

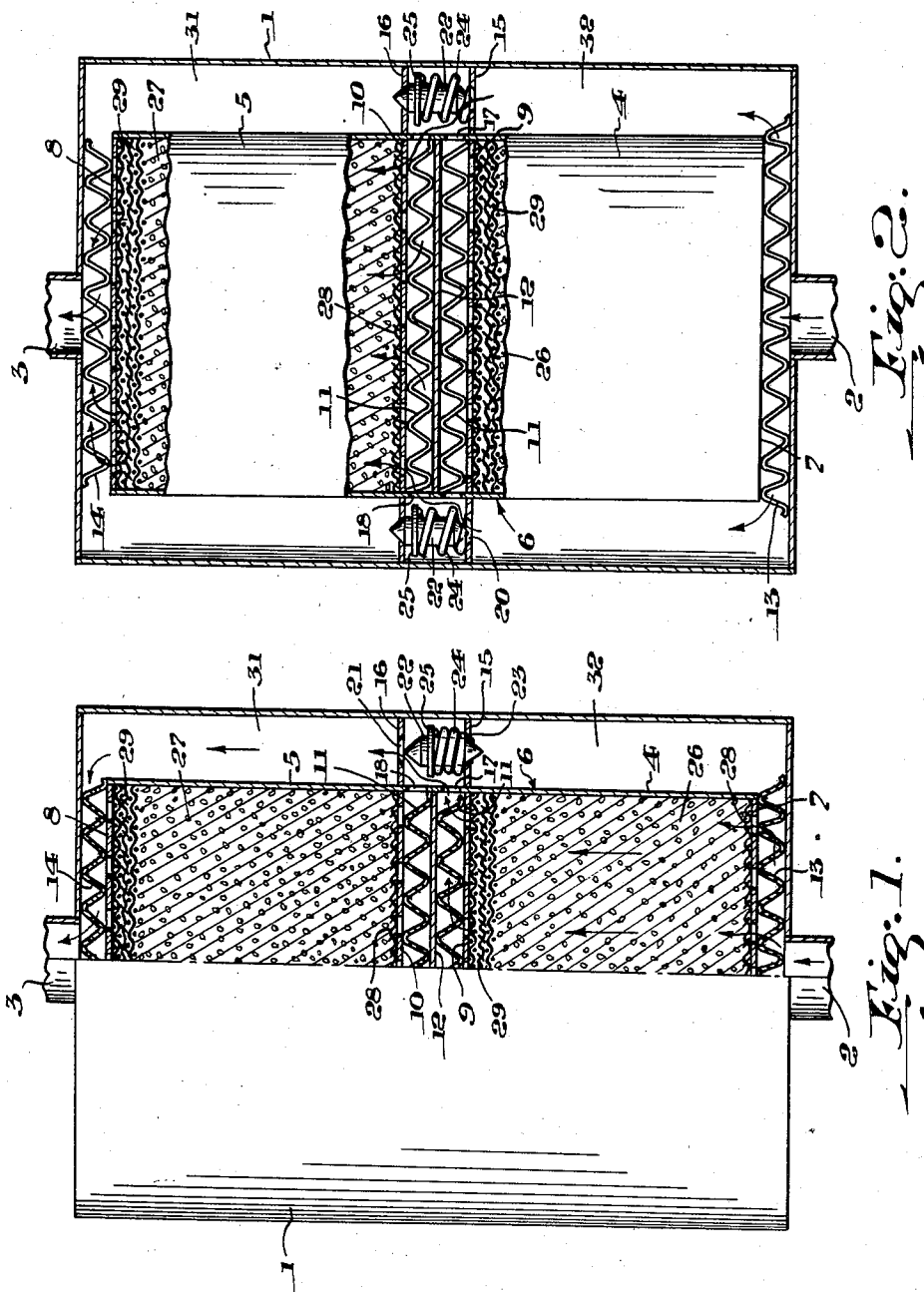
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OXYGEN PRODUCING CANISTER FOR BREATHING APPARATUS

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OXYGEN PRODUCING CANISTER FOR BREATHING APPARATUS

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This invention relates to closed circuit breathing apparatus, and more particularly to a canister containing a chemical for removing carbon dioxide from the exhaled breath and generating oxygen.

