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BREATHING APPARATUS

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FIG. 1

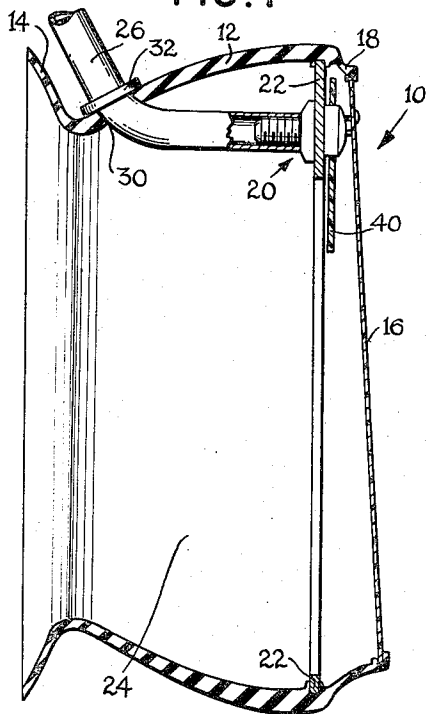


FIG. 2

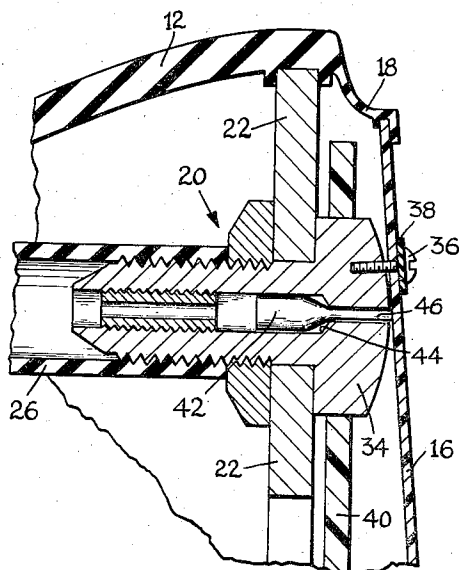


FIG. 3

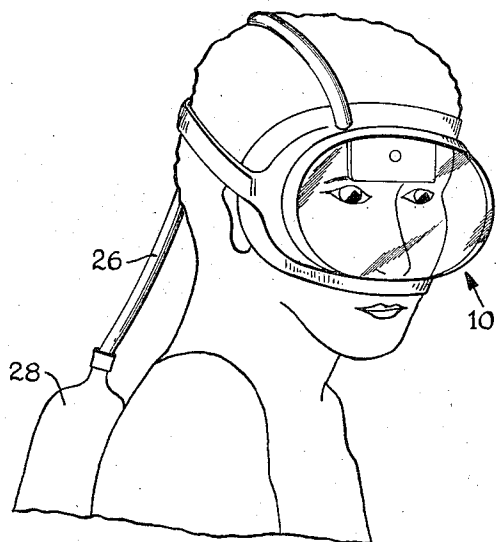
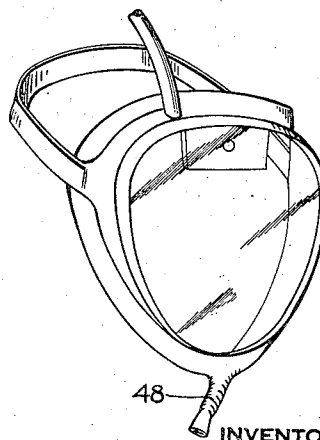


FIG. 4



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BREATHING APPARATUS

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This invention relates to a method and apparatus for breathing air from a high pressure source that is carried with the individual and is particularly well suited as a breathing apparatus employed in free diving.

There have been various devices employed for feeding air to a free diver upon demand created by the diver when he inhales. These apparatuses have had various disadvantages. For example, in some the mask through which the free diver looks out becomes fogged, and in others there has been difficulty in inhaling. Apparatuses designed to overcome these disadvantages have been quite complex which necessitated the cost thereof to be relatively high.

