

March 18, 1969

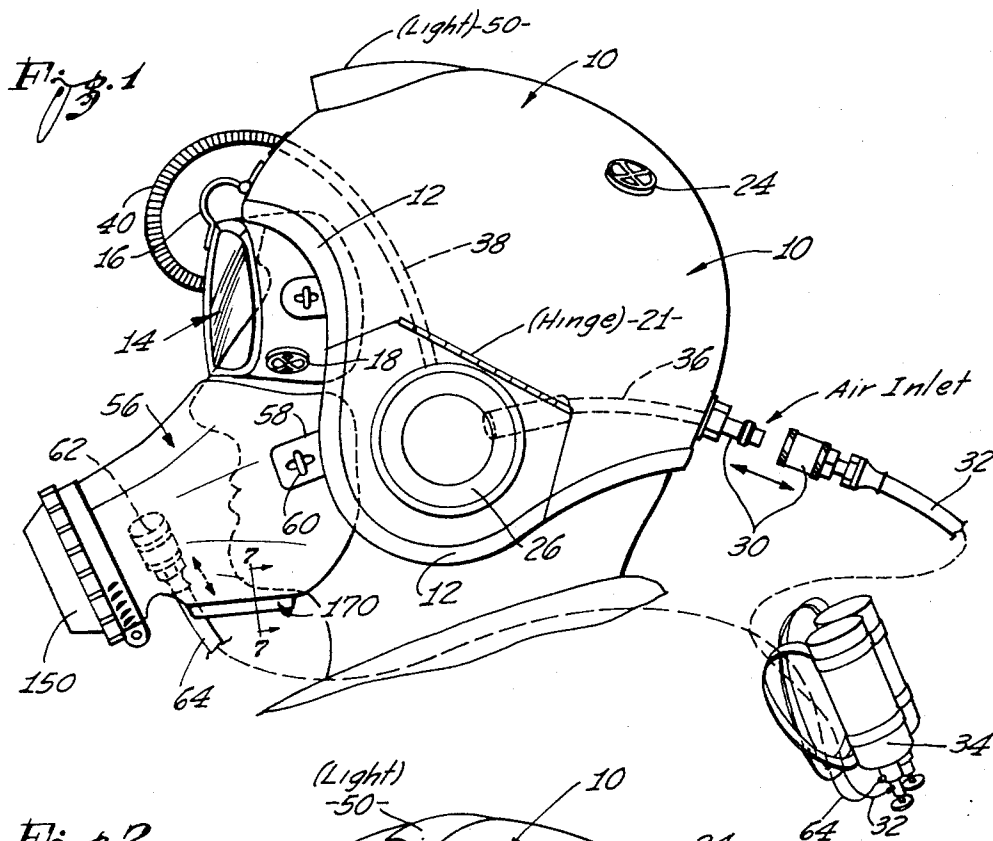
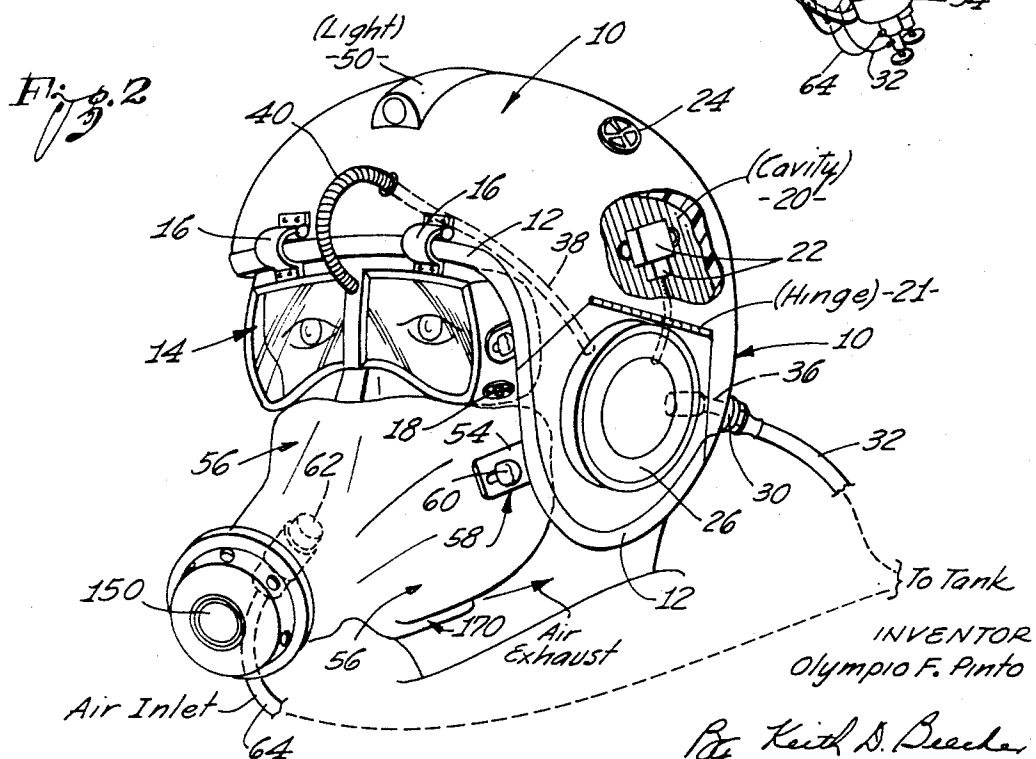
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3,433,222

