Oct. 27, 1959 E. A. MONROE ET AL 2,910,063

DIVING MASK

Filed March 7, 1958

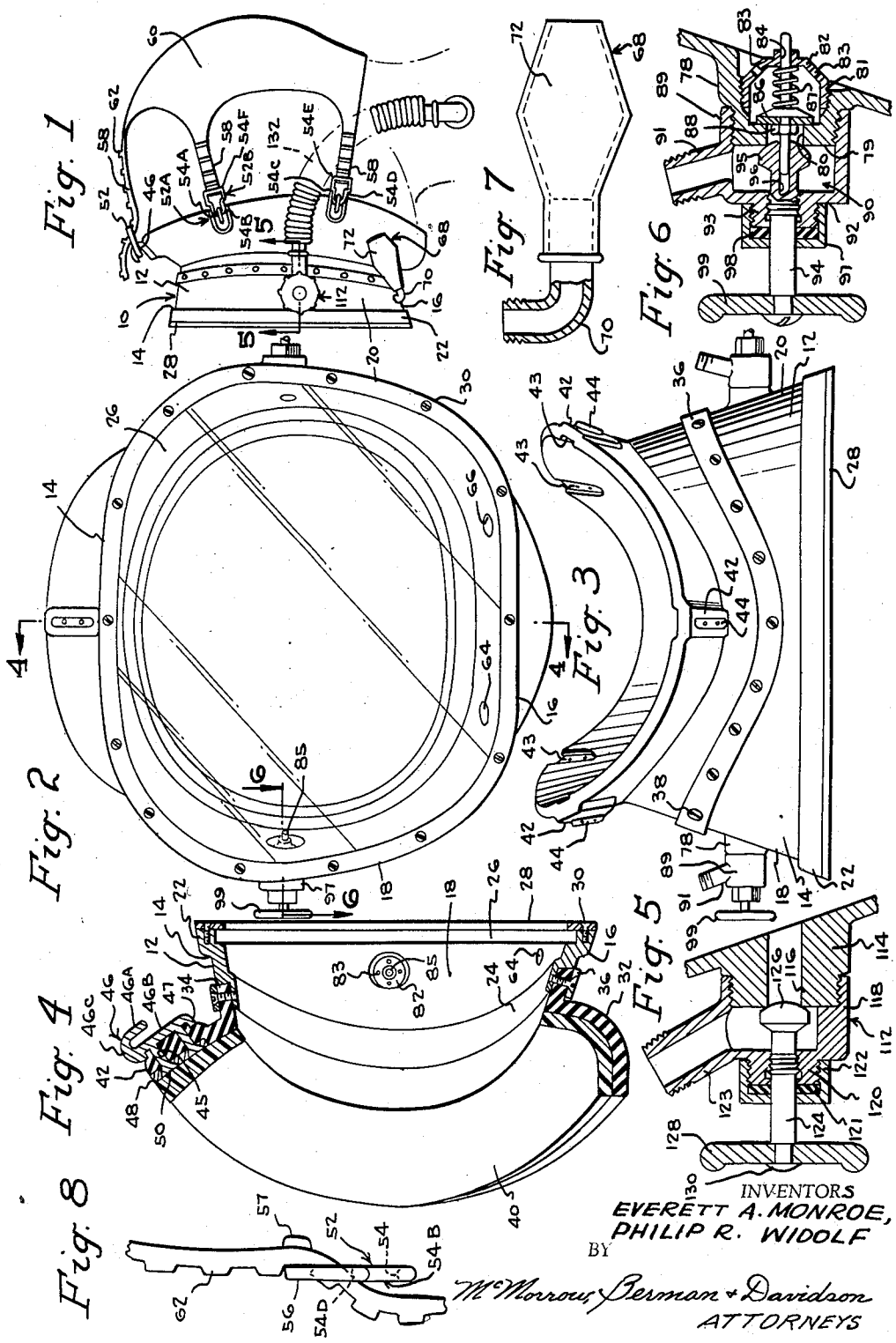


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

INVENTORS
EVERETT A. MONROE,
PHILIP R. WIDOLF

BY McMorrow, Berman & Davidson
ATTORNEYS

United States Patent Office 2,910,063 Patented Oct. 27, 1959

2,910,063

DIVING MASK

Everett A. Monroe and Philip R. Widolf, Costa Mesa, Calif.

Application March 7, 1958, Serial No. 719,799

4 Claims. (Cl. 128—144)

This invention relates to underwater diving masks and, more specifically, to a diving mask adapted to be used in conjunction with an inflatable diving suit and having means for the regulation of the air pressure within the mask and within the suit.

