustrated. The regulated gas supply 100 is a miniature and self-contained apparatus. In particular, the regulated gas supply 100 includes a body 1 or cartridge containing a pressurized reservoir 4 and a regulating assembly 20. The regulating assembly 20 includes a piston 3 having a piston flange 3a and a spring 5 that are housed in a piston chamber 6. The piston chamber 6 includes a chamber seat 6a and an uppermost surface 6b opposite said chamber seat 6a, with a chamber wall 6c connecting said chamber seat 6a and uppermost surface 6b. The spring 5 is positioned between the piston flange 3a and the chamber seat 6a. The force of the spring 5 will tend to push the piston 3 away from the chamber seat 6a, thereby allowing gas to flow from inlet passage 8 to piston channel 10, and then out of the body through gas outlet 2.

[0010] Comparing Figures 1 and 2, as the pressure in the gas outlet 2 increases, pressure will also increase in upper cavity 11 of the piston chamber 6. As the pressure in upper cavity 11 increases, a force develops on the piston 3 proportional to the pressure in upper cavity 11. This pressure in the upper cavity 11 counteracts the force of the spring 5, and when the pressure is great enough, the piston 3 will be forced against the seat 6a (see Figure 2). When the piston 3 abuts the chamber seat 6a, piston channel 10 within the piston 3 will abut the body 1, thereby preventing further gas flow from the gas reservoir 4. Furthermore, the piston chamber 6 containing the spring 5 is vented to the atmosphere through vent aperture 7, thus maintaining a constant relationship between regulated pressure and atmospheric pressure.

[0011] In order to counteract the force of the high pressure against the portion of the piston 3 that is constantly exposed to the high pressure in the gas reservoir 4, the present design further includes a secondary chamber 9 that is engaged by one end of the piston 3. In particular, the piston 3 includes a piston body 3b and a piston extension 3c, wherein piston extension 3c engages the secondary chamber 9. A central channel 12 is employed through the piston body 3b and piston extension 3c to allow the high-pressure gas to flow into the secondary chamber 9.

The area of the piston **3** acted upon by the gas in secondary chamber **9** is equal to the area of the piston **3** that is constantly exposed to the same high-pressure gas. This arrangement causes the piston **3** to be balanced, so that changes in the pressure of the gas in the reservoir **4**, such as when gas is withdrawn during use, or due to temperature changes in the gas, do not affect the regulated pressure at the outlet port **2**. The pressure at the outlet **2** is therefore proportional to the force of the spring **5**. If the force of spring **5** is increased, the regulated pressure is also increased, conversely, if the force of the spring **5** is decreased, the regulated pressure is also decreased.

[0012] It is foreseen that the present self-contained regulated gas supply **100** can be used in multiple designs of pneumatically operated devices that require a portable supply of pressurized gas at constant pressure for convenient operation of the particular device. In one embodiment, the regulated gas supply **100** could be used with firearm simulators **30**, such as the one illustrated in Figure 3. In this embodiment, the regulated gas supply **100** is able to provide the necessary gas at the desired pressure level such that the release of the gas at gas outlet **2** will control the simulated force of the firearm **30** being shot, and it may further provide the necessary force to lock the firearm from further operation.

[0013] Thus, although there have been described particular embodiments of the present invention of a new and useful REGULATED GAS SUPPLY SYSTEM, it is not intended that such references be construed as limitations upon the scope of this invention except as set forth in the following claims.

Claims

What is claimed is:

