United States Patent

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[31] 15010

[54] **EXHALATION VALVE**
13 Claims, 6 Drawing Figs.

[52] U.S. Cl. 251/263, 251/285, 251/340, 137/330, 137/513.5, 137/523
[51] Int. Cl. F16k 31/528, F16k 15/18
[50] Field of Search 251/77, 84, 87, 117, 257, 263, 285, 340, 368; 137/330, 513, 513.3, 513.5, 522, 523

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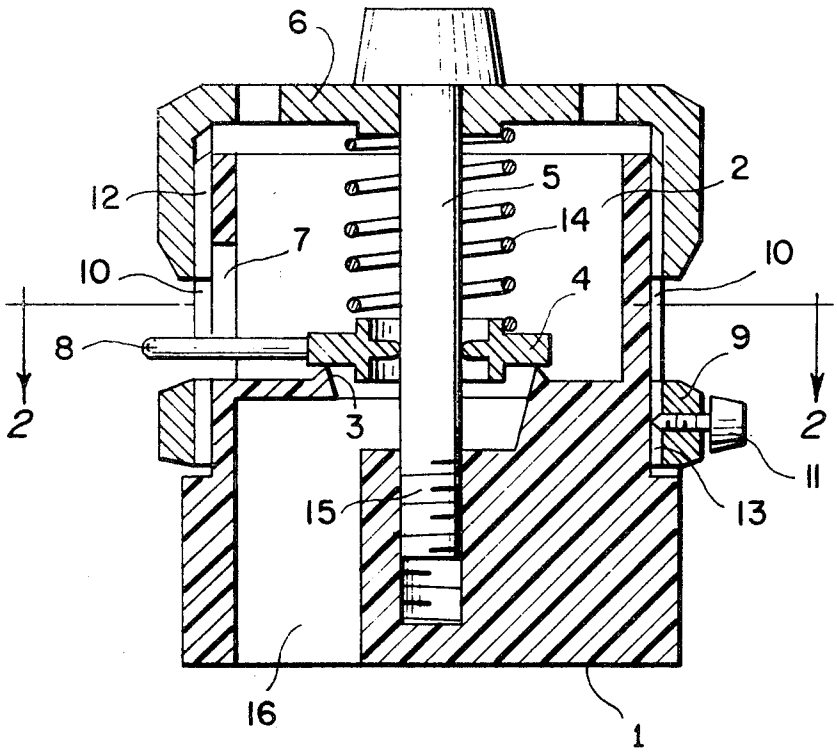
ABSTRACT: An exhalation valve for a breathing apparatus having a valve member urged against a valve seat by an adjustable retaining force. A mechanism is provided to adjust the relative position between the valve member and the valve seat independently of the retaining force.



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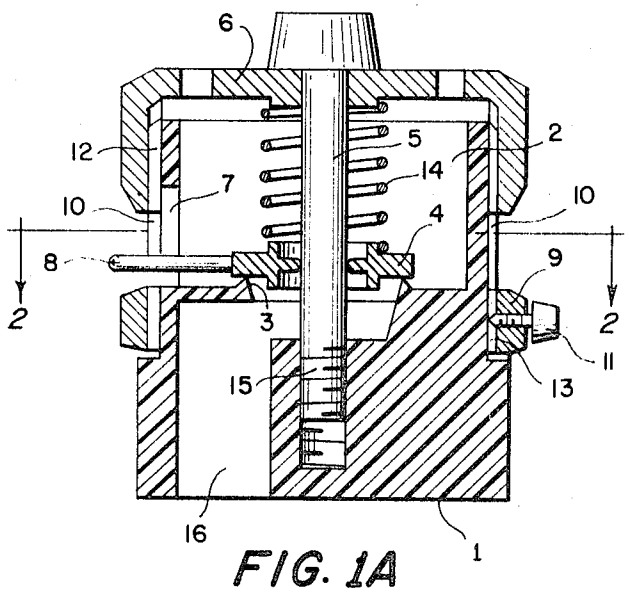

