July 28, 1970 TOMIJU HASHIMOTO ET AL 3,521,626

SUBMARINE MASK FOR A DIVER

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Fig. 1.

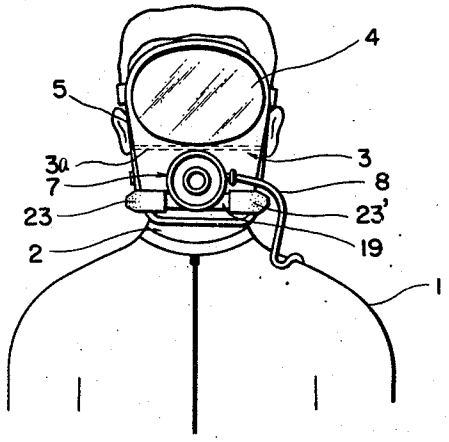

Fig. 2.

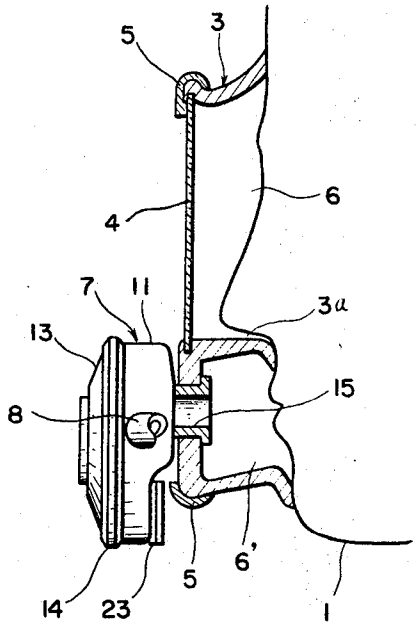

Fig. 3.

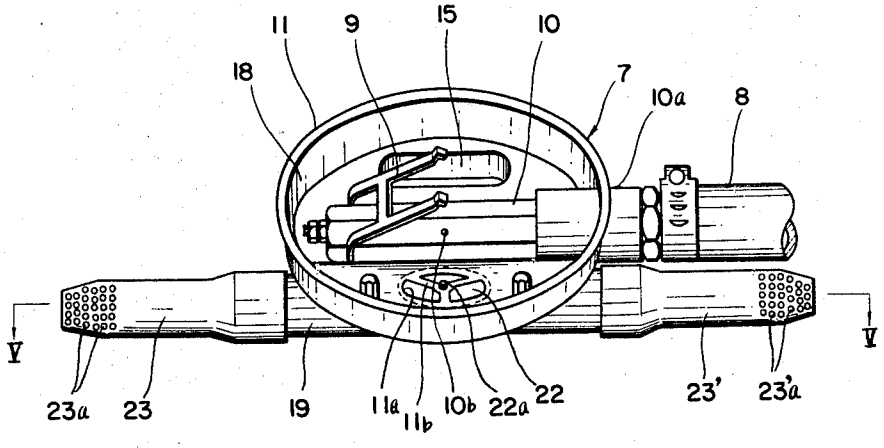

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Fig. 4.

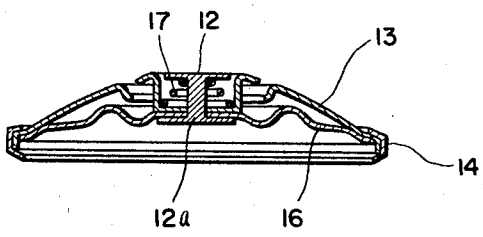


Fig. 5.

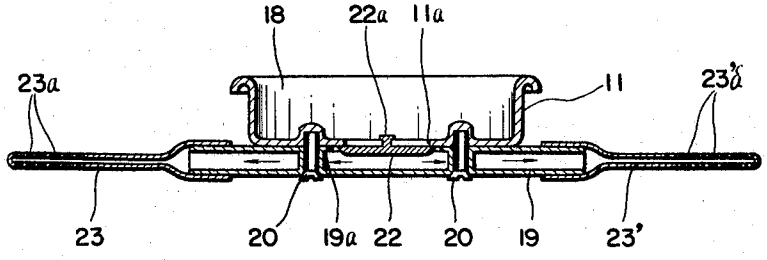
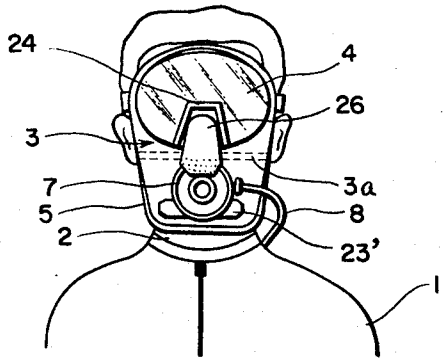


Fig. 6.