It is an object of this invention to provide a breathing apparatus which will be of simple design and low in cost of manufacture.

Another object of this invention is to provide a free diving and breathing apparatus employing a viewing mask which will be free of any condensation of water vapor thereon when the diver inhales.

A further object of this invention is to provide a valve mechanism which will be actuated by the movement of the face plate whenever the user commences to inhale to thereby release air to the user.

A further object is to mount the valve actuating mechanism so that a long lever arm actuating action will be attained when the mask user breathes to open a high pressure valve.

Another object is to provide a breathing apparatus wherein the air discharged from a compressed source of air supply will be deflected so as to evaporate any condensation that might condense on the face of the mask.

A further object is to provide a valve mechanism wherein a person may breathe as comfortably under water as he can above water.

Other objects and features of the invention will appear as the description of the particular physical embodiment selected to illustrate the invention progresses. In the accompanying drawings, which form a part of this specification, like characters of reference have been applied to corresponding parts throughout the several views which make up the drawings.

Fig. 1 is a vertical cross-section taken through the face mask.

Fig. 2 is an enlarged sectional view taken through the inlet valve of the face mask of the free diving apparatus.

Fig. 3 is a perspective view of a free diver wearing a face mask embodying the present invention.

Fig. 4 is a perspective view of a full face mask embodying the present invention.

My invention may be readily employed with a face mask which covers either the eye and nose portion of the face, or the eye, nose and mouth portion of the face and may be used for underwater swimming as well as above water such as going into gas or smoke infested areas. For purposes of illustration I have shown how

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my invention may be employed with a face mask which is mounted over the eyes and nose portions of the diver and wherein the mouth portion of the diver is left uncovered as shown in Fig. 3.

It has been found that some divers prefer a mask which only covers the eyes and nose portion because a better water seal is obtained on these portions of the face, while in other cases a free diver prefers to have his entire face, including his eyes, nose and mouth covered by the mask such as shown in Fig. 4, because he finds that in times of stress he is able to take in larger quantities through his mouth than through his nose and breathing through his mouth is easier than through the nose.

In the embodiment of the mask used to illustrate the invention, the diving mask 10 fits the upper portion of the face of the free diver and covers his nose and eyes but leaves his mouth uncovered as shown in Fig. 3. The mask 10 has a thick rubber frame 12. The inner edge portion 14 of the frame 12 is made of a thin rubber so that it will seal against the free diver's face. A transparent plate 16 may be made of any suitable plastic and is fixedly mounted with respect to the frame 12 by means of a thin rubber flange portion 18 which may be made integral with the thicker frame 12.

This construction permits plastic plate 16 to move back and forth over a limited range due to the yieldable mounting 18 of the plastic plate 16.

An air inlet valve 20 is mounted on a metal reinforcing stiffener 22 which extends around the interior of frame 12 to prevent it from collapsing when pressure within said chamber 24 becomes less than the pressure outside of the chamber 24.

Chamber 24 is formed by means of the inner edge 14, the thick rubber frame 12, the transparent face plate 16, and face of the free diver.

The high pressure hose 26 leads from a conventional source of compressed air such as a bottle 28 carried in a harness and mounted on the back of the skin diver. The high pressure hose 26 runs from the inlet valve 20 and is connected at the other end to the high pressure source or bottle 28 which is well known in the art.

The hose 26 extends through an opening 30 formed in the thick rubber frame 12. The opening 30, between frame 12 and the high pressure hose 26 is sealed by a suitable grommet 32. The transparent plate 16 is pivotally mounted on casing 34 of inlet valve 20 by means of a suitable screw 36. The opening through transparent plate 16 to which screw 36 extends is sealed by means of a conventional sealing washer 38 which may be made from a suitable material such as rubber. A thin transparent deflector 40, which may be made of plastic, is mounted around casing 34 of valve 20 as shown in Fig. 2.

When the diver inhales, the pressure in chamber 24 becomes less than the pressure surrounding the mask of the free diver. This tends to move the transparent face plate 16 inwardly to compensate for the reduced volume of chamber 24 under the outward pressure of the surrounding medium which may be water.

