Nov. 13, 1945. J. W. BROWNE 2,388,674

DIVING SUIT

Filed Jan. 22, 1942 6 Sheets-Sheet 1

Fig. 1.

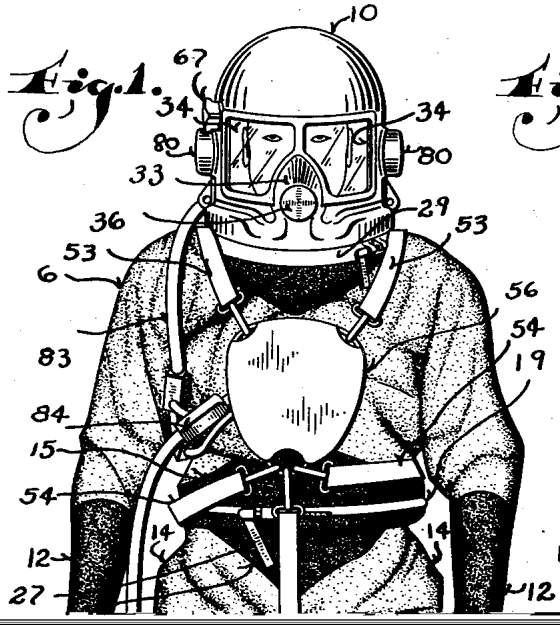
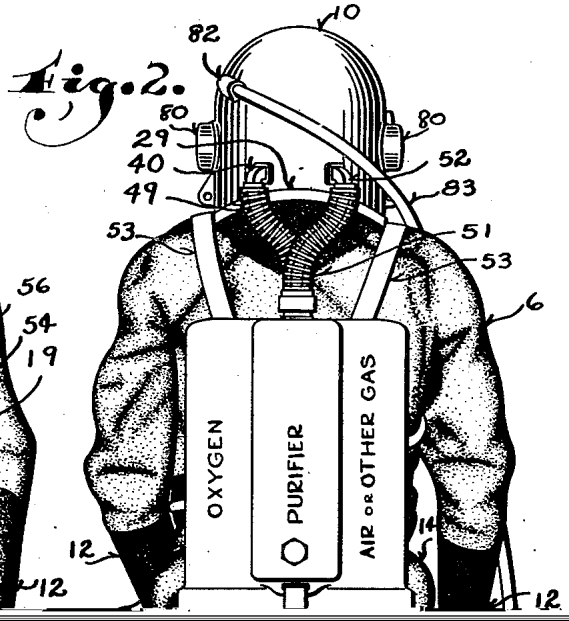


Fig. 2.