1. A miniature regulated gas supply system (100) for distributing highly pressurized gas at a desired pressure, said system (100) being characterized by:
 - a body (1) defining a gas reservoir (4) and a gas outlet (2), said gas reservoir (4) containing a pressurized gas; and
 - a regulating assembly (20) positioned in said body (1) between said gas reservoir (4) and said gas outlet (2), said regulating assembly (20) controlling the pressure of the gas dispersed.
2. The regulated gas supply system (100) as defined in claim 1 wherein said regulator assembly (20) is characterized by:
 - a piston chamber (6) defined in said body (1), said piston chamber (6) having
 - a uppermost surface (6b);
 - a seat (6a) opposing said uppermost surface (6b); and
 - a chamber wall (6c) between said uppermost surface (6b) and said seat (6a);
 - a piston (3) slidably positioned in said piston chamber (6), said piston (3) having
 - a piston flange (3a) engaging said chamber wall (6c); and
 - a piston channel (10) traversing said piston (3);
 - a spring (5) between said piston flange (3a) and said seat (6a), where said spring (5) urges said piston flange (3a) away from said seat (6a).
3. The regulated gas supply system (100) as defined in claim 2 further being characterized by:
 - a secondary chamber (9);
 - a central channel (12) traversing said piston (3);
 - wherein said piston (3) includes a piston extension (3c) having a first end and a piston body having a second end, said central channel (12) extending from said first end of said piston extension (3c) to said second end of said piston body;
 - wherein said piston extension (3c) slidably engages said secondary chamber (9).
4. The regulated gas supply system (100) of claim 1 further being characterized by a vent aperture through said body (1), said vent aperture proximate said spring (5).
5. A method for controlling the pressure of gas provided from a regulated gas supply system (100) being characterized by the steps of:

- a) providing a body (1) defining a gas reservoir (4) and a piston chamber (6), said gas reservoir (4) connected to said piston chamber (6) by a channel, said piston chamber (6) having an uppermost surface (6b), a seat (6a), and a chamber wall (6c) connecting said uppermost surface (6b) with said seat (6a);
 - b) providing a piston in said piston chamber (6), said piston having a first end, a second end, and a piston flange (3a), said piston flange (3a) contacting said chamber wall (6c);
 - c) urging said piston (3) away from said seat (6a) with a spring (5);
 - d) releasing gas from said gas reservoir (4) into said piston chamber (6), said gas flowing through a piston channel (10) through said piston (3); and
 - e) exerting said gas from said body (1) through a gas outlet (2).
6. The method as described in claim 5 wherein after step e) further being characterized by the steps of:
- applying a pressurized force on said piston flange (3a) opposite said spring (5); and
 - forcing said piston (3) into contact with said seat (6a) of said piston chamber (6) to obstruct the flow of said gas through said piston channel (10).
7. The method as described in claim 5 further being characterized by the steps of:
- providing a secondary chamber (9);
 - providing a central channel (12) traversing said piston (3) from a first end of said piston (3) to a second end of said piston (3);
 - engaging said secondary chamber (9) with a first end of said piston (3); and
 - distributing gas through said central channel (12) into said secondary chamber (9) to balance said piston (3).
8. A discrete gas regulator (100) for distributing highly pressurized gas at a desired pressure, said regulator being characterized by:
- a cartridge (1) defining a high-pressure gas reservoir (4) and a gas outlet (2) for dispersing gas at a desired pressure; and
 - a regulating assembly (20) positioned within said cartridge (1) between said gas reservoir (4) and said gas outlet (2), said regulating assembly (20) controlling the pressure of the gas dispersed through said gas outlet (2) from said gas reservoir (4).
9. The discrete gas regulator (100) as defined in claim 8 wherein said regulator assembly is characterized by:

- a piston chamber (6) defined in said body (1), said piston chamber (6) having
- a uppermost surface (6b);
 - a seat (6a) opposing said uppermost surface (6b); and
 - a chamber wall (6c) between said uppermost surface (6b) and said seat (6a);
- a piston (3) slidably positioned in said piston chamber (6), said piston (3) having a piston flange (3a) engaging said chamber wall (6c) and a piston channel (10) traversing said piston (3);
- and
- a spring (5) between said piston flange (3a) and said seat (6a), where said spring (5) urges said piston flange (3a) away from said seat (6a).
10. The discrete gas regulator (100) as defined in claim 9 further being characterized by:
- a secondary chamber (9);
 - a central channel (12) traversing said piston (3);
- wherein said piston (3) includes a piston body and a piston extension (3c), said central channel (12) traversing said piston (3) from an edge of said piston body to an edge of said piston extension (3c);
- wherein said piston extension (3c) slidably engages said secondary chamber (9).
11. The discrete gas regulator (100) of claim 8 further being characterized by:
- a vent (7) traversing said cartridge (1);
- wherein said cartridge (1) has an outer periphery, and said vent (7) extends from said outer periphery to said piston chamber (6) proximate said spring (5).