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BREATHING GAS SUPPLY FOR A DIVING SUIT

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Fig. 1

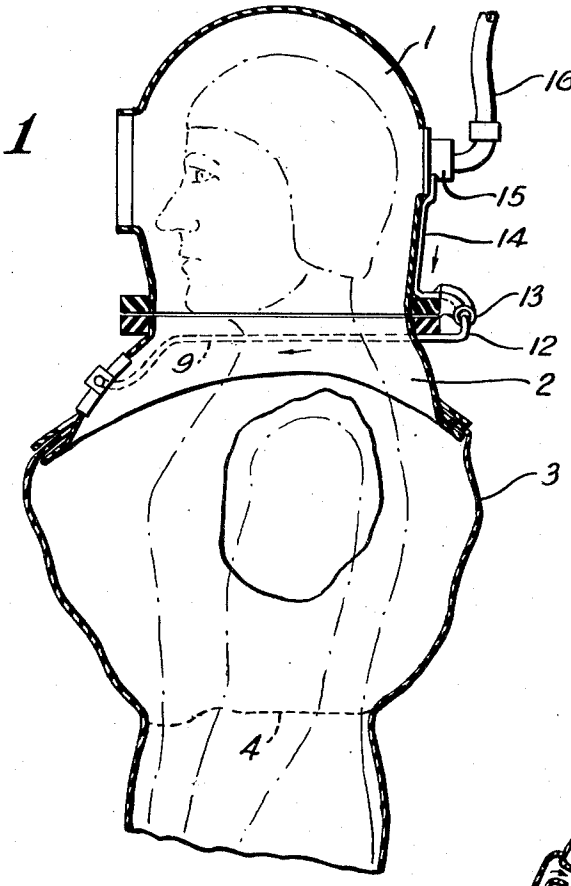


Fig. 2

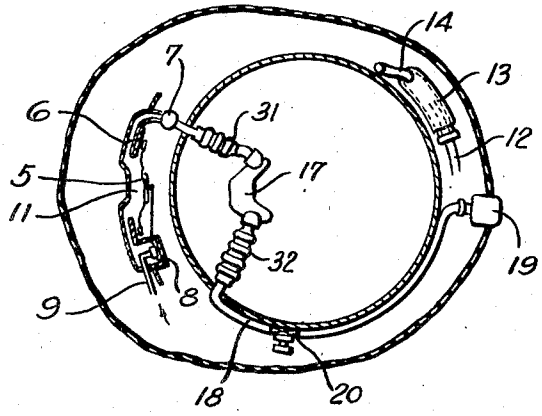
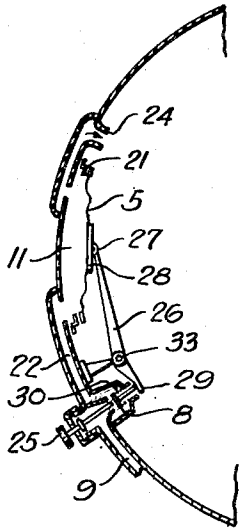


Fig. 3



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BREATHING GAS SUPPLY FOR A DIVING SUIT

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3 Claims. (Cl. 128—144)

This invention relates to improvements in diving suits and more particularly to improvements in regulators for furnishing breathing air or other gas to the divers.

A regulator is known for the separation of the air for breathing from the air for equalizing the difference between the weight of the diver and the buoyant force. However, the known regulator is a separate unit connected to the helmet through tubes and makes use of a diaphragm subject to the pressure of the water on the outside and the pressure of the air breathed on the opposite side. However, the external pressure on the diaphragm varies continually according to the position of the diver and causes difficulty in breathing.

It is an object of the present invention to provide a regulator of the type described that is built into the diving suit.

A further object is to provide a regulator which is under the direct influence of the internal pressure in the diving suit rather than under the infiuence of the external water pressure.

Another object is to provide a regulator that will give greater breathing comfort to the diver than known similar devices.

Other objects of the instant invention will become apparent in the course of the following specification.

