

Oct. 24, 1967

J. H. McDONALD
UNDERWATER MASK WITH COMBINATION SPEAKING
DIAPHRAGM AND DEMAND VALVE

3,348,539

Filed Jan. 14, 1965

2 Sheets-Sheet 1

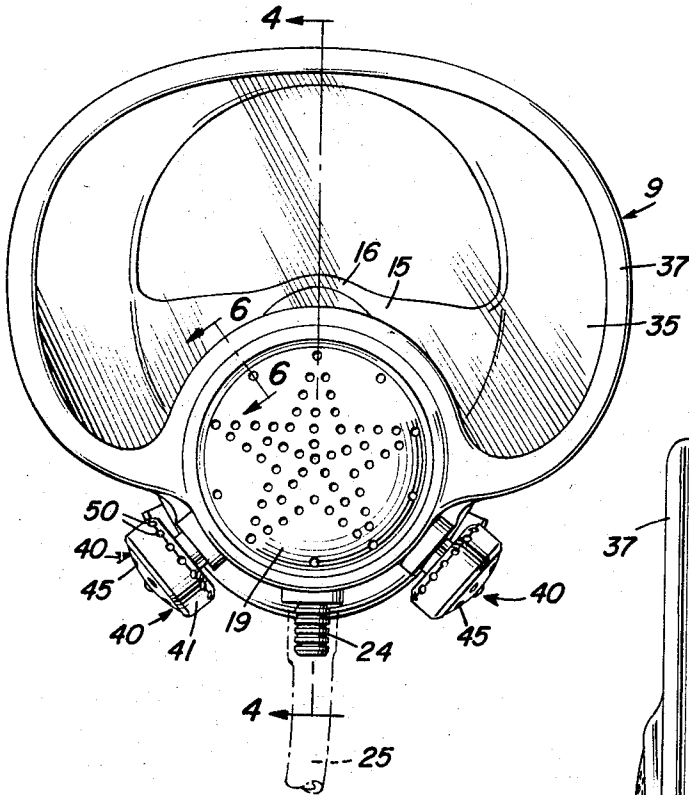


Fig. 1