Among the objects of this invention is to provide a diving mask of the class described which is engineered to maintain a constant air pressure therein regardless of the outside water pressure exerted on it at whatever depth it may be used.

Another object is to provide a diving mask conforming to the above objects and having a valve intake and exhaust system capable of regulation by the user thereof.

A further object is to provide a diving mask of the class described having a buckle device that is positive in operation and may be readily connected and disconnected by the user thereof.

A still further object is to provide a diving mask of the class described supra, the diving mask being positive in operation and durable in use.

Other and further objects and advantages may more readily be seen from a consideration of the following specification when read in conjunction with the annexed drawing, in which:

Figure 1 is a side elevational view of an underwater diving mask constructed and assembled in accordance with the teachings of this invention, showing the diving mask as it is worn by a diver clad in an inflatable diving suit;

Figure 2 is an enlarged end elevational view of the main body portion of the diving mask having certain of the fittings removed for purposes of illustration;

Figure 3 is a top plan view of the diving mask as it is seen in Figure 2;

Figure 4 is a detail cross-sectional view of the mask as it is shown in Figures 2 and 3, taken substantially on the vertical plane of the line 4—4 of Figure 2, looking in the direction of the arrows;

Figure 5 is an enlarged detail cross-sectional view of the air bypass valve seen in Figure 1, taken along the horizontal plane of the line 5—5 of that figure;

Figure 6 is an enlarged detail cross-sectional view of the air supply control valve shown in Figure 2, taken along the horizontal plane of line 6—6 of that figure, looking in the direction of the arrows;

Figure 7 is an enlarged side elevational view of one of the two oneway air exhaust valves employed in practicing this invention with a portion of the L-shaped shank member thereof in fragmentary cross-section; and,

Figure 8 is an enlarged side elevational view of the strap and buckle portions of the device, thus enlarged to more clearly illustrate the manner of connection therebetween.

Proceeding now to a more detailed description of this invention, reference numeral **10** designates in general a diving mask constructed and assembled in accordance with the teachings of this invention. The mask is seen to comprise a substantially hollow, trapezoidal main body portion **12** formed of bronze or any other suitable material, and having its major axis extending horizontally

across the face thereof; the main body portion **12** comprising a pair of opposed, substantially trapezoidal top and bottom sides **14, 16** and a pair of opposed, substantially trapezoidal ends **18, 20**. The main body portion **12** is also provided with a peripheral outwardly extending flange **22** formed around the edge of the open frontal face thereof and an inwardly extending peripheral flange **24** formed around the opposed rear face thereof. A substantially rectangular, transparent face plate **26** is releasably mounted within the flange **22** and is normally held in place by an open retaining band **28** having the configuration of the flange **22** and being affixed thereto by means of a plurality of machine screws **30** of a conventional type.

The device **10** is also provided with a substantially ovate face member **32** formed of rubber or some equivalent material and having a top, bottom and opposed sides shaped to conform to the contour of a user's forehead, chin and face. The face member **32** is provided with a substantially rectangular inner flange **34** formed integral therewith and adapted to be fitted over and around the flange **24** of the main body portion **12**. A retaining band **36** is positioned around the juncture of the flanges **24, 34** and is held in place by a plurality of conventional screws **38**.

The face member **32** is provided with a sponge rubber liner **40**, attached thereto by vulcanization, conforming in shape to the inner dimensions of the face member **32** for the purpose of providing a water tight fit between the face member **32** and the portion of the diving suit surrounding the user's face.

A series of spaced, substantially rectangular protrusions **42** are integrally formed around the outer side of the face member **32** and are each provided with a substantially rectangular, integral hook holder block **44** in axial alignment therewith. Correspondingly spaced depressions **43** are formed in the inner side of the face member **32** and a like number of substantially U-shaped hook members **46** are provided. As is seen in Figure 4, each of the hook members **46** includes a pair of substantially parallel arms **46A, 46B** having a pair of their adjacent ends connected by a bight portion **46C**. The arm **46B** is provided with a laterally extending continuous peripheral flange **47** which projects laterally from one side thereof and along its marginal edges. A pair of longitudinally spaced studs or rivets **50** project laterally from the arm **46B** and in the same direction as the flange **47**. As is seen in Figure 4, the hook members **46** are supported on the protrusions **42** with the flange **47** abutting against the sides of the hook holder block **44** and with the rivets **50** extending through suitable openings **45** formed in each block and protrusion. A suitably apertured locking plate **48** is fitted over the outer ends of the rivets **50** and is pressed into the depression **43** after which the outer ends of the rivets **50** are peened thereover to a flat position thereby fixedly securing each of the hooks **46** to the device.