UNDER-WATER DIVING EQUIPMENT

Filed April 1, 1966

Sheet 1 of 2



INVENTOR
Olympio F. Pinto

By Keith D. Beecher
ATTORNEY

March 18, 1969

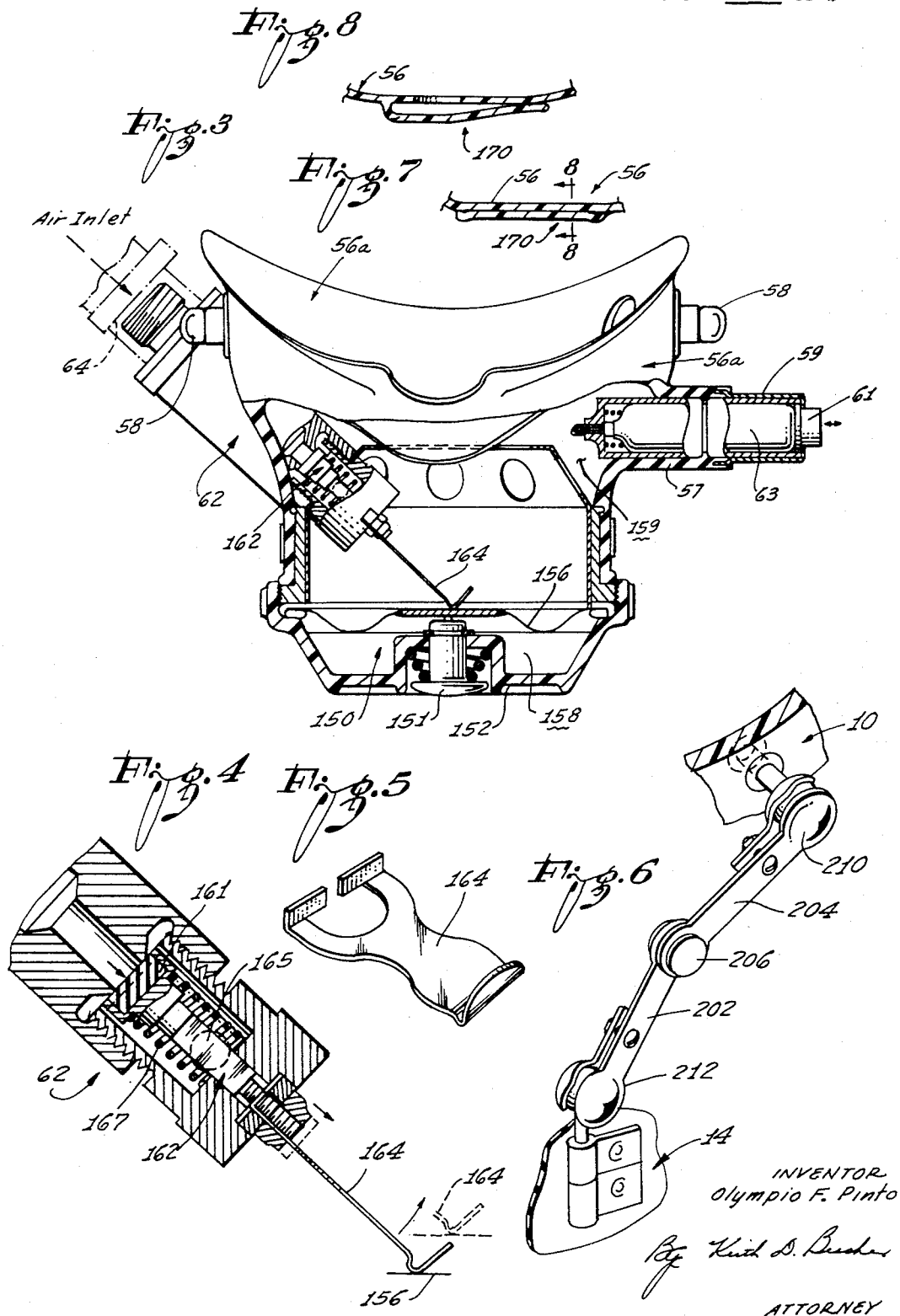
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UNDER-WATER DIVING EQUIPMENT