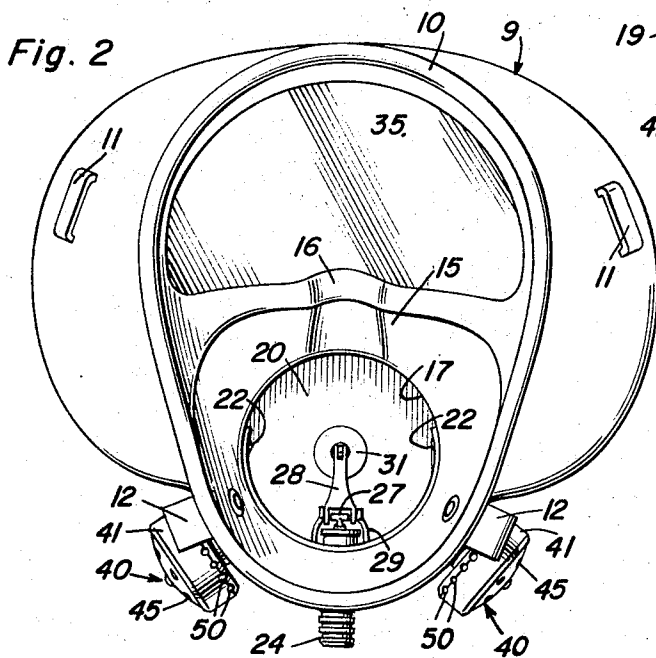


Fig. 2

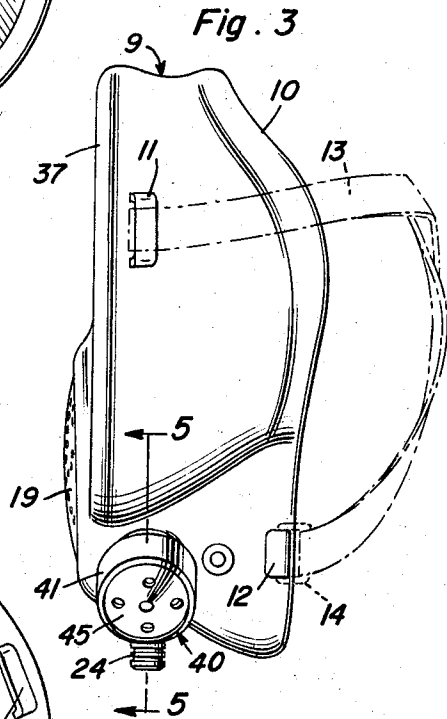


Fig. 3

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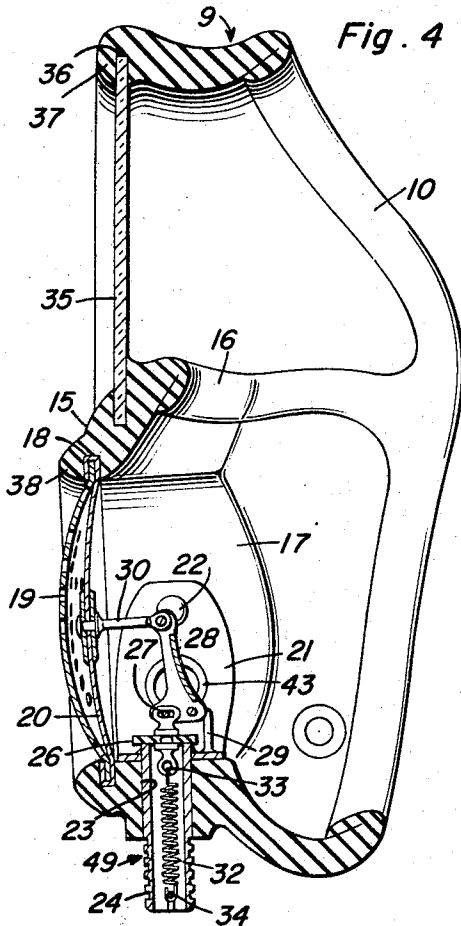


