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COMBINATION BREATHING VALVE AND SPEAKING DIAPHRAGM UNIT

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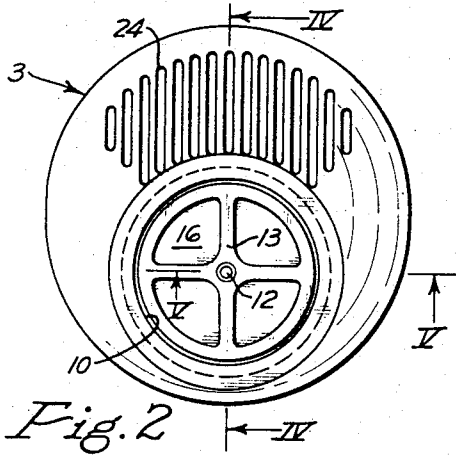


Fig. 2

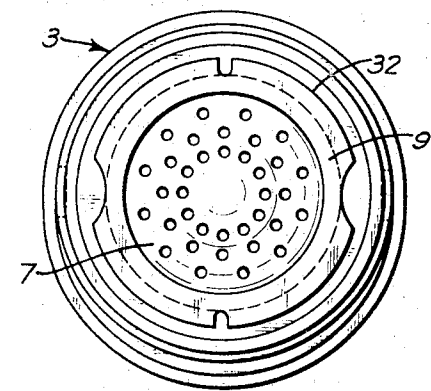


Fig. 3

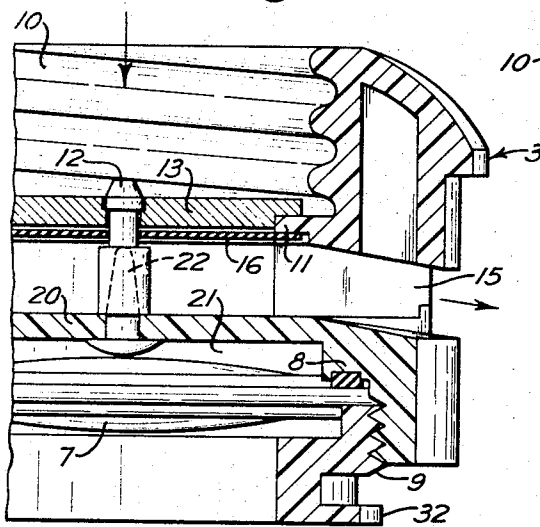


Fig. 5

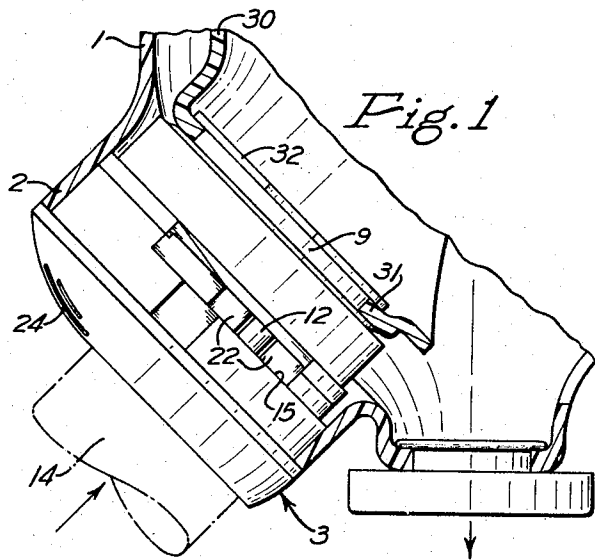


Fig. 1

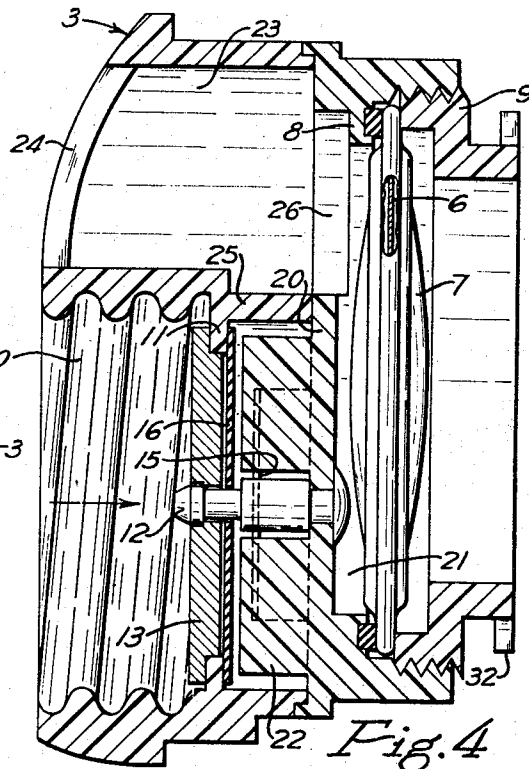


Fig. 4

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COMBINATION BREATHING VALVE AND SPEAKING DIAPHRAGM UNIT

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ABSTRACT OF THE DISCLOSURE

A housing that is adapted to be sealed in an opening in a breathing mask contains a speaking diaphragm and a valve spaced from it. The diaphragm forms one end of a chamber that is connected by a passage through the housing to the opposite end of the housing. The valve is spaced from this chamber, and the side wall of the housing between them has an opening that communicates with the valve.

In Patent 3,035,574, a device consisting of an exhalation valve and a speaking diaphragm is shown mounted in an opening in a breathing mask and projecting forward from it. Although that device performs satisfactorily, it will be observed that the space directly behind the diaphragm unit has to be fairly large in order not to restrict exhalation, and for the same reason the rearwardly opening exhalation valve must be located a considerable distance in front of the face piece.

It is an object of this invention to provide a combination breathing valve and speaking diaphragm unit, in which the valve is more protected than the one shown in the above-mentioned patent, in which the chamber beside the diaphragm can be made smaller, and in which the valve does not have to be spaced in front of the mask.

In accordance with this invention, a housing that is open at one end has a side wall adapted to be sealed in an opening in a breathing mask. The other end of the housing has an end wall provided with an opening through it, in which a breathing valve is mounted. Mounted in the housing adjacent its open end is a speaking diaphragm. The side wall of the housing is provided with an outlet port between the valve and diaphragm. Inside the housing, between this port and the diaphragm, there is an upright partition wall that is spaced from the diaphragm to form a thin chamber between them. The housing is provided with an internal passage connecting this chamber with a voice transmission opening in the end wall beside the valve.