Olympio F. Pinto, Rio de Janeiro, Brazil, assignor, by mesne assignments, to Bioengionics, Inc., Beverly Hills, Calif., a corporation of California

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7 Claims

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ABSTRACT OF THE DISCLOSURE

A diving helmet assembly is provided to be worn by under-water skin divers. The diving helmet serves to mount all the essential equipment needed by the diver. It is composed, for example, of hard plastic, and it has internal cavities for electronic and acoustical equipment. The helmet assembly also includes a transparent face mask, a mouthpiece, and ear cups. Air pressure is introduced into the helmet for breathing purposes and also for pressure equalizing purposes.

The present invention relates generally to under-water diving equipment, and it relates more particularly to a multi-purpose helmet combination to be worn by under-water skin divers.

The principal objective of the present invention is to provide a helmet-like combination for under-water skin divers which serves to mount all the essential components of the under-water diving equipment, and which may be worn comfortably, and easily put on and taken off.

The improved combination of the present invention, includes, for example, a helmet composed, for example, of a hard plastic and including interior padding. The helmet also includes internal cavities. Various types of electronic or acoustical communication equipment, and associated batteries, may be mounted in the internal cavities.

The helmet combination of the invention, in the embodiment to be described, also includes straps which may be buckled to a mouthpiece. This mouthpiece, for example, may be of the type described in copending application Ser. No. 324,352, filed Nov. 28, 1963 and which issued Dec. 20, 1966 as Patent 3,292,618. These straps, when coupled to the mouthpiece serve not only to hold the mouthpiece in place, but the mouthpiece, in turn, serves to hold the helmet itself in place.

The helmet combination to be described also includes ear cups on each side. These ear cups permit the diver to "hear" by picking up acoustic waves in the water. Ear phones may be mounted in the ear cups, and these may be connected to the electronic communication equipment carried in the interior cavities of the helmet.

The ear cups may also include self-equalizing pressure regulators. These pressure regulators respond to the external water pressure to control the air pressure in the ear cups and in the face mask and equalize the internal air pressure with the external water pressure. This is achieved in a self-regulating, self-equalizing manner. By this means, the pressure in the ear cups and in the face mask is at all times automatically maintained in an equalized state with respect to the external water pressure.

Therefore, with the construction to be described, the pressure inside the helmet and face mask is automatically regulated so that water pressure is equalized and excessive pressure differentials are thereby avoided.

As the diver descends, for example, the pressure-regulators in the ear cups permit pressurized air to flow into the helmet and face mask; as soon as water pressure is equalized, the regulators stop the flow of pressurized air. Any excess pressure in the helmet or face mask is removed by appropriate purge valves, for example.

The face mask can be constructed, if desired, to cover both the mouth and nose of the diver. When the face mask covers the diver's nose, he can breathe normally through his nose and mouth.

Quick disconnects are provided on the air hoses in the embodiment to be described. This not only adds to the convenience in putting on or removing the equipment, but it also provides a rapid means of disconnecting an air hose under water so as to provide air to another diver who might be in trouble. To this end, two air hoses are provided in the illustrated embodiment, as will be described, so that one is available for a fellow diver without completely depriving the first diver of his air supply.

Also the second air hose can be used under water for other purposes, such as inflating life vest, pneumatic salvaging equipment, and so on. The quick disconnects, as will be described, are provided with anti-backflow valves so that there is no flow of water into the helmet face mask, or mouthpiece, when an air hose is removed.