Since the transparent plate 16 is pivotally mounted on casing 34 of inlet valve 20 by means of the screw 36, the transparent plate pivots and moves the valve body member 42 away from the valve seat 44 which is formed in valve casing 34 by exerting pressure against the end of valve stem 46 which extends outwardly from the valve body member 42. The valve stem 46 is situated only a very short distance from the point on the valve casing 34 on which the window 16 pivots. Since this arrangement provides the user with a long lever arm for pushing in the high pressure valve 46 there is no difficulty experienced in opening this valve by normal breathing

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and the necessity of a pressure reduction valve or chamber may be dispensed with. The valve body member 42 and the valve stem 46 are made of lesser diameter than the inner passages formed in casing 34 so that air may flow past them. Valve stem 46 extends a slight distance beyond valve casing 34 when the valve 20 is in closed position.

Opening of the valve body member 42 away from the valve seat 44 results in the release of air from the air pressure tank into the chamber 24. The release of air is accomplished by the diver inhaling. When the diver inhales he removes part of the air that is in chamber 24 which causes the surrounding medium which may be air, water or some other gas to press against the face plate 16.

When pressure is exerted on the face plate 16 it pivots on the casing 34 to which it is mounted by screw 36 thereby causing the valve stem 46 to be engaged by the face plate. The engagement of the valve stem 46 by the face plate 16 pushes the valve stem inwardly unseating the valve body member 42 from its seat 44. As soon as this occurs, air rushes from the pressure hose 26 past the valve body 42, the seat 44 and stem 46 into the space between the face plate 16 and the deflector 40 and from there it passes into the chamber 24.

When the pressure of volume of air inside chamber 24 has been reestablished, the face plate 16 will move outwardly thereby disengaging the valve stem 46. When this occurs, the valve body 42 is pushed by the air against the seat 44 thereby shutting off the supply of air. If desired, a light spring could be employed behind the valve body 42 to urge it into closed position but it has been found that this is not necessary in most cases because the air from the compressed source of air supply is sufficient to move the body member 42 into closed position.

As already stated, when air is admitted by the inlet valve 20, the deflector 40 causes the air to flow across and over the transparent plate 16. This kind of movement tends to remove any water vapor that may have condensed on the inside of transparent plate 16 and thus providing a clear viewing window for the user to look out through his mask 12 and it avoids direct impact of incoming air on the eyes. Because the face plate 16 has a fairly substantial area which is used as a lever arm for opening the inlet valve 20 the construction of the apparatus may be very much simplified and reduces the size of chamber 24.

In the embodiment of the invention I have chosen to use to illustrate the invention, the diver may inhale air through his nose and discharge the air so inhaled out through his mouth. If he desires, he can also exhale the air he inhales through his nose out through his nose and in the latter case, the air so exhaled will then escape out from the chamber 24 between the soft rubber inner edge portion 14 of the mask 10 and the diver's face. If desired, a conventional rubber exit valve 48 such as shown in Fig. 4 can be mounted in the lower portion of either the eyes and nose mask shown in Fig. 3 or the full face mask shown in Fig. 4, for allowing water and air to be ejected from the mask when the user exhales.

The invention hereinabove described may be varied in construction within the scope of the claims, for the particular device selected to illustrate the invention is but one of many possible embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. A breathing apparatus comprising a face mask, means for effecting a seal between the face mask and the face of the user, a transparent viewing window mounted on said face mask, a connection between said transparent viewing window and said face mask which permits said transparent viewing window to move a slight amount in and out relative to the face mask, a demand valve mounted in said face mask, a source of compressed air connected

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to said demand valve, a valve stem mounted in said demand valve and having a stem projecting from the end thereof up against the viewing plate of the mask, said valve stem being adapted to shut off said air from said source of supply and to release air from said source when said valve stem has been actuated by the movement of said viewing window.