FIG. 1A

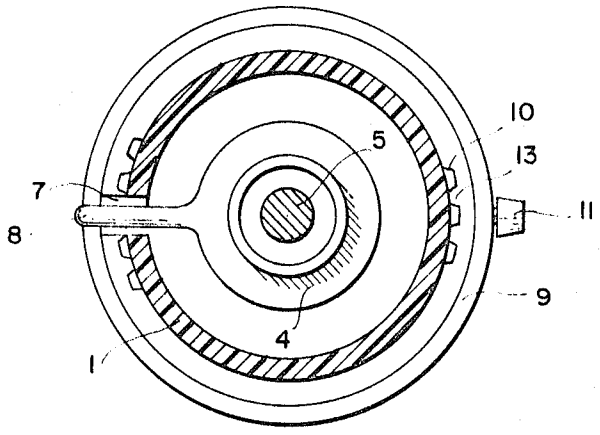

FIG. 2

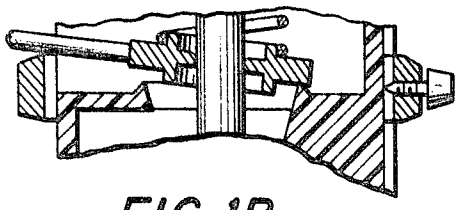

FIG. 1B

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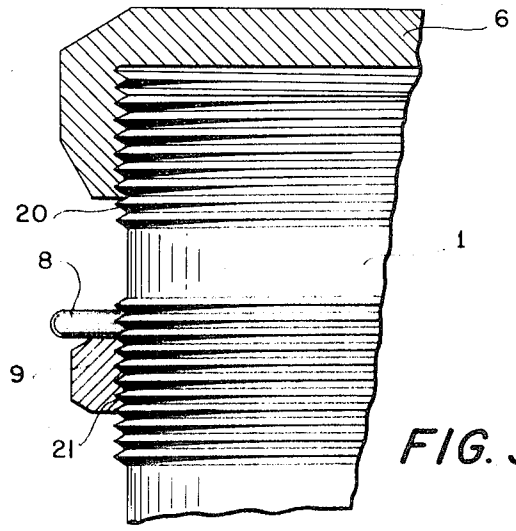

FIG. 3

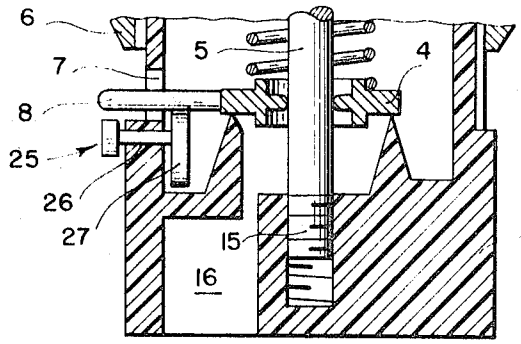

FIG. 4

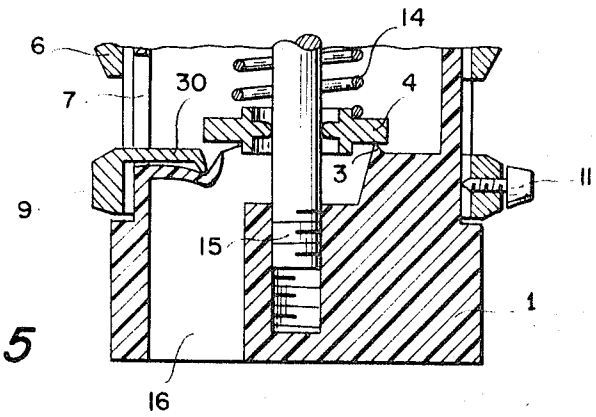

FIG. 5

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EXHALATION VALVE

BACKGROUND

The present invention relates to an exhalation valve of the type adapted for a breathing apparatus and comprising a valve member which is urged towards a valve seat.

In this type of valve it is important that the valve member be easily actuated so that it is not necessary for the patient to exert excess force to exhale through the valve. Exhalation valves of this type are often used in breathing apparatus for administering medical agents carried by the breathing air. In exhalation, such medical agents tend to deposit as a thin film on the valve member, causing it to adhere to the valve seat. This increases the breathing resistance and if the apparatus if out of use for some time, the valve member becomes attached to the valve seat and is relatively hard to unfasten.

SUMMARY OF THE INVENTION

Thus it is a purpose of this invention to provide a new and improved breathing valve of the type referred to wherein certain difficulties of the previous valves are eliminated.