Other objects, features and advantages of the invention will become apparent from a consideration of the following description, when the description is considered in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a helmet combination incorporating the concepts of the present invention;

FIGURE 2 is a front perspective view of the helmet combination;

FIGURE 3 is a view, partly in section, of a modified mouthpiece component of the helmet; and of a self-equalizing pressure regulator which may be included in the mouthpiece, and also which may be included in each of the ear cups;

FIGURE 4 is a fragmentary sectional view of an inlet boss for the mouthpiece and a demand valve therein;

FIGURE 5 is a perspective view of an actuator for the demand valve;

FIGURE 6 is a fragmentary view of a modified hinge for a face mask component of the helmet;

FIGURE 7 is a fragmentary sectional view along the line 7—7 of FIGURE 1 showing an exhaust valve for the mouthpiece; and

FIGURE 8 is a section along the line 8—8 of FIGURE 7.

The helmet combination of the present invention as shown, for example, in FIGURES 1 and 2 includes a helmet 10. This helmet may be composed, for example, of a rigid plastic or metal, or other appropriate material. The helmet 10 includes the usual interior padding 12.

A transparent face mask 14 is mounted on the front of the helmet 10. The face mask is hinged to the helmet by a pair of spring loaded hinges 16. As will be described in conjunction with FIGURE 5, a second embodiment of the hinges permits the face mask to be moved towards and away from the face of the diver, and to be adjustable to the left or right, or up and down. The face mask may be swung up to an open position. When it is turned down into the position shown in the drawings, the spring loaded hinges 16 hold it tight against the face of the diver. Additional springs may be used to maintain the face mask in position.

The face mask 14 is formed to include a curved glass window, so as to provide a wide angle view for the diver, and yet maintain the interior space at a minimum, so as to reduce the interior volume requiring purging. The distance of the face mask from the face of the diver is kept at a minimum so as to permit wide angle vision.

A purge valve 18 is mounted on the face mask, this valve operates in known manner to pass fluid from the interior to the exterior, whenever the interior pressure exceeds the external water pressure.

The helmet 10 has intrnal cavities 20 formed in the interior padding, or in the plastic wall of the helmet itself. Electronic or acoustical communication equipment, represented by the units 22 may be mounted in the cavities 20. The sides of the helmet may be hinged, by hinges such as the hinge 21, so that the sides may be turned out from the ears of the wearer to permit the helmet to be readily removed. Conversely, a single hinge may be provided at the center of the helmet.

The helmet also includes a purge valve, such as the valve 24. This valve permits air trapped in the helmet to escape, whenever the internal air pressure exceeds the external water pressure. This purge valve is of particular value in assisting in the rapid descent of the diver. It will be appreciated that the helmet itself is not water-tight, although the face mask is water-tight.

The helmet also includes a pair of water-tight ear cups, such as the ear cup 26, these being disposed on each side of the helmet. Appropriate purge valves may also be provided in the ear cups. The ear cups may be constructed, as will be described, to include a self-equalizing pressure regulator. This pressure regulator responds to the external water pressure to control the internal air pressure in the ear cups, and in the face mask 12, so that the internal air pressure is equalized at all times with the external water pressure.

A quick disconnect coupler 30 may be mounted on the helmet 10, and a hose 32 from a usual air tank 34 is coupled to the coupler 30. The coupler itself may be of known construction, and it permits the hose 32 to be coupled to the helmet 10, or uncoupled therefrom, merely by a pushing or pulling operation. A usual valve is included in the coupler to prevent water from flowing into the helmet when the hose is uncoupled.

An internal hose 36 couples the coupler 30 to the ear cup 26, and a similar hose couples the coupler to the opposite ear cup. An additional hose 38 couples the ear cup 26 to a flexible hose 40 which, in turn, is coupled to the interior of the face mask 14. The coupler 30 may be constructed, for example, of anodized aluminum or plastic, so as to avoid salt water contamination and oxidation, and it may include glass, or plastic, bearings.

An appropriate pressure regulator valve mechanism mounted within the ear cup 26, as will be described, responds to the external water pressure, to control the flow of pressurized fluid from the tank 34 into the ear cup 26 and into the interior of the face mask 14. The control is such that the internal air pressure is equalized with the external water pressure at all times. A similar pressure regulator may be mounted in the opposite ear cup.

It may be noted that the hose 32, which extends from the tank 34 to the quick disconnect 30, can also serve as a spare hose. That is, the hose 32 can quickly be disconnected from the coupler 30 and plugged into another diver's mouthpiece, to supply air to the other diver, should an emergency arise.