A like plurality of buckle members **52** are provided, each having an open T-shaped configuration. As is seen in Figures 1 and 8, each of the buckles comprises a stem **52A** and a cross head **52B**. The stem **52A** includes a hook engaging bight member **54** from the opposed ends of which project a pair of side arms **54A, 54B** each of which terminate in parallel, diverging extensions **54C, 54D**, respectively. The outer ends of the extensions **54C, 54D** are integral with one of the ends of a pair of laterally extending bight members **54E, 54F**, respectively, and the outer ends of the latter connect with one of the ends of a pair of inwardly converging overlapping strap engaging jaws **56, 57**. The buckles **52** are utilized to provide a detachable connection between the face member **32** and the rear head covering **60**. To this end, one end of the strap **58** is fixedly secured to the head covering **60** and

the other end thereof is extended forwardly toward the face to a desired position adjacent either of the free ends of the jaws 56, 57. Thereafter, the user inserts the strap between the jaws 56, 57 and the strap is held in its adjusted position by means of a pair of adjacent rectangular slots 62 which extend along the strap 58 in longitudinally spaced relation.

A pair of exhaust valves 68 are threadedly connected to the device at the openings 64, 66 provided in the bottom side 16 of the main body portion 12, the structure of the exhaust valve 68 being shown in Figure 7. The valve 67 is seen to comprise a tubular metal, L-shaped shank 70 threaded at one end for mounting in the opening 64 or 66 in the main body portion 12, and a resilient oneway valve member 72 which serves to allow the escape of expended air. The positioning of the valves 68 at the bottom side of the main body portion 12 also allows the escape of any water which might, by accident, enter the device.

To accommodate an air supply control valve, one side of the main body portion 12 is provided with an outwardly projecting boss 78 the inner and outer ends of which are internally and externally threaded, respectively, as shown in Figure 6, and the boss 78 includes a wall 79 extending across the outer end thereof and provided with an aperture 80. A substantially hollow cylindrical element 81 is externally threaded at its outer end for threaded engagement with the internal threads of the boss 78, the element 81 having a closure wall 82 extending across the inner end thereof. As is seen in Figure 6, the closure wall 82 is provided with a plurality of transversely extending air passages 83 and a centrally positioned bore 84 coaxially aligned with the aperture 80. A shaft 85 has one of its ends mounted for reciprocation in the bore 84 and the outer end thereof projects through the aperture 80. A leather valve member 86 is mounted on the shaft 85 and extends across the aperture 80 in its normally closed position. A helicoidal spring 87 surrounds the shaft 85 and engages against one side of the valve 86 and the adjacent side of the wall 82, the spring constantly biasing the valve for movement towards its closed position. Reference numeral 88 denotes a spring tension adjusting nut threaded on the shaft 85 intermediate its ends and in engagement with the other side of the valve 86.

A substantially hollow cylindrical internally threaded valve casing 89 is threaded on the externally threaded portion of the boss 78, the casing 89 providing a chamber 90 which is in open communication with one end of an outwardly diverging hollow tubular externally threaded hose connector 91. The casing 89 includes an end wall 92 having a laterally outwardly projecting internally and externally threaded, hollow cylindrical boss 93 coaxially aligned with the aperture 80 and bore 84.

A manually operable valve actuating shaft is threaded intermediate its ends for connection with the internally threaded portion of the boss 93, and the inner end thereof terminates in an enlarged valve element 95 having a substantially ovate configuration. As is seen in Figure 6, the valve element 95 is disposed for movement within the chamber 90 and is adapted to seat against the other side of the aperture 80 in its normally closed position. The inner end of the shaft 94 and valve element 95 are concentrically bored at 96 to receive and support for reciprocation therein the other end of the shaft 85.

A packing box 97 for a packing washer 98 is threaded on the externally threaded portion of the boss 93 and a manually operable valve actuating wheel 99 is fixedly secured to the other end of the shaft 94 for rotation therewith.

To serve a purpose to be described, a source of air under pressure (not shown) is connected to the air connector 91.