In the attainment of the aforesaid objects, the improved regulator is constituted of a chamber formed on the inner surface of the diving suit. One end of the chamber is connected by an intake tube to a fresh air supply while the opposite end is connected by another tube to the mask over the nose and mouth of the diver. A portion of the chamber on the side of the diver is open and covered by a diaphragm. When the diver consumes the air from within the chamber, the pressure on the opposite side of the diaphragm is increased so that the diaphragm will move inwardly. A valve actuated by the diaphragm is placed in the intake tube and so connected with the diaphragm that as the diaphragm moves, it opens the valve to admit more air and to restore the equilibrium in the chamber and to close the valve when the equilibrium is restored.

The invention will be more clearly understood from the following detailed description taken in connection with the accompanying drawings showing by way of example a preferred embodiment of the inventive concept.

In the drawings:

Figure 1 shows schematically the improved regulator formed as an integral part of the diving suit which is constituted of a helmet, a shoulder portion and a diving dress, the regulator and diving suit being constructed in accordance with the principles of this invention;

Figure 2 is a plan view of the improved regulator shown in Figure 1; and

Figure 3 is a sectional view of the improved regulator shown in Figures 1 and 2 but on an enlarged scale.

Referring now in greater detail to the drawings where like reference numerals are taken to denote corresponding parts, reference numeral 1 (Fig. 1) indicates the helmet, 2 the shoulder portion, 3 the diving dress.

The helmet 1 is of known type and the bottom rim thereof is screwed onto the top rim of the following described shoulder portion 2.

The shoulder portion 2 may be made of metal and when assembled with the helmet extends downwardly over the shoulders and the upper portion of the front and back of the diver as illustrated.

The diving dress 3 is a flexible member designed for inflation at the top portion, that is, substantially above the waist-line 4 of the diver to provide, in combination with the helmet and shoulder portion a reservoir for the air intended to balance the weight of the immersed diver against the buoyant force. Around the waist line 4, the dress is constricted to prevent the air from passing downwardly around the legs of the diver. Thus, when submerged, the constricted lower portion of the dress 3 will cling to the lower portion of the diver's body by virtue of the water pressure.

The regulator is affixed to the inner surface of the diving suit and preferably to the inner surface of the shoulder portion 2 at the front, and is constituted of a frame 21 affixed by any known means to the inner surface of the shoulder portion 2 and forming therewith the chamber 11.

The chamber 11 has a communicating tube 6 (Fig. 2) at one end terminating in an outlet 24 (Fig. 3). At the opposite end of the chamber 11 is a tube 22 (Fig. 3) which communicates with a fresh air inlet tube 9. The frame 21 has formed through the inner wall thereof an opening covered by a diaphragm 5 which coacts with a valve 8 which forms a communicating passage between the tubes 9 and 22 when open. The valve 8 is maintained normally closed and is in operable engagement with the diaphragm 5 by a lever 26 fulcrumed to the tube 22 at the point 33. One end 27 of the lever is secured to the center of the diaphragm 5 by any suitable means 28. The opposite end 29 of the lever 26 is secured in a known manner to the valve stem 30 slidably inserted through the tube 22 as illustrated. An adjustable screw 25 is threaded through the shoulder portion 2 in such a manner that the valve 8 can be operated by the diver from the outside of the diving suit if desired.

The tube 9 extends from the valve 8 rearwardly and terminates at the back of the shoulder portion in an end 12 coacting with an element 13 so designed that when the helmet 1 is screwed onto the shoulder portion 2, the end 12 of the tube 9 will be sealed to the element 13. The element 13 communicates with a piece 15 through a tube 14 while another tube 16 supplies air to the piece 15 from the surface or from reservoirs located near or carried by the diver.

The outlet 24 of the chamber 11 is attached by any known connector 7 to a tube 31 leading to one side of the breathing mask 17 which is designed in a known manner to cover the nose and mouth of the diver. The second tube 32 of the mask 17 is connected by a conduit 18 to an outlet 19 situated on the shoulder portion at the back for the discharge of spent air into the water. In the conduit 18 is a valve 20, operable from outside the diving suit, and designed as a further aid in equalizing the variation of pressure in the suit to further facilitate the breathing of the diver in any position.