It may also be noted that if the interior of the face mask 14 becomes flooded, the diver can press the pressure regulator in either one of the ear cups to cause a supply of air to flow into the helmet, so that the water in the face mask is purged out the valve 18. The diver then releases the pressure regulator, and the air pressure within the ear cups and within the face mask will again be automatically controlled, until it is again equalized with the external water pressure.

The hose 38 from the ear cups is preferably positioned below the ear cups, rather than in the position shown in FIGURE 1, so that if there is water in either ear cup, it will be expelled through the corresponding hose into the interior of the face mask, and out the purge valve 18. The purge valve 18 also serves as an anti-fogging device.

If so desired, an electric light 50 may be mounted on top of the helmet. Also, additional colored lights may be provided under the control of the diver, so as to provide

warning signals to other divers. For example, one of the lights is energized automatically when the pressure in the tank decreases below a particular threshold. Other colored lights may be used to designate other pressure thresholds.

A plurality of straps, such as the strap 54, are mounted in the helmet 10, and these straps are buckled to a mouthpiece 56 by means, for example, of the buckles 58. A quick release for the mouthpiece, as indicated 60 may also be provided.

As noted above, the mouthpiece 56 may extend over the nose of the diver, as shown in FIGURES 1 and 2 so as to permit nose and mouth breathing. Air is introduced into the mouthpiece through an inlet 62 by way of a hose 64. The hose 64 also extends to the air tank 34, together with the hose 32. The hose 64 may be coupled to the inlet by a quick-disconnect coupler, like the coupler 30 described above. The hoses 32 and 64 may be coupled to the air tank 34, likewise, by quick-disconnect couplers, if so desired.

As mentioned above, the straps 54 not only serve to hold the mouthpiece in place around the mouth of the diver, but also enable the mouthpiece to hold the helmet in place on his head.

The modified mouthpiece 56a, which may be similar to that described in the aforesaid copending application, is shown in detail in FIGURE 3. The mouthpiece 56a terminates under the nose of the diver. As illustrated in FIGURE 3, the inlet hose 64 is clamped to the tubular boss which forms the inlet 62. The mouthpiece 56 includes a pressure regulator 150 as an integral unit. The regulator is a self-equalizing demand valve type.

As shown in FIGURE 3, the regulator 150 includes an outer wall 152, and an internal flexible diaphragm 156. The diaphragm defines a water chamber 158 with the apertured wall 152. The diaphragm 156 is water-tight, and it separates the water chamber 158 from the internal chamber 159 of the mouthpiece. A spring-loaded manually operable push button 151 is included to permit a flow of purging air into the mouthpiece when desired.

The inlet 62 communicates with the interior of the chamber 159. A spring-loaded tilt valve assembly 162 is positioned in the inlet 62, and this assembly includes an elongated bracket 164 (FIGURE 5), or its mechanical equivalent, which serves as an actuator for the valve 162. The bracket 164 extends into engagement with the inner surface of the diaphragm 156.

Then, as the diver inhales, the diaphragm 156 moves inwardly. This causes the bracket 164 to pivot at its left-hand end and pull the valve stem 165 to unseat the valve head 161 in the demand valve assembly 162, so as to permit pressurized air to enter the chamber 159. Then, when the diver exhales, the diaphragm 156 moves outwardly, and away from the actuator 164, so that the valve 162 closes under the pressure of spring 167. In this manner, the diver is enabled to breathe comfortably into the mouthpiece.

The particular type of tilt valve assembly shown in FIGURES 3 and 4 is a "down stream" variety which will not jam and will continue to operate even in the presence of excessively high inlet air pressures.

It will be appreciated that the pressure on either side of the diaphragm 156 is substantially equilized, by the air in the chamber 159 and by the water in the water chamber 150. It will also be appreciated that the diaphragm 156 conveniently serves as a transducer, so as to permit communication, even without a microphone and electronic equipment, to be carried out at short distances.

Any speech by the diver sets up a corresponding vibration in the diaphragm 156 which, in turn, sets up acoustical vibrations in the water, these latter vibrations being communicated to adjacent divers. Because of the equalized pressure on both sides of the diaphragm 156, it is able to vibrate freely, as the diver speaks.