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SUBMARINE MASK FOR A DIVER

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Fig. 7.

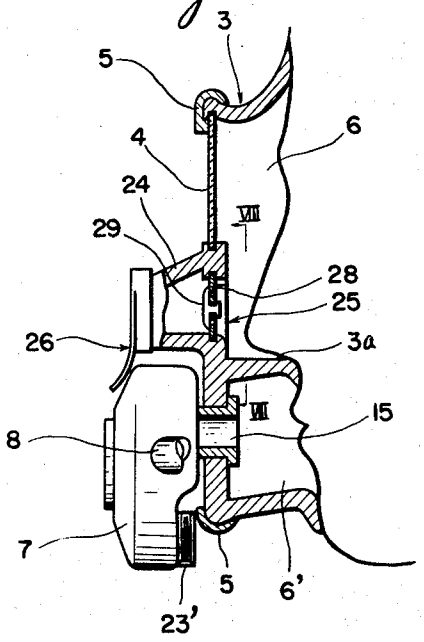


Fig. 8.

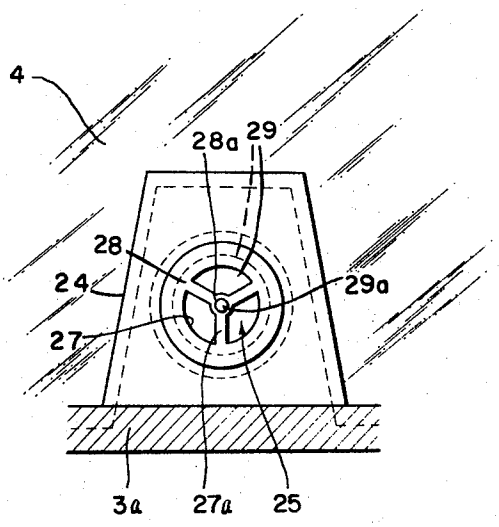


Fig. 9.

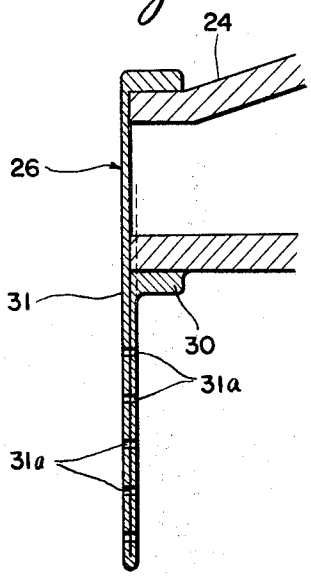
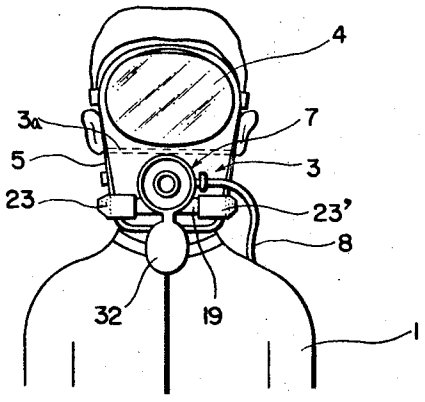


Fig. 10.



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SUBMARINE MASK FOR A DIVER

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Fig. 11.