Positioned on the main body portion 12 opposite the valves 86 and 95 is a by-pass valve assembly 112 best illustrated in Figure 5. This valve assembly comprises a substantially cylindrical, threaded extension 114 of the main body portion 112 having a substantially cylindrical passageway 116 therethrough. Threadedly mounted on the extension 114 is a substantially hollow, cylindrical primary valve portion 118 having a substantially cylindrical, threaded extension 120 in alignment with its major axis. Resting on the extension 120 is an annular packing washer 121 held in place by a cup-shaped packing nut 122 threadedly mounted on the extension 120. An angularly extending substantially hollow cylindrical, threaded hose fastening member 123 is positioned adjacent the hollow portion of the primary valve portion 118. A substantially cylindrical valve stem 124, threaded intermediate its ends, is threadedly mounted through the extension 120 of the primary valve portion 118 and terminates at its inner end in a substantially ovate valve 126 which serves as a valve for the passageway 116. The action of the stem and valve is controlled by a substantially circular handle 128 secured to the outer end of the stem by a conventional means for rotation therewith. The hose fastening member 123 is threadedly connected to a flexible air hose 132 which leads to the neck portion of an air tight diving suit, as seen in Figure 1.

In operation, the user of the device adjusts the air supply control valve 95 to admit a flow of air from the air source by turning the handle 99 thus causing the valve 95 to move away from the opening 80. The air under pressure now forces the leather washer 86 against the pressure of the spring 87 and moves away from the aperture 80 to its open position so that air enters element 81 and passes through the passages 83 into the mask 10. In case of accidental loss of air supply, the spring 87 presses the washer 108 back against the opening 79 thus preserving the pressure within the mask.

The purpose of the by-pass valve is to allow the diver to inflate the suit to a desired degree of pressure, and to adjust this pressure at various levels thus assuring comfort and safety at all depths. This is accomplished by rotating the handle 128 thus causing the plunger 126 to move away from the passageway 116, the air from the main body portion moving through the passageway to inflate the suit to the desired pressure. When the desired pressure is reached, the valve is closed by rotating the handle to close the valve 121 against the passageway 116. If, at a greater depth the suit begins to react unfavorably to the increased water pressure, the diver simply reopens the valve in the above manner thus increasing the pressure within the suit. A constant pressure, found to be ideally set at one half pound per square inch greater than outside pressure, is maintained within the mask by the exhaust valves 68. The valves 68 are of the self-closing type and, being positioned as shown in the drawing, direct the flow of expended air away from the face plate, and thus does not obstruct the vision of the user.

Having described and illustrated one embodiment of this invention in detail, it is to be understood that the same is to be offered merely by way of example and that this invention is to be limited only by the scope of the appended claims.

What is claimed is:

1. A diving mask comprising a hollow main body portion having a pair of opposed open ends, a transparent face plate releasably mounted on said main body portion adjacent one of said open ends, a face member mounted adjacent the other of said open ends of said main body portion, a resilient face engaging liner fixedly secured to and conforming to the inner contour of said face member, fastening means positioned around said face member to releasably connect it with straps leading to a head covering, a pair of pressure sensitive exhaust valves leading from said main body portion, an air supply control valve mounted on one side of said main body portion, means for connecting said air supply control valve between said mask and a source of air under pressure, said air supply

control valve including means for supplying a constant flow of air from said air source into said main body portion, a by-pass valve positioned on the opposed side of said main body portion, said by-pass valve including means for conducting air from said main body portion to an inflatable diving suit, and means for connecting said by-pass valve with said suit.

2. A diving mask as defined in claim 1, wherein said fastening means comprises a plurality of substantially U-shaped hook members fixedly connected to said main body portion, a plurality of buckle members having an open T-shaped configuration, said T-shaped buckle members each having a hook engaging bight to releasably connect with said hook members, said buckle members also having a pair of overlapping strap engaging jaws, a plurality of straps leading from said head covering to said buckle members, said straps each having longitudinally spaced substantially rectangular stops formed on one side thereof, and said straps being adapted to be inserted between said jaws to tensionally hold said mask against the face of the user.

3. A diving mask as defined in claim 1, wherein said air supply control valve comprises a substantially cylindrical hollow casing threadedly mounted on a substantially hollow boss projecting from said main body portion, said boss having an opening extending therethrough for the passage of air, said casing also being provided with an angularly disposed substantially cylindrical hollow hose connector for connection with said air source, a substantially cylindrical valve shaft extending through and being threaded intermediate its ends into said casing, a handle fixedly connected to the outer end of said shaft and a substantially ovate valve formed at the opposed end thereof, said valve being movable towards and away from the adjacent end of said boss and having a bore extending inwardly from the inner end thereof, a substantially hollow cylindrical element threadedly connected in said boss, said element having a wall extending across an end thereof and provided with a plurality of air ports, and said end wall having a substantially centrally located bore therethrough, said bore receiving for reciprocation therethrough one end of a substantially cylindrical valve stem, said valve stem extending through said boss and into said bore provided in said ovate valve, and a valve mounted for reciprocation on said valve stem, and means constantly biasing said last named valve for engagement across the inner end of said boss.