This general type of canister for closed breathing circuits is well known. The chemical may be potassium superoxide, which reacts with the moisture in the air exhaled into it to produce oxygen. At the same time, the chemical removes carbon dioxide. As the chemical granules pick up moisture from the breath, they become soft and mushy and fuse together. As the chemical becomes spent, it hardens and the breathing resistance is increased. Also, the chemical generates considerable heat during the reaction.

It is among the objects of this invention to provide an oxygen producing canister which will have less breathing resistance and a lower temperature than comparable ones known before.

In accordance with this invention, a housing is provided with an inlet for exhaled air and an outlet for oxygen. Located inside the housing are two chambers that contain oxygen generating chemical, which becomes hot as it reacts with moisture in the exhaled air. Each of these chambers has an inlet and an outlet. Also disposed in the housing is a valve that normally is held by low melting point material in a position compelling exhaled air to flow through a given one of the chambers. When the material is melted by heat produced in the chemical reaction in the active chamber, a spring moves the valve to another position where it compels air to flow through the other chamber. Consequently, the length of the chemical body through which the air flows at any one time can be cut in half, thereby reducing the breathing resistance.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

Fig. 1 is a side view of my canister, half in section; and

Fig. 2 is an axial section through the canister after the valves have shifted to their second position.

Referring to the drawings, the outside of the canister is an airtight housing 1, except for an inlet 2 at one end and an outlet 3 at the opposite end for connection to the hoses of a closed circuit breathing apparatus. The housing may have any desired shape and is used in an upright position. Inside of it there are two axially aligned chambers 4 and 5, which may be formed by the opposite end portions of a hollow element 6 having perforated end walls 7 and 8. The shape of element 6 is not important, but it will be called a cylinder. The adjacent inner ends of the chambers are formed by axially spaced perforated walls 9 and 10 that may be held apart by corrugated mesh 11 on opposite sides of a solid baffle wall 12 at the center of the cylinder. The cylinder is shorter than the housing and is spaced from the opposite ends of the housing by corrugated mesh spacers 13 and 14 similar to those used in the center of the cylinder. Consequently, air will be allowed to flow through the

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end spacers and the adjoining perforated cylinder end walls, as well as laterally between those walls and the adjacent end walls of the housing.

The cylinder also is smaller in diameter than the housing and is held concentrically therein by means of a pair of annular partitions 15 and 16, which encircle the central portion of the cylinder in the space between it and the side wall of the housing. These partitions are secured in any suitable manner to the housing and cylinder. The side wall of the lower chamber 4 directly below baffle wall 12 is provided with a plurality of circumferentially spaced ports 17 forming outlets between the partitions for air passing through the lower chamber. Between the baffle wall and the perforated wall 10 above it, the lower end of the side wall of the upper chamber is provided with similar ports 18 that form inlets for the upper chamber. It will be observed that these ports open into the area between the two annular partitions.

The partitions 15 and 16 are provided at circumferentially spaced intervals with pairs of axially aligned openings 20 and 21 respectively. Closing the openings 20 in the lower partition are valves 22, as shown in Fig. 1. The valves normally are held in place by a low melting point material 23, such as one of the well-known low melting point alloys that solder the valves to the partition. Each valve preferably has a solid cylindrical body provided with conical ends as shown. With the valves secured to the lower partition, the openings 21 in the upper partition are open for flow of air therethrough. However, each valve is urged upward toward the opening above it by a spring 24, most suitably a coil spring encircling the valve and compressed between the lower partition and an integral collar 25 encircling the upper portion of the valve below its conical end.