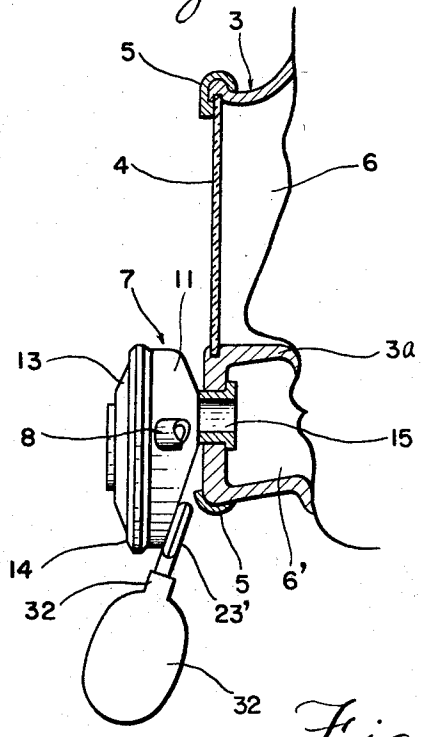
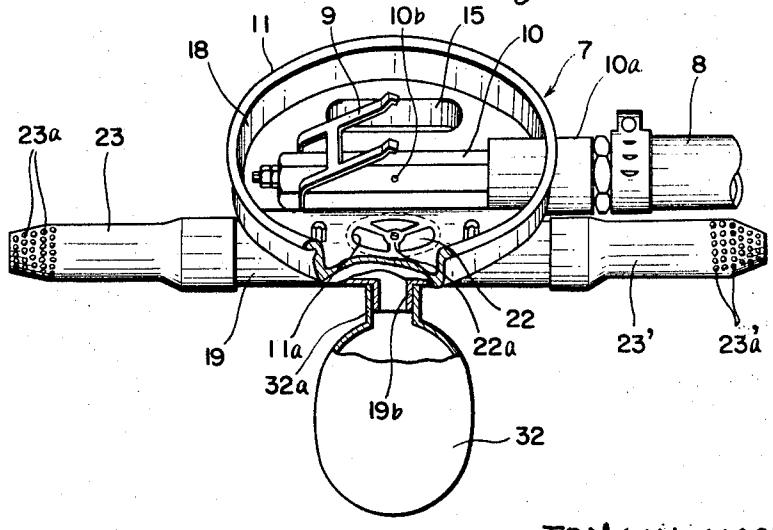


Fig. 12.



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3,521,626

SUBMARINE MASK FOR A DIVER

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Int. Cl. A62b 7/02
U.S. Cl. 128—142 8 Claims

ABSTRACT OF THE DISCLOSURE

A submarine mask for a diver comprising a mask proper covering the nose and/or mouth of the diver, in which inhalant air is supplied from an air bomb through a pressure regulator and exhalant air is discharged through an exhalant device in the mask. The exhalant device comprises an exhalant tube, a non-return valve normally adapted to be closed by restorative character of an elastic plate, and an exhalant valve connected to the open end of said exhalant tube and consisting of a normally closed flat bag made of rubber and provided with a plurality of small perforations in the vicinity of its closed end portion. Discharge into water of the exhalant air is effected through the plurality of small perforations upon inflation of the flat bag valve.

One of the objects of the present invention is to provide an improved submarine mask for a diver, wherein the diver wearing the mask may make a telephone call with an uninfluenced clear voice.

Numerous other objects and advantages will be more apparent from the following detailed description when considered in connetcion with the accompanying drawings, wherein:

FIG. 1 is a front view of the mask according to the present invention as worn by a diver;

FIG. 2 is a side view partly in vertical section of the mask shown in FIG. 1;

FIG. 3 is a perspective view of a pressure regulator employed in the mask, and shown on an enlarged scale;

FIG. 4 is a sectional view of the top portion of said pressure regulator;

FIG. 5 is a section taken along line V—V of FIG. 3;

FIG. 6 is a front view of a modified form of the mask according to the invention as worn by the diver;

FIG. 7 is a partial vertical section of the mask shown in FIG. 6, the section being shown on a somewhat enlarged scale;

FIG. 8 is a detail as seen from the right of FIG. 7 as shown by arrow line VIII—VIII of FIG. 7;

FIG. 9 is an enlarged sectional view of a breathing exhalant valve provided in an outlet pipe for exhalation of air from the nose;

FIG. 10 is a front view of another modified form of the mask according to this invention as worn by the diver;

FIG. 11 is a side view partly in vertical section of the mask shown in FIG. 10; and

FIG. 12 is a perspective view of the pressure regulator shown in FIG. 10, showing the construction of the interior thereof.