4. An underwater diving mask comprising a substantially hollow trapezoidal rigid main body portion having a circumferential outer flange formed around an open frontal face thereof, a substantially rectangular transparent face plate releasably mounted in said outer flange and secured thereto by an annular band having a plurality of screws for connection with said main body portion, an inwardly extending peripheral flange formed around the open inner face of said main body portion, a substantially ovate resilient face member having an integral substantially rectangular flange formed therein, said flange and said face member being juxtaposed around said inwardly extending flange of said main body portion, a substantially circular retaining band extending around the juncture of said flanges and held in place by a plurality of screws, a resilient liner fixedly connected to the inner surface of said face member and conforming substantially to the contours thereof, a plurality of spaced substantially rectangular protrusions integrally formed adjacent the opposed edge of said face member, a substantially rectangular hook holder projecting from each of said protrusions, a corresponding number of substantially rectangular depressions in said inner side of said face member, a plurality of substantially rectangular plates press-fitted into said depressions, a plurality of substantially U-shaped hook members each having a continuous peripheral flange projecting laterally from one arm thereof, said flange conforming in size to the outer dimensions of said hook holders, a plurality of rivets projecting from each of said one arms of said U-shaped hook members, said rivets extending through said face member and said plates, said rivets at their terminus being peened over said plates to fixedly connect said hook members to said face member, a plurality of buckle members each comprising a substantially open T-shaped hook engaging portion adapted to releasably receive said hook members, said T-shaped hook engaging buckle members including a pair of overlapping strap engaging jaws, a flexible rear head covering, a plurality of straps extending from said head covering, said straps being provided with a plurality of longitudinally spaced substantially rectangular stops, said straps being adapted to be inserted between said jaws of said buckles, said stops engaging said jaws to hold said straps at the desired adjusted position, a pair of one way exhaust valves threadedly connected to said main body portion, an air supply control valve comprising a substantially hollow casing threadedly mounted on a substantially cylindrical boss extending from said main body portion and having an opening therethrough for the passage of air, said casing also being provided with an angularly disposed substantially hollow cylindrical hose connector for connection with one end of a flexible hose having its other end connected to a source of air under pressure, a valve shaft threaded intermediate its ends for threaded connection with said casing, said shaft having a handle fixedly connected to the outer end thereof and a substantially ovate valve formed at the opposed end of said shaft, a substantially hollow cylindrical member threadedly connected to the inner end of said boss, said cylindrical member having a wall extending across an end thereof and provided with a plurality of air ports, said wall having a substantially centrally located opening therethrough, said opening in said wall receiving one end of a valve stem for reciprocation therein, said valve stem extending through said boss and into said casing, said shaft having an ovate valve on the other end thereof, said ovate valve being movable towards and away from the outer end of said opening formed in said boss and having a bore extending inwardly from the inner end thereof to slidably receive the other end of said valve stem, a valve mounted on said valve stem, a helicoidal spring partially surrounding said valve stem and engaging against and biasing said last named valve for movement towards the inner end of said opening formed in said boss, and a by-pass valve comprising a substantially cylindrical internally threaded extension of said main body portion and having a passageway therethrough, a substantially hollow cylindrical primary valve portion threadedly mounted on said extension of said main body portion, an angularly extending substantially cylindrical hollow hose fastening member in open communication with the hollow portion of said primary valve portion, a substantially hollow extension formed on the outer end of said primary valve portion, said last named extension having an opening therethrough in axial alignment with said passageway and said last named extension of said main body portion, a substantially cylindrical valve shaft threaded intermediate its ends and extending through said last named opening in said last named extension of said primary valve portion and having a handle releasably secured to the outer end thereof, and an ovate valve at the opposed end of said shaft, said last named valve serving as a closure for said last named passageway and said extension of said main body portion, and a flexible hose connecting said hose fastening member of said by-pass valve with the inflatable suit of the user.

References Cited in the file of this patent

UNITED STATES PATENTS

2,593,988 Cousteau ..... Apr. 22, 1952

FOREIGN PATENTS

633,421 France ..... Oct. 24, 1927