As mentioned above, a pressure regulator similar to

the regulator 150 may be included in each of the ear cups 26. The regulators in the ear cups respond to any differential in water pressure to open corresponding air tilt valves and thereby control the flow of air into the ear cups and into the interior of the face mask. Also, the diaphragms in the regulators of the ear cups are free to vibrate, so that any acoustical vibrations in the surrounding water are communicated as sound waves to the ears of the diver, so that the ear phones in the ear cups are not essential for communication with adjacent divers.

The air exhaust from the mouthpiece 56 is normally through an exhaust port 170 at the bottom of the mouthpiece. This exhaust could be directed inside the helmet to warm the head of the diver, and it would then bubble up from the purge valve 24. The position of the purge valve permits the escaping air bubbles to be away from the face mask 14, so as not to obstruct the view of the diver. Also, they could be relatively noiseless, so as not to interfere with acoustical communication. As shown in FIGURES 7 and 8, the exhaust port 170 may be in the form of a molded slit. This slit passes exhaust air out of the mouthpiece and functions as a valve so as to prevent water from being drawn into the mouthpiece when the diver inhales.

A boss 57 may be formed at one side of the mouthpiece, as shown in FIGURE 3. A housing 59 is supported in the boss and extends into the mouthpiece. A push button 61 is mounted at one end of the housing 59. An aerosol cartridge 63 is mounted in the housing. The cartridge contains compressed air and is replaceable. In an emergency, the diver can push the button 61 and provide himself with sufficient air to reach the surface.

The hinges 16, shown in FIGURES 1 and 2, may be replaced by hinges such as the hinge 200 shown in FIGURE 6. The latter hinge is advantageous in that it permits the face mask to be adjusted to any desired position.

The hinge 200 is provided with two links 202 and 204 which are intercoupled by means of a knee joint 206. The link 204 is coupled to a pin on the helmet 10 by means of a ball and socket joint 210. The link 206 is coupled to a pin on the face mask 14 by means of a ball and socket joint 212. The joints 206, 210 and 212 are all sufficiently tight so as to cause the face mask to be retained in any position in which it may be set.

The invention provides, therefore, an improved helmet combination for under-water diving equipment. The combination, as is evident from the foregoing description, is easy to put on or take off, and is extremely comfortable to wear. Moreover, the helmet assembly may include all the components required by the diver to exist under water and to communicate with others.

While a particular embodiment of the invention has been described, modifications may be made. It is intended in the claims to cover all modifications which come within the scope of the invention.

What is claimed is:

1. Under-water diving equipment including: a helmet composed of rigid material and having interior padding; a transparent face mask mounted on said helmet in position to extend across the eyes of the wearer; a mouthpiece removably mounted on said helmet in position to enclose the mouth of the wearer; a pair of ear cups mounted on

each side of said helmet; a source of breathable pressurized fluid; first conduit means coupled to said source for introducing pressurized fluid therefrom into the interior of said ear cups and into the interior of said face mask for pressure equalizing purposes; first self-equalizing pressure regulator means coupled into said first conduit means; first purge valve means mounted on said face mask to pass fluid from the interior of said face mask to the exterior thereof whenever the interior pressure exceeds the external water pressure; second conduit means coupled to said source for introducing the breathable pressurized fluid into said mouthpiece; second self-equalizing pressure regulator means coupled in said second conduit means; and an exhaust valve means mounted on said mouthpiece to discharge fluid from the interior thereof.

2. The assembly defined in claim 1, in which said interior padding defines at least one interior cavity, and which includes communication equipment mounted in said interior cavity.

3. The assembly defined in claim 1, and which includes purge valve means mounted on said helmet for passing fluid from the interior of said helmet to the exterior thereof whenever the interior pressure of said helmet exceeds the external water pressure.

4. The assembly defined in claim 1, and which includes a pair of hinges coupling said face mask to said helmet, each of said hinges including a pair of links, a knee-coupling means intercoupling said links, and a pair of ball and socket coupling means respectively coupling one of said links to said helmet and the other of said links to said face mask.

5. The assembly defined in claim 1, and which includes a compressed air cartridge mounted in said mouthpiece in position to permit compressed air from said cartridge to be discharged into said mouthpiece.

6. The assembly defined in claim 1, in which said helmet includes at least one hinged section to permit easy removal thereof from the head of the wearer.

7. The assembly defined in claim 1, in which said exhaust valve means mounted on said mouthpiece has a slit-like configuration.

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WILLIAM E. KAMM, *Primary Examiner*.

U.S. Cl. X.R.

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