This purpose is achieved in accordance with the present invention by providing the valve with a means for adjusting the retaining force urging the valve member towards its seat and also with an adjusting member for controlling the relative position between the valve member and the valve seat, the said adjustments resulting in an easy-breathing valve. Because of this adjusting means, a very thin slot is formed between the valve member and its seat independently of the retaining force. This slot does not have to be present along the entire periphery of the valve seat; and indeed it is advantageous for it to extend only for a portion of the said periphery. In this case the advantages of the invention are obtained and at the same time the loss of breathing gas is reduced. With this arrangement it is possible to control the resistance to exhalation individually for each patient. Such an arrangement is particularly desirable when the patient suffers from certain diseases of the breathing organs.

Numerous embodiments are encompassed within the scope of the invention for providing the said adjustments. For example, the valve member may include a lever which is acted upon by a member surrounding the valve housing, which member may be movable along slots or by means of a threaded engagement with the housing, or the lever can be actuated by an eccentrically mounted cam. Additionally, the adjustments can be effected by acting on the valve seat rather than the valve member.

Thus, it is an object of this invention to provide a new and improved exhalation valve.

It is another object of this invention to provide a new and improved valve including means for adjusting the relative positions between the valve member and the valve seat independently of the means for retaining the valve member against the valve seat.

Other objects and the attendant advantages of the present invention will become apparent from the detailed description to follow together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

There follows a detailed description of a preferred embodiments of the invention to be read together with the accompanying drawings. However, it is to be understood that the invention is capable of numerous modifications and variations without departing from the spirit and scope of the invention.

FIG. 1 is a sectional view through a first embodiment of a valve device constructed in accordance with the present invention.

FIG. 1B shows a portion of FIG. 1 with certain elements in a different position.

FIG. 2 is a sectional view taken along line 2–2 of FIG. 1.

FIG. 3 is a partial elevational view, showing parts in cross section, and showing a modification of the invention.

FIG. 4 is a sectional view similar to FIG. 1 but showing a modification of the invention.

FIG. 5 is a sectional view similar to FIG. 1 but showing another modification of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, like numerals are used to indicate like elements throughout.

Referring to FIGS. 1 and 2, which show a first embodiment of the invention, the valve device comprises a housing 1 with a chamber 2 in which a valve seat 3 is provided. Positioned on the valve seat 3 is a spring urged valve member 4, in the form of a disc, which is guided along the stem of a screw 5. The chamber 2 has a lid 6 which is slidably adjustable in the longitudinal direction of the housing for controlling the loading of the spring 14 on the valve disc 4.

In the lateral wall of the valve housing 1 there is provided an aperture 7. A lever 8 is attached to the valve disc 4 and extends through the aperture 7 to the exterior of the valve housing 1. An adjusting member in the form of an annular ring 9 is movable longitudinally along the exterior of the housing for moving the lever 8 and hence moving the valve disc 4 relative to the valve disc 3. With this mechanism it is possible to slant the valve disc 4 relative to the valve seat 3, as shown in FIG. 1B thereby providing a continuously open segmentally shaped slot between the valve member and the valve seat. With this arrangement there is considerably less risk of the valve member 4 becoming attached to the valve seat 3.

In the embodiment of FIGS. 1 and 2, the exterior of the housing is provided with a plurality of longitudinally extending slots or grooves 10; and each of the members 6 and 9 are provided with longitudinally extending teeth 12 and 13, respectively, for engaging the slots 10 and moving longitudinally therein for accomplishing their respective adjusting functions. The longitudinal position of the adjusting ring 9 is fixed by engaging the stop screw 11 with the exterior of the housing, and the longitudinal position of the lid 6 is fixed by the threaded engagement 15 of the stem 5 with the housing 1.

FIG. 3 shows a modification of the invention wherein the tooth and slot engagement, including elements 10, 12 and 13, on the exterior of the housing, are replaced by a screw-threaded engagement between the members 6 and 9 and the exterior of the housing 1. In this embodiment cooperating screw threads 20 are provided between the lid 6 and the housing 1; and cooperating screw threads 21 are provided between the adjustment member 9 and the housing 1. With this arrangement the lower portion of the stem 5 may be modified to eliminate the screw thread 15 between the stem 5 and the housing 1. In this case, the screw threads 20 serve the purpose of holding the lid 6 onto the housing 1. The adjusting ring 9 is adjusted by simply turning the ring about the housing 1 thereby moving the adjusting member 9 longitudinally of the housing. In this arrangement the stop screw 11 may also be eliminated. While the modification of FIG. 3 may be applied to an exterior housing of any convenient shape, it is preferably applied to an arrangement wherein the outer surface of the housing 1 is generally cylindrical.