In operation:

Assume that the diver has donned the suit and is about to be lowered into the water, air is introduced through the tube 16, the piece 15, the tube 14, the element 13, and the tube 9 into the chamber 11, filling the helmet 1, the shoulder portion 2, and the upper portion of the diving dress 3 to balance the weight of the diver against the buoyant force of the water. When the pressure in the chamber 11 becomes less than the pressure on the diaphragm 5 on the side of the diver, the diaphragm 5

will move toward the side of the chamber **11**, and move the end **27** of the lever **26** to open the valve **8** with the end **29** of the lever which is attached to the valve in a known manner. Since the mask **17** is over the nose and mouth of the diver in the usual manner, when the diver inhales, fresh air is drawn from the chamber **11** through the tubes **31** and **6** and the connector **7** to the respirator organs of the diver, which lessens the pressure on the diaphragm **5** on the inside of the chamber **11** relative to the opposite side so that the diaphragm **5** will move and draw therewith the end **27** of the lever and force the lever end **29** in the opposite direction to pull the valve **8** to the open position for the admission of additional fresh air. As soon as the pressure in the chamber **11** is equalized with the internal pressure of the diver's suit, the diaphragm **5** will move away from the chamber **11** and move the valve **8** for a repetition of the cycle. The exhaled air will escape through the tube **32**, the conduit **18**, the valve **20**, and the outlet **19** to the outside of the diving suit.

While there is above disclosed but one embodiment of the improved regulator and diving suit, it is possible to produce still other embodiments without departing from the inventive concept herein disclosed, and it is desired therefore that only such limitations be imposed on the appended claims as are stated therein, or required by the prior art.

What is claimed is:

1. In a diving suit; a respiratory regulator, said regulator comprising a chamber disposed in the suit, said chamber having formed therein an inlet port and an outlet port and further having an opening formed therethrough on the side of the diver to equalize the pressure within said chamber, and said suit, means for connecting said inlet port with a fresh air supply, means for connecting said outlet port with the respiratory organs of the diver, and valve means for the inlet port, said valve means regulating the inlet port communicating with said chamber depending from the pressure within said diving suit, and means for expelling spent air.

2. In a diving suit having a rigid shoulder portion intermediate a helmet and a dress portion, the shoulder portion having a wall and the upper part of the dress portion being adapted to be inflated; the improvements comprising a respiratory regulator for the shoulder portion, said regulator comprising a chamber formed on the inner surface of said shoulder portion, said chamber having an inlet port and an outlet port and further having an opening formed therein on the side of the diver, an elastic diaphragm closing said opening, said diaphragm being on the side of the diver, a valve for said inlet port,

means intermediate said diaphragm and said valve for closing said valve when the diaphragm moves toward the side of the diver and for opening said valve when said diaphragm moves toward the side of the chamber, a tube disposed intermediate the inlet port and the helmet adjacent the back of the shoulder portion, a socket disposed on the helmet and coacting with said tube when the helmet is fixed to the shoulder portion, means for interconnecting the socket with a fresh air supply, means for interconnecting the outlet of the chamber to the respiratory organs of the diver, and means for discharging spent air outside of the diving suit.

3. In a diving suit having a shoulder portion intermediate a helmet and a dress portion, the bottom of the helmet being adapted to be screwed on the top of the shoulder portion and the upper part of the dress and the shoulder portion and the helmet being adapted to receive air for equalizing the weight of the diver with the upward and downward thrusts when immersed; the improvements comprising a respiratory regulator for the shoulder portion, said regulator comprising a frame disposed on the inner surface of said shoulder portion at the front and forming therewith a chamber, said chamber having an inlet port and an outlet port and further having an opening on the side of the diver, a diaphragm disposed over said opening on the side of the diver, a valve disposed in the inlet port, a lever fulcrumed on the frame intermediate said diaphragm and said valve, the diaphragm opening the valve by said lever when the pressure in said chamber is substantially less than the pressure in said shoulder portion and closing said valve when the pressure in said chamber is substantially equal to the pressure in said shoulder portion, means for opening and closing said valve from outside said shoulder portion, a tube disposed intermediate said inlet port and helmet at the back thereof, an element disposed on said helmet and interconnected with said tube at the back of said helmet, means for interconnecting said element to an air supply, a tube for interconnecting the outlet port of the chamber with the respiratory organs of the diver, tubular means for expelling spent air, and a second valve for said tubular means.

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