Each of the chambers 4 and 5 in the housing is filled with a granular oxygen generating chemical 26 or 27, such as potassium superoxide, which will also remove carbon dioxide from the air passing through it. The granules are prevented by a fiber glass cloth 28 or the like from sifting out through the perforations in the lower ends of the chambers. Between the perforated upper wall of each chamber and the chemical body therein, there is located a porous mat 29 of fiber glass or other heat resistant material. This mat serves as a filter to prevent any chemical particles from being drawn into the canister outlet, from which they might reach the lungs of the user.

When the canister is first put in use, the valves 22 are in the position shown in Fig. 1, thereby preventing air from flowing up through partition openings 20. It must therefore flow up through the lower chemical chamber 4, where carbon dioxide is removed and oxygen is added. The rejuvenated air leaves the lower chamber through the outlets 17 in its upper end and enters the space between the two partitions 15 and 16. From there it flows up through openings 21 in the upper partition and up around the upper chamber 5 in the surrounding space 31, which thereby forms a bypass around the upper chamber. From this bypass the air flows out of the canister through the outlet 3 at the upper end of the housing. Although there is nothing that positively prevents the air from flowing through the upper chamber, the resistance of the chemical therein will cause it to take the easier path, which is by way of the bypass.

The moisture in the exhaled air entering the lower end of the lower chamber will cause the chemical at the bottom to generate oxygen. As the moisture penetrates farther up into the chemical, the oxygen generating zone continues to rise while the chemical be-

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low it becomes exhausted. The chemical reaction also produces heat that likewise rises through the chemical bed, and by the time the entire bed is about spent, the heat will have become great enough adjacent the lower partition to melt the fusible material 23 sufficiently to permit the coil springs to project the valves up into openings 21 in the upper partition. This will close those openings and open the openings 20 below them.

The valves then will be in the position shown in Fig. 2, where it will be seen that air can no longer flow up through the upper bypass 31, but must pass through the upper chemical chamber 5. The breathing resistance of the lower chamber is now great enough to cause most, if not all, of the incoming air to flow up around the lower chamber in the bypass formed by the space 32 around it. It will be seen that the air escapes from the lower bypass through openings 20 in the lower partition and then enters the bottom of the upper chamber through inlets 18. The same type of chemical reaction that occurred in the lower chamber then takes place in the upper chamber until that one is exhausted also.

An important advantage of this system is that the user never has to breathe through more than about half the length of the cylinder 6 at any one time. If it were not for this invention, he would have to breathe through the entire length of the cylinder, where the breathing resistance would be much greater.

The valves are shown originally soldered to the lower partition, but it is within the scope of this invention to invert them and solder them to the upper position. In such a case the incoming air would first flow through bypass 32 and the upper chamber. After release of the valves, the air would pass through the lower chamber and the upper bypass 31.

I claim:

1. An oxygen producing canister comprising a housing provided with an inlet for exhaled air and an outlet for oxygen to be inhaled, two chambers in said housing adapted to contain oxygen generating chemical that becomes hot as it reacts with moisture in said exhaled air, each chamber having an inlet and an outlet communicating with the inside of the housing, a valve in the housing, low melting point material normally holding the valve in a position to compel exhaled air to flow through a predetermined one of said chambers, and a spring for moving the valve when said material is melted by heat produced by said reaction in said one chamber, said spring moving the valve into a position to compel air to flow through the other chamber.

2. An oxygen producing canister comprising a housing provided with an inlet for exhaled air and an outlet for oxygen to be inhaled, two chambers in said housing arranged in series between said inlet and outlet and adapted to contain oxygen generating chemical that becomes hot as it reacts with moisture in said exhaled air, each chamber having an inlet and an outlet, the housing being provided with a first passage around one of said chambers from the housing inlet to the inlet of the other chamber, the housing being provided with a second passage around the other chamber from the outlet of said one chamber to the housing outlet, a valve for said passages, low melting point material normally holding the valve in a position to close one passage and open the other, and a spring for moving the valve when said material is melted by heat produced by said reaction in the chamber having the closed passage, said valve movement being such as to open the closed passage and close the open passage.