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

FIG. 1 is a side view of our unit mounted in a breathing mask;

FIG. 2 is a front view of the unit;

FIG. 3 is a rear view thereof;

FIG. 4 is an enlarged longitudinal vertical section through the unit, taken on the line IV—IV of FIG. 2; and

FIG. 5 is an enlarged fragmentary cross section, taken on the line V—V of FIG. 2.

Referring to FIG. 1 of the drawings, a mask 1 of any suitable construction is provided in a convenient location, usually directly in front of the mouth, with an opening encircled by a forwardly and downwardly projecting flange 2. The flange surrounds the central and rear portions of a housing 3 that preferably is cylindrical. The side wall of the housing is sealed in the opening in any suitable manner.

As shown in FIGS. 4 and 5, the inner or back end of the housing is open and contains a speaking diaphragm 6 in a unit 7 that may be held against an integral shoulder

8 inside the housing in any suitable way, such as by a retaining ring 9 screwed into the housing. The outer or front wall of the housing has an inlet opening through it, preferably a circular opening 10 the center of which is offset downwardly from the axis of the housing. The side wall of the opening extends into the housing and has an internal flange 11 at its inner end. Snap-mounted in this opening around a pin 12 rigidly supported by the housing, there is the circular spider 13 of an inhalation valve that will be described in the next paragraph. The side wall of opening 10 may be threaded to receive a breathing tube 14 (FIG. 1) connected to an air purifying canister, if desired.

Behind the valve the side wall of the housing, preferably at its opposite sides, is provided with a pair of outlet ports 15 that are spaced from the encircling wall of the mask. These ports may be in the form of arcuate slots that extend part way around the housing. Consequently, when the wearer of the mask inhales, air enters the housing 3 through inlet 10 and leaves the housing through ports 15 inside the mask. To prevent exhalation in the reverse direction through the same channel, a flexible diaphragm 16 is mounted on central pin 12. The marginal area of this diaphragm normally engages a seat formed by flange 11.