Referring to the drawing, FIGS. 1 and 2, the reference numeral **1** designates a diver wearing the mask according to the present invention, and **2** is a throat microphone carried by the diver. A mask **3** of a size sufficient to cover the face of the diver has a transparent glass **4** which is reinforced and firmly held along the peripheral edge by means of a metal clamp **5**. The surrounding portion of the mask **3** is preferably made of thin rubber,

particularly of anti-brine chloroprene rubber having appropriate hardness. **3***a* is a horizontal extension projecting inwardly from the mask proper and forming a partition wall disposed at the position just beneath the nose of the wearer. By said partition wall **3***a* the interior of the mask is divided in an air-tight and water-tight manner into an upper space or section **6** including the eyes and the nose of the wearer and a lower space or section **6'** including the wearer's mouth. **7** is a pressure regulator adapted for regulating air supplied from a cylinder (not shown) carried by the wearer through an air hose **8**.

As shown in FIGS. 3 and 4, the pressure regulator **7** comprises a casing **11** including a regulating cylinder **10** having an actuator **9**, and a presser **12** (FIG. 4) protruding from a cover **13** which is secured to the casing **11** by means of a clamp **14**. An air duct **15** (FIG. 2) projecting from the bottom of the casing **11** is in communication with the lower space **6'** of the mask. A nipple **10***a* (FIG. 3) connected to the regulating cylinder **10** is secured to the casing **11**, and the projecting outer end thereof is connected to the air hose **8**. **12** is a press button having an actuator plate **12***a* at its lower end (FIG. 4), which is secured to a diaphragm **16** so as to be held water-tight, said plate **12***a* being manipulated or acted upon by a variation of water pressure to press down the actuator **9** of the regulating cylinder **10** against the section of a spring **17**. When the actuator **9** is pressed, the regulating cylinder **10** will feed air through a small hole **10***b* formed therein into a low pressure chamber **18** confined by the casing **11** and the cover **13**, the breathing inhalant air being fed under suitable pressure to allow the diver's breathing.

19 is an exhalant tube for exhausting exhalant air of the diver. At the mid portion, said exhalant tube **19** is provided with small holes **19***a*, and three sector holes **11***a* are perforated in the bottom of the casing **11**, leaving a spider **11***b* as shown in FIG. 3. Said exhalant tube **19** is fixedly mounted to the bottom of the casing **11** by means of screws **20** (FIG. 5). The sector holes **11***a* are normally closed by a non-return valve **22** which is made of rubber and its peripheral edge portion is in engagement with the outer side of the bottom of the casing **11**, with a central pin **22***a* inserted into a central hole in the spider **11***b*. The non-return valve **22** is held normally closed by virtue of the elastic restoring force of the flexible rubber thereof, and it is opened by the pressure of the exhalant air of breathing of the diver to provide communication of the low pressure chamber **18** with the exhalant tube **19**. The closed end portions of the rubber flat bags **23** and **23'** are provided with a plurality of small perforations **23***a* and **23'***a* respectively, whereby should the pressure in the exhalant tube **19** be increased the flat bags **23** and **23'** will be automatically inflated, so that the exhalant air is exhausted through the perforations **23***a* and **23'***a*. The exhalant valve, i.e. the flat bags **23** and **23'**, are normally kept flat by virtue of their elastic restorative character and by water pressure surrounding the same.

In conventional diver's masks, both ends of the exhalant tube are fully open, and the non-return valve is normally subjected directly to water pressure, so that the exhalant air through the diver's mouth is intermittently exhausted through the non-return valve. Hence, during telephone calls the diver's vocal chords will be subjected to back pressure, making his voice vibrate, thereby influencing particularly vowel sounds. In contradistinction to such conventional diver's masks, according to the present invention the exhalant tube has non-return valves, each consisting of a flat bag having a plurality of small perforations, and the exhalent air via the exhalent tube is continuously exhausted through said plurality of small perforations, so that the diver's vocal chords will not be

subjected to any substantial back pressure, whereby maintaining a high degree of clarity of voice.

While the above mentioned embodiment of the invention shown in FIGS. 1 to 5 is described as a mask for dealing with exhalant air coming from the diver's mouth, the invention may also be applied to a mask for dealing with exhalant air coming from the diver's nose, with the exhalant device arranged in the upper space **6** covering the diver's nose and eyes.