3. An oxygen producing canister comprising a housing provided with an inlet for exhaled air and an outlet for oxygen to be inhaled, two chambers in said housing arranged in series between said inlet and outlet and adapted to contain oxygen generating chemical that becomes hot as it reacts with moisture in said exhaled air, each chamber having an inlet and an outlet, the housing being pro-

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vided with a first passage around one of said chambers from the housing inlet to the inlet of the other chamber, the housing being provided with a second passage around the other chamber from the outlet of said one chamber to the housing outlet, a transverse partition in each passage provided with an opening, a valve between said partitions, low melting point material normally holding the valve in a position to close the opening in one of said partitions, and a spring for moving the valve toward the other partition when said material is melted by heat produced by said reaction in the chamber adjoining said one partition, the spring moving the valve into a position to close the opening in said other partition.

4. A canister according to claim 3, in which said valve has tapered ends, and said spring is coiled around the valve and compressed between said one partition and a collar around the valve.

5. An oxygen producing canister comprising a housing provided at one end with an inlet for exhaled air and at the other end with an outlet for oxygen to be inhaled, a pair of chambers disposed end to end in said housing and spaced from the walls thereof and adapted to contain oxygen generating chemical that becomes hot as it reacts with moisture in said exhaled air, each chamber having in its ends an inlet and an outlet, the inlet and outlet at the inner ends of the chambers communicating with the space around the chambers, a pair of transverse partitions surrounding said chambers in said space and forming between the partitions an annular area in communication with said inner inlet and outlet, said partitions being provided with a pair of openings, a valve between the partitions, low melting point material normally holding the valve in a position to close the opening in one of said partitions, and a spring for causing the valve to close the other partition opening when said material is melted by heat produced by said reaction in the chamber adjoining said one partition, whereby air is by-passed around first one chamber and then the other.

6. A canister according to claim 5, in which said partition openings are axially aligned with each other, and said spring is a coil spring that moves the valve in a straight line from one of said openings to the other.

7. An oxygen producing canister for breathing apparatus, comprising two chambers adapted to contain oxygen generating chemical that becomes hot as it reacts with moisture in the breath, each chamber having an inlet and an outlet, a housing into which said inlets and outlets open, the housing having an inlet for exhaled air and an outlet for oxygen to be inhaled, a pair of partitions in the housing outside of said chambers, one partition being between the inlet and outlet of each chamber and being provided with an opening, a valve between the partitions, low melting point material normally holding the valve in a position closing the opening in one partition, and a spring for moving the valve toward the other partition when said material is melted by heat produced by said reaction in the chamber adjoining said one partition, the spring moving the valve into a position to close the opening in said other partition.

8. The combination with an oxygen producing canister having an inlet for exhaled air and an outlet for oxygen to be inhaled, of two chambers adapted to contain oxygen generating chemical that becomes hot as it reacts with moisture in the breath, each chamber having an inlet and an outlet, the canister having a passage extending outside of one chamber from the canister inlet to the inlet of the other chamber, the canister having another passage extending outside of said other chamber from the outlet of said one chamber to the canister outlet, a valve adapted to close either passage, low melting point material normally holding the valve in a position closing one of said passages, and a spring for moving the valve when said material is melted by heat produced by said reaction, said spring moving the valve into a position

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closing the other passage to permit air to flow through said normally closed passage.

9. An oxygen producing canister for breathing apparatus comprising two chambers adapted to contain oxygen generating chemical that becomes hot as it reacts with moisture in the breath, each chamber having an inlet and an outlet, the canister being provided with a passage connecting the inlet of one chamber with the inlet of the other chamber, the canister also having a passage connecting the outlet of said other chamber with the outlet of said one chamber, a valve adapted to close either passage, low melting point material normally hold-

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ing the valve in a position closing one of said passages, and a spring for moving the valve when said material is melted by heat produced by said reaction, said spring moving the valve into a position closing the other passage and permitting air to flow through said normally closed passage.

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