Fig. 4

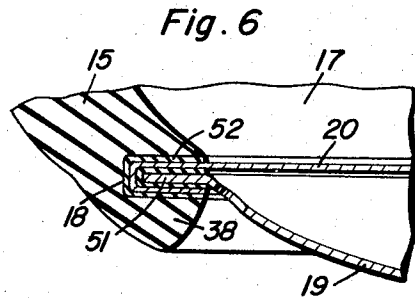


Fig. 6

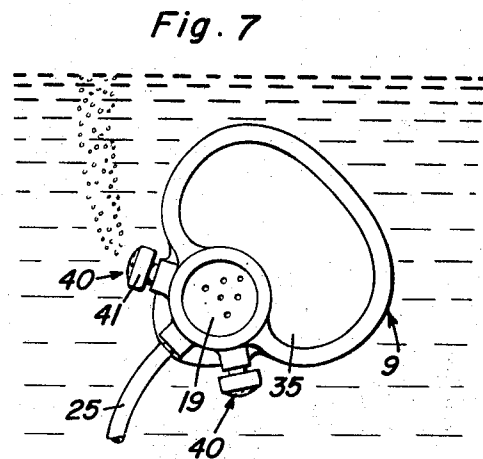


Fig. 7

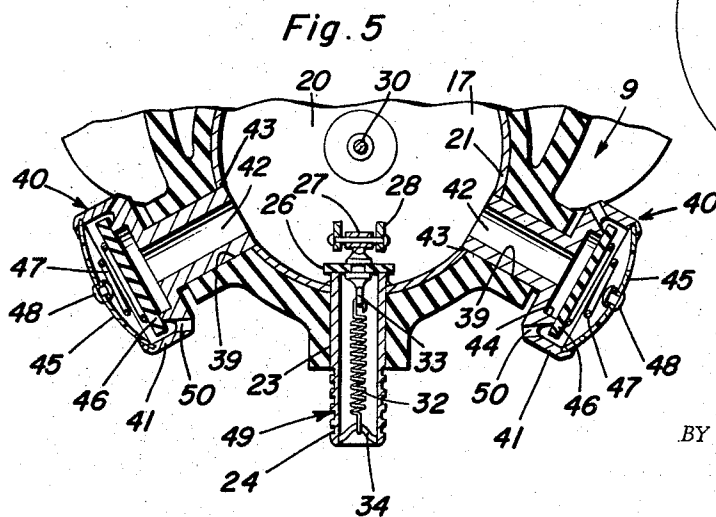
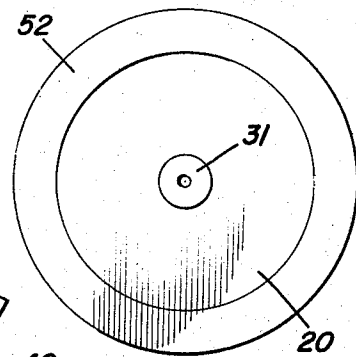


Fig. 5

Fig. 8



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1

3,348,539

**UNDERWATER MASK WITH COMBINATION
SPEAKING DIAPHRAGM AND DEMAND
VALVE**

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4 Claims. (Cl. 128—142.2)

ABSTRACT OF THE DISCLOSURE

A mask to be worn under water for breathing and communication purposes comprising a resilient frame divided into upper and lower chambers by a generally transverse partition. The chambers are independent of each other with the upper chamber including a viewing window and the lower smaller chamber including air intake and exhaust valves and a diaphragm constituting the front wall thereof. The diaphragm is flexible and capable of producing vibrations in response to sound emitting from the mouth of the user, such vibrations transferring the sound over an extended area. Link means connects the diaphragm and the air intake valve for opening the valve in response to an inward movement of the diaphragm resulting from the user's inhalation.

This invention relates to new and useful improvements in underwater masks particularly for skin divers and has for one of its important objects to provide, in a manner as hereinafter set forth, a device of this character wherein the demand valve is located directly on the mask proper close to the mouth and nose for easier breathing.

Another highly important object of the present invention is to provide an improved mask of the aforementioned character comprising novel means whereby two or more persons, each equipped with the improved mask, may converse while under water and be clearly heard within a given range. Also, the talking or conversation may be heard by persons not equipped with the mask.

Still another important object of the invention is to provide an improved underwater mask of the character set forth comprising unique means for assisting in opening the intake valve.

Another object of the present invention is to provide an underwater mask comprising an intake valve which permits the passage of air only while the user is inhaling, thus conserving the air supply.

Another important object of the present invention is to provide an underwater mask of the character set forth embodying a novel construction and arrangement of exhaust valves for preventing air bubbles from rising in front of the viewing glass and obstructing the vision.

Other objects of the invention are to provide an improved underwater mask of the character set forth which will be comparatively simple in construction, strong, durable, compact, of light weight, safe and which may be manufactured at low cost.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a view in front elevation of an under-

2

water mask constructed in accordance with the present invention;

FIGURE 2 is a view in rear elevation thereof;

FIGURE 3 is a side elevational view;

FIGURE 4 is a vertical sectional view on an enlarged scale, taken substantially on the line 4—4 of FIGURE 1;

FIGURE 5 is a fragmentary view in vertical section through the intake and exhaust valves, taken substantially on the line 5—5 of FIGURE 3;

FIGURE 6 is a fragmentary sectional view on an enlarged scale, taken substantially on the line 6—6 of FIGURE 1;

FIGURE 7 is a front elevational view, illustrating diagrammatically the operation of the exhaust valves;

FIGURE 8 is a detail view in elevation of the diaphragm.

Referring now to the drawing in detail, it will be seen that the embodiment of the invention which has been illustrated comprises a face frame 9 of resilient rubber, plastic or other suitable material. The rear edge 10 of the frame 9 is contoured for sealing contact with the face of a user. Loops and hooks 11 and 12, respectively, are provided on the upper and lower portions of the frame 9 for connecting head straps 13 thereto. The straps 13 are detachably connected at one end to the hooks 12 through the medium of rings 14.