2. A demand valve for a breathing mask which comprises a face mask, means for seating said face mask tightly against the face of a user of the mask, a viewing window mounted for relative movement with respect to said mask, means for maintaining said viewing window in a certain predetermined position relative to said mask, a demand valve mounted inside of said mask, said valve having a valve actuating stem projecting from said valve wherein said viewing window engages directly with said valve stem to cause said viewing window to engage with said valve stem whenever the volume of air in said mask is reduced and to remain in said actuating position until the volume of said air has been replenished from said source of compressed air when said viewing window is pushed outwardly by said air to thereby disengage it from contact with the valve stem and shut off the supply of air from said source.

3. A demand valve for a breathing mask comprising a valve housing mounted in said mask, a valve stem projecting from said valve housing, a viewing window mounted in said mask and positioned adjacent said valve stem so as to engage directly with the valve stem when a user inhales air to open said valve to release compressed air through the valve into the mask and means for actuating said valve stem to move same into closed position when the viewing window has moved out of contact with said valve stem when the mask has been replenished with air.

4. A demand valve for a breathing mask comprising a valve housing mounted in said mask, a face plate, a source of supply of compressed air, a valve for controlling the release of air from said compressed source of air supply, a valve core pin mounted in said valve and engaging directly with said face plate to cause said valve to be opened whenever said face plate is moved a predetermined distance relative to said valve housing.

5. A demand valve having the features provided for in claim 4 wherein there is provided in said mask, a viewing window, a resilient mounting for said window to permit said window to move relative to said valve housing when the pressure on one side of said window is less than pressure on the other side of said window, and a valve core pin engaged directly by said viewing window to effect a release of air whenever said viewing window moves said valve core pin.

6. Breathing apparatus comprising a breathing mask, means for effecting a seal between one side of said mask and the face of the wearer, a moveable viewing window mounted on said mask, a valve housing connected to one side of said mask opposite to said viewing window, a source of compressed air, means connecting said source of compressed air to said valve housing, a valve core pin mounted in said valve housing to be engaged directly by said window for controlling the release of air from said source of compressed air each time the pressure on the inside of said mask is different from the pressure exerted on the outside of said mask by having said window engage with said valve core pin.

7. A breathing mask for enabling a user to breathe air from a source of compressed air comprising a face mask, a viewing window resiliently mounted in said mask, means for effecting an air seal between the sides of said face mask and the face of the user of the mask, a source of compressed air, a valve housing mounted in the upper portion of said mask so that it will seat itself against the forehead of the user, a valve core pin controlling the release of air from said source of compressed air mounted in said housing and positioned to be engaged directly by

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said viewing window whenever the pressure inside of said mask is varied relative to the pressure outside of said mask so as to cause said window to contact said pin to effect a release of air from said source of compressed air.

8. A breathing device comprising a face mask, means 5 for effecting an air seal between one side of said face mask and the face of a user, a valve housing mounted on said face mask, a viewing window pivotally mounted on one side of said valve housing, means for effecting a resilient air seal between the periphery of said viewing window 10 and said face mask, a valve core pin controlling the release of air from said source of supply, said viewing window making direct contact with said valve core pin so that when the viewing window is pivoted relative to said valve housing it will control the release of air from said 15 source of compressed air into said mask by depressing said pin, and means for allowing an excess quantity of air in said mask to be released from said mask.

9. Breathing apparatus comprising a face mask, means 20 for effecting an air seal between one side of said mask and the face of an individual using said mask, a source of supply of compressed air, a reinforcing member extending around the other side of said mask, a valve housing

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connected to said mask, a viewing window resiliently connected to said reinforcing member and being positioned to move relative to said reinforcing member and said valve housing whenever there is a pressure differential between the pressure inside of said mask and the pressure outside of said mask and a valve core pin mounted in said valve housing and positioned to be engaged directly by said viewing window to effect a release of air from said source of compressed air whenever the user inhales and to stop the release of air whenever the pressure inside of said mask comes into equilibrium with the pressure outside of said mask.

10. Breathing apparatus having the features provided for in claim 9 wherein means are provided for allowing air to escape from said mask whenever the user exhales into the mask.

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