Another feature of this invention is that housing 3 is provided behind its outlet ports 15 with an upright partition wall 20 that is spaced a short distance from the front of the speaking diaphragm unit in order to form a chamber 21 between them. This wall supports the rear end of valve pin 12 and also preferably supports a central vertical rib 22 that extends above and below the pin and close to the valve diaphragm. During inhalation, the diaphragm bends or folds back over the rib and leaves clear laterally-extending passages between the spider and outlet ports, thus providing the least resistance path of air flow.

Above the valve, housing 3 is provided with an internal passage 23 that connects a grille-like voice opening 24 in its front wall with the inside of chamber 21. Preferably, the passage is formed between the upper part of the housing side wall and a partition wall 25 extending backward from the lower part of the voice opening to a similar opening 26 in upright partition wall 20. The sides of the horizontal partition 25 are connected with the side wall of the housing at opposite sides of the inhalation valve. When the wearer of the mask speaks, the speaking diaphragm is vibrated and generates sound waves in chamber 21 in front of the speaking diaphragm, which pass through the internal passage 23 to the opening 24 in the front wall and thereby transmit the speech to nearby listeners.

If desired, a small oral-nasal mask 30 may be used inside mask 1, in which case an returned flange 31 around its inlet is clamped between the back of housing 3 and a flange 32 encircling retaining ring 9, as shown in FIG. 1.

It will be seen that the valve is inside the mask, where it is well protected by the surrounding housing 3. The air being drawn into the mask does not have to pass across the speaking diaphragm, so the chamber 21 in front of that diaphragm can be made quite thin. The result is that the entire unit is quite short and does not project very far from the front of the mask.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desired to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A combination breathing valve and speaking diaphragm unit for a breathing mask, said unit comprising a housing having a side wall adapted to be sealed in an

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opening in such a mask, the housing having a wall at one end but being open at the opposite end, a speaking diaphragm mounted in the housing adjacent its open end and closing that end, said end wall of the housing having an opening therethrough spaced lengthwise of the housing from the diaphragm, the diaphragm overlapping at least the major portion of the end wall opening, a valve mounted in said wall opening, the side wall of the housing being provided with an outlet port between said valve and diaphragm, and a partition wall in the housing substantially parallel to said diaphragm, the partition wall being located between said port and diaphragm but spaced from the diaphragm to form a chamber between the diaphragm and partition wall, said end wall being provided with a voice transmission opening at one side of said end wall opening, and the housing being provided with an internal passage connecting said voice opening with said chamber.

2. A combination valve and speaking diaphragm unit according to claim 1, in which said voice transmission opening is above said end wall opening, said partition wall is provided with an opening in line with said voice opening, and a second partition wall in the housing extends lengthwise thereof connecting the bottoms of said voice opening and partition opening and is joined along its sides with the housing side wall to form therewith said internal passage.

3. A combination valve and speaking diaphragm unit according to claim 1, in which said valve includes a flexible diaphragm anchored at its center and adapted to flex toward said partition wall when opened, the partition wall being provided with a central vertical rib projecting close to said flexible diaphragm and engageable thereby when the valve is opened.

4. A combination inhalation valve and speaking diaphragm unit for a breathing mask, said unit comprising a housing having a side wall adapted to be sealed in an

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opening in such a mask, the housing having a front wall and an open back end, a speaking diaphragm disposed in the housing adjacent its back end and closing that end, a retaining ring holding the speaking diaphragm in place and projecting from said back end, the projecting portion of the ring being provided with an encircling flange spaced from said housing to form an annular groove, said front wall of the housing having an inlet opening therethrough spaced from the diaphragm, the diaphragm overlapping at least the major portion of said inlet opening, an inhalation valve mounted in said wall opening, the side wall of the housing being provided with an outlet port behind the valve, and an upright partition wall in the housing substantially parallel to said diaphragm, the partition wall being located behind said port and spaced from the front of the diaphragm to form a chamber in front of the diaphragm, said front wall being provided with a voice transmission opening, and the housing being provided with an internal passage connecting said chamber with the voice opening.

5. A combination inhalation valve and speaking diaphragm unit according to claim 4, the side wall of said inlet opening being formed for receiving an inhalation tube.

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