Extending across the lower portion of the frame 9 and integral therewith is a forwardly and upwardly bowed partition 15 which is formed, as at 16, to accommodate the nose of the wearer. The partition 15 with the lower portion of the frame 9 are formed to provide, in conjunction with each other, a generally cylindrical breathing chamber 17 for the reception of the mouth, nose and chin of the user.

The forward end portion of the substantially cylindrical chamber 17 has formed therein a circumferential groove or channel 18 for the reception of the peripheral portion of a perforated, concavo-convex disk or plate 19 of suitable metal. As shown to advantage in FIGURE 4 of the drawing, the disk 19 comprises a flat marginal portion which is engaged in the groove or channel 18. Also mounted in the chamber 17 in back of the disk 19 is a diaphragm 20 of suitable flexible material. The marginal portion of the diaphragm 20 is folded over the periphery of the disk 19 and secured thereby in the groove or channel 18.

Mounted circumferentially in the lower portion of the chamber 17 is an arcuate metallic plate 21. Suitable fasteners 22 in the end portions thereof secure the plate 21 in the chamber 17. Fixed in an opening provided therefor in the plate 21 at an intermediate point and extending downwardly therefrom through an opening 23 provided therefor in the lower portion of the frame 9 is an air intake tube 24. A hose 25 from a usual source of air under pressure is connected to the depending lower end portion of the tube 24. A valve 26 is adapted to seat on the upper end of the tube 24 for controlling the flow of air therethrough. The valve 26 is pivotally connected at 27 to one end portion of a bellcrank lever 28 which is pivotally mounted for forward and rearward swinging movement in a vertical plane on a suitable bracket 29 in the rear portion of the plate 21. A link 30 operatively connects the diaphragm 20 to the bellcrank lever 28. The central portion of the diaphragm

20, which receives the link 30 is suitably reinforced as indicated at 31. Mounted in the tube 24 is a light coil spring 32 having its upper end connected at 33 to the valve 26. The lower end of the spring 32 is anchored at 34 to the tube 24. Spring 32 has sufficient tension to hold the valve 26 in closed position against the usual pressure of air in the hose 25.

Mounted in the front of the frame 9, above the chamber 17, is a viewing glass or window 35. The frame 9 and the partition 15 have formed therein a groove or channel 36 which receives the marginal portion of the glass 35. The groove 36 provides a resilient lip 37 which facilitates insertion and, if necessary, removal of the glass 35. A substantially similar resilient lip 38 retains the disk 19 and the diaphragm 20 in the groove or channel 18.

Mounted in openings 39 which are provided therefor in the lower portion of the frame 9 on opposite sides of the tube 24 and spaced therefrom are identical, downwardly divergent exhaust valves 40. Each exhaust valve 40 includes a generally cup-shaped body 41 having formed integrally therewith a communicating tubular stem or the like 42. The tubular stem 42, which communicates with the valve body 41, is anchored in any suitable manner in one of the openings 39 in communication with the chamber 17 through an opening 43 provided therefor in the plate 21. The body 41 of the valve 40 has formed therein an annular rib 44 which is coaxial with the tubular stem 42 and which provides a seat around said tubular stem. The open end of the generally cup-shaped valve body 41 has mounted therein a substantially concavo-convex perforated disk 45 of suitable metal or other material. Operable in the body 41 for engagement with the seat 44 is a disk 46 of suitable resilient material. A light coil spring 47 in the body 41 between the disk or plate 45 and the valve disk or member 46 yieldingly urges said valve disk toward the seat 44. A rivet 48 secures the spring 47 to the disk or plate 45. The assembly is such as to prevent the backflow of air into the chamber 17, said assembly thus functioning as a check valve. Access to the interior of the valve 40 may be had by removing the disk or plate 45 with the spring 47 thereon.