Referring to the modified embodiment of the invention shown in FIGS. 6 to 9, **24** is an exhalant box for breathing through the nose. This exhalant box **24** is made of rubber and is airtightly secured to and disposed beneath the transparent glass **4** in the vicinity of the tip of the diver's nose and in communication with the upper space **6** covering the diver's eyes and nose. A non-return valve **25** closes an inner opening of the exhalant box **24** connecting the interior thereof with the upper space **6**. **26** is an exhalant valve normally preventing introduction of water into the exhalant box **24**. As shown in FIGS. 7 and 8, the non-return valve **25** comprises a support plate **28** having three sector openings **27** and a spider **27***a* which has a central hole **28***a*, and a rubber plate **29** having a pin **29***a* inserted into said hole **28***a*, said rubber plate **29** being adapted to close the openings **27** by virtue of its restorative character. As shown in FIGS. 7 and 9, the exhalant valve **26** consists of a boss **30** having a flat bag **31** made of thin rubber sheet having a plurality of small perforations **31***a*, the said boss **30** being mounted to the outer open end of the exhalant box **24**. This exhalant valve **26** made of a flat rubber bag is normally held in the flat shape by its restorative character, with the inner walls thereof in contact with each other, thereby preventing any introduction of water thereinto. When said valve is inflated by the exhalant air of breathing through the nose, the exhalant air is exhausted into the water through the perforations **31***a*. As the space **6** surrounding the nose is in communication with said non-return valve **25** and the exhalant valve **26**, any nasal effects in telephone conversation due to stuffy breathing may be prevented. Moreover, as the non-return valve **25** is not in direct contact with water and the exhalant valve is adapted to discharge the breathing exhalant into the water, improved clarity of voice during telephone conversations may be obtained.

FIGS. 10 to 12 show a modified embodiment of this invention. Referring to these figures, a branch nipple **19***b* is soldered to the mid portion of the exhalant tube **19**, to which nipple there is securely mounted a reservoir bag **32** having a watermouth **32***a*. Should there occur any percolation of water through the exhalant valve, water will collect in the reservoir bag, and there will not be any danger of wetting the non-return valve, so that any drawback of influencing the telephone call voice clarity. During diving for a long period of time, there might occur gradual percolation of water through the small perforations forming the exhalant valve, and the provision of said reservoir bag **32** will substantially prevent wetting of the non-return valve. When the reservoir bag **32** becomes full of water, it may be manually squeezed by diver's hand, thereby discharging water out of the reservoir through the small perforations **23***a* and **23'***a*.

Although in the described embodiments the mask covers

the whole face of the diver and the pressure regulator is provided in the lower section of the mask, it will be understood that the mask may comprise a single section covering the mouth only of the diver or covering the nose as well as the mouth of the diver, and provided with the pressure regulator.

What we claim is:

1. A diver's mask wherein the mask interior is divided into an upper nose receiving space and a lower mouth receiving space, and including breathing exhalent discharge device connected to said mask interior, the improvement wherein said discharge device comprises duct means communicating with said mask interior through a non-return valve means for preventing water from entering said mask, said duct means consisting of a thin rubber bag means in the form of a substantially flat double-walled sheet having two sides in contact with each other and connected along the peripheral edges thereof, the walls having a plurality of perforations therethrough for discharging exhalent air upon inflation of said flat bag means.

2. A diver's mask as claimed in claim **1** wherein said duct means comprises two rubber bag means.

3. A diver's mask as claimed in claim **1**, wherein said duct means communicates with said mask interior at said upper nose receiving space.

4. A diver's mask as claimed in claim **1**, further comprising a water reservoir bag made of flexible material and connected to said duct means.

5. A diver's mask wherein the mask interior is divided into an upper nose receiving space and a lower mouth receiving space, said mask comprising a casing mounted thereon and including a pressure regulator, a non-return valve integral with said casing, a breathing exhalent discharge duct means communicating with said mask interior through said non-return valve for preventing water from entering said mask, said exhalent duct means consisting of a thin rubber bag means in the form of a substantially flat double-walled sheet having two sides in contact with each other and connected along the peripheral edges thereof, the walls having a plurality of perforations therethrough for discharging exhalent air upon inflation of said flat bag means.

6. A diver's mask as claimed in claim **5**, wherein said duct means comprises two rubber bag means.

7. A diver's mask as claimed in claim **5**, wherein said duct means communicates with said mask interior at said upper nose receiving space.

8. A diver's mask as claimed in claim **5**, further comprising a water reservoir bag made of flexible material and connected to said duct means.

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