FIG. 4 shows another modification of the invention wherein the ring 9 is replaced by an adjusting member 25 which includes a shaft 26 rotatably mounted in the housing and including an eccentric head 27 which is mounted to cooperate with the lever 8 such that rotation of the shaft 26 causes the eccentric cam 27 to move the lever 8 and thereby separate a portion of the valve 4 from the valve seat 3.

FIG. 5 shows still another embodiment of the invention. This embodiment is similar to FIG. 1 except that the lever 8 is eliminated, and instead an arm 30 is provided on the adjusting member 9, this arm acting on the valve seat 3 rather than on the valve member 4 for changing the relative positions between the valve seat 3 and the valve member 4.

Although the invention has been described in considerable detail with respect to preferred embodiments, it is apparent that the invention is capable of numerous modifications and variations apparent to those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. A valve adapted for use as an exhalation valve in a breathing apparatus, comprising, a housing, a valve seat in said housing, a guide stem attached to the housing and extending in an axial direction relative to the opening of the valve seat, a valve member mounted on said guide stem with the guide stem passing through an opening in the valve member such that the valve member is slidable relative to the guide stem, retaining means for applying an adjustable retaining force against the valve member to normally urge the same against the valve seat, an adjusting means for acting on one of said valve seat or said valve member to create a segmentally shaped opening between the valve member and the valve seat, said adjusting means being operable independently of said retaining means such that the segmentally shaped opening can remain even when the force of the retaining means would otherwise be sufficient to close the valve member against the valve seat under normal conditions in the absence of the adjusting means.

2. A valve according to claim 1 wherein said valve member includes a lever affixed thereto, and wherein said adjusting means is mounted to act on said lever.

3. A valve according to claim 2 wherein said adjusting means includes an adjusting member surrounding the housing and movable therealong, and said lever extends out of said housing and is engaged by the adjusting member, such that the movement of the adjusting member along the housing causes the lever to move and thereby control the position of the valve member relative to the valve seat.

4. A valve according to claim 3 wherein said adjusting member engages the exterior of the said housing by means of a parallel tooth and slot engagement, so that the adjusting member is movable in the direction parallel to the teeth and slots to adjust the position of the lever.

5. A valve according to claim 3 wherein said adjusting member engage the exterior of the housing by means of a screw-threaded engagement, such that the adjusting member is movable to adjust the position of the lever by being turned along about said housing along said screw threads.

6. A valve according to claim 3 wherein said adjusting member includes a stop screw passing therethrough and engaging the housing for locking the adjusting member in a selected position.

7. A valve according to claim 2 wherein said adjusting means comprises a shaft rotatably mounted in the housing and a cam head eccentrically mounted on said shaft and engaging the lever such that rotation of the shaft causes movement of the lever to adjust the position of the valve member relative to the valve seat.

8. A valve member according to claim 1, said valve member being disposed in a chamber having a lid, said retaining means including said lid and a spring means acting between the lid and the valve member to urge the latter towards the valve seat, said lid being movably mounted on the housing relative to the valve member to adjust the force of the spring on the valve member and hence adjust the said retaining force.

9. A valve according to claim 8 including an aperture in the wall of the housing, a lever connected to the valve and extending through the said aperture to the exterior of the housing, and including an adjusting member surrounding the housing and mounted to move said lever to vary its position relative to the valve seat.

10. A valve according to claim 9 wherein said adjusting member engages the exterior of the said housing by means of a parallel tooth and slot engagement, so that the adjusting member is movable in the direction parallel to the teeth and slots to adjust the position of the lever.

11. A valve according to claim 9 wherein said adjusting member engage the exterior of the housing by means of a screw threaded engagement, such that the adjusting member is movable to adjust the position of the lever by being turned about said housing along said screw threads.

12. A valve according to claim 11 wherein the exterior surface of the housing is of circular cross section.

13. A valve according to claim 1 wherein said adjusting means includes a member mounted to act directly on the valve seat to vary the position of the valve seat relative to the valve member.