It is thought that the operation of the mask will be readily apparent from a consideration of the foregoing. Briefly, with the frame 9 strapped to the face of the user and the air supply line connected to the tube 24 of the demand valve assembly 49, the valve 26 is normally retained in closed position by the spring 32. However, when the diver inhales, the diaphragm 20 is drawn inwardly in a manner to lift the valve 26 to open position against the tension of the spring 32 through the medium of the link 30 and the bellcrank lever 28. Thus, the valve 26 is actuated to full open position in response to comparatively little effort on the part of the user. When the user ceases to inhale, the valve 26 instantly closes and remains closed until the next demand is made, thus conserving the air supply. The perforated plate or disk 19 exposes the diaphragm 20 to the water. The construction and location of the diaphragm 20 is such that when the user speaks said diaphragm is caused to vibrate in an obvious and the vibrations are carried by the water for a considerable distance to be heard by others in the vicinity who, of course, are also submerged. When the user exhales the disks 46 are unseated and the outgoing air is exhausted into the water. With the user's head in an upright or vertical position the exhaust valves 40 occupy the same horizontal plane as in FIGURE 1 of the drawing and said valves open simultaneously or substantially so and the usual air bubbles rise therefrom at the sides of the viewing glass or window 35. However, if the user's head is tilted laterally to either side, as indicated in FIGURE 7 of the drawing one of the exhaust valves 40 will be above the horizontal plane of the other of said exhaust valves. When this occurs the valve 40 which is uppermost will open while the lowermost valve remains closed owing to the

slight difference in water pressure. The air, exhausting only from the uppermost valve 40, rises on one side of the viewing glass or window 35 and therefore does not interfere with the vision of the user. Vents 50 are provided in the exhaust valve bodies 41 around the annular seats 44. The marginal portion of the diaphragm 20 which is folded over the flat marginal portion 51 of the disk 19 is provided with reinforcing rings 52 as shown to advantage in FIGURES 6 and 8 of the drawing. The resilient lips 37 and 38 facilitate insertion and removal of the members 35, 19 and 20. The construction and arrangement also is such as to ensure against leakage around these members. As will be readily apparent, the perforated disk or plate 19 functions as a protective shield for the diaphragm 20.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. An underwater breathing and communicating mask comprising a resilient face frame, said frame including a rear peripheral edge contoured for sealing contact with the face of a user, a transverse partition spanning said frame at the forward portion thereof and dividing said mask into distinct upper and lower chambers, said lower chamber constituting an air chamber and being of a size so as to closely conform to the nose and mouth area of a user's face, at least the central portion of the partition arching upwardly to overlie and confine the nose of a user within the lower chamber, said upper chamber being substantially larger than the lower chamber and constituting a viewing chamber, a transparent plate forming the forward wall of the viewing chamber, said transparent plate being peripherally sealed to the upper portion of the forward edge of the frame and the upper portion of the partition constituting the lower level of the viewing chamber, a valve-controlled air intake communicated with the lower air chamber and a valve-controlled air exhaust communicated with the lower air chamber whereby a movement of breathing air into and out of the air chamber can be effected independent of the viewing chamber, a flexible sound responsive vibrating diaphragm forming the forward wall of the air chamber for orientation immediately forward of the mouth of a user for a sound transmitting vibration in response to sounds emitting from the mouth of a user, link means connecting the diaphragm and the valve control for the intake for effecting an opening of the air intake in response to an inward movement of the diaphragm resulting from the act of inhaling by a user and means for securing the mask to a user.

2. The mask of claim 1 wherein said lower chamber, at the forward portion thereof, is cylindrical in cross-section, said diaphragm similarly being circular in shape.

3. The mask of claim 2 including a perforated outwardly convex plate overlying said diaphragm in forwardly spaced relation thereto so as to form a protective shield therefor.

4. The mask of claim 3 including an arcuate plate overlying and following the contour of the lower interior portion of the air chamber, said air intake being mounted by said arcuate plate and projecting through said air chamber on the vertical centerline of the mask, said air exhaust comprising a pair of exhaust tubes, one fixed to said arcuate plate to each side of said air intake and projecting radially from said plate to the exterior of the air chamber at an angle to the vertical axis of the mask.

5

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5