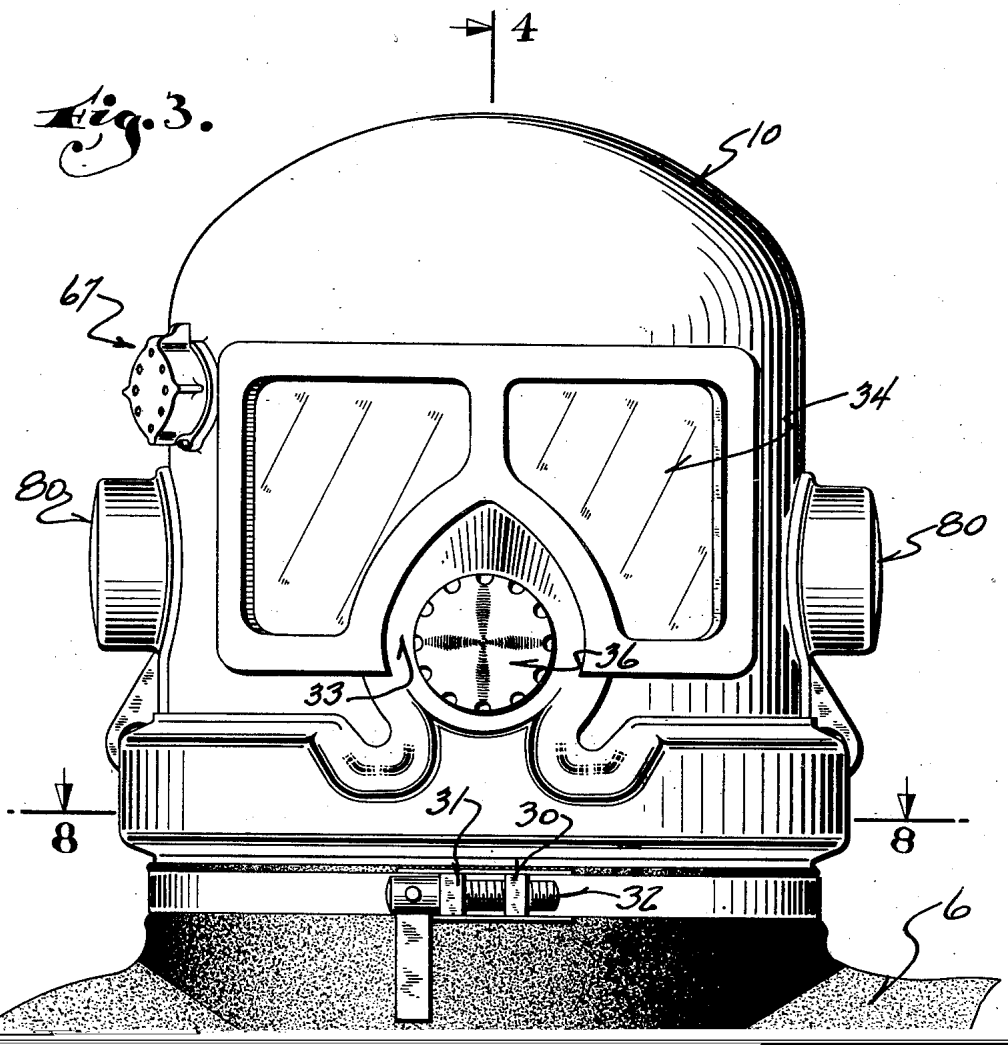


Nov. 13, 1945. J. W. BROWNE 2,388,674

DIVING SUIT

Filed Jan. 22, 1942 6 Sheets-Sheet 2

Fig. 3.

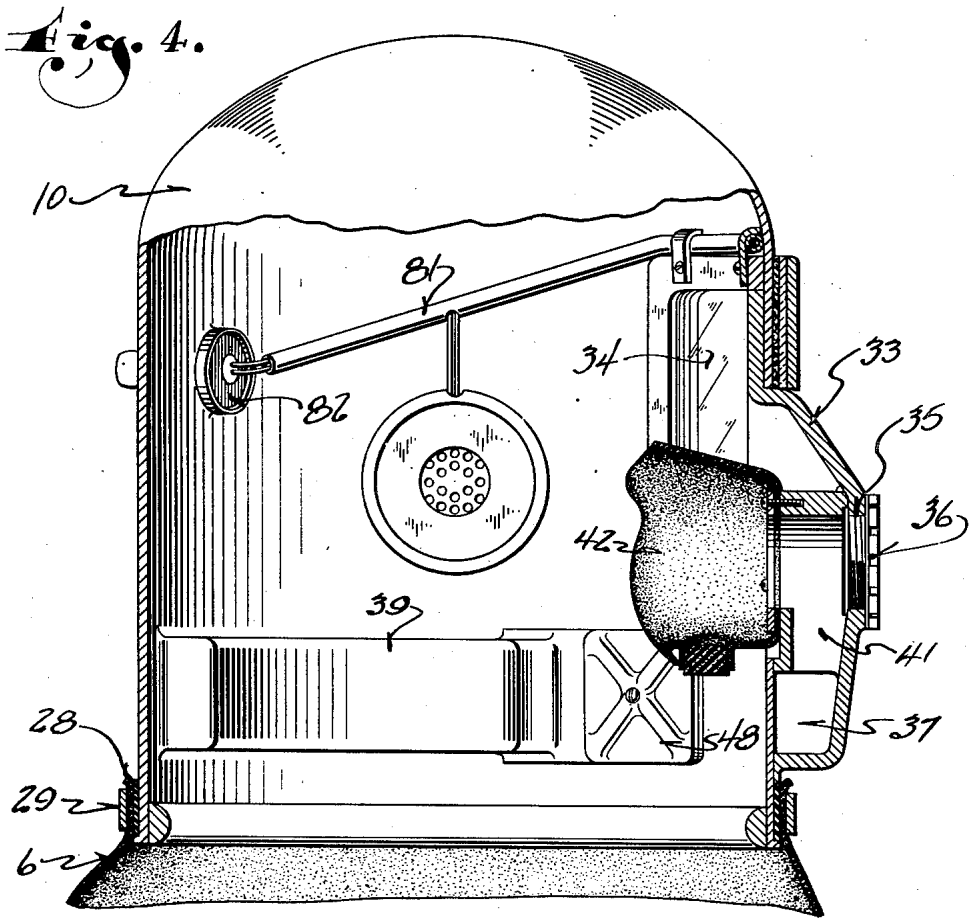


Nov. 13, 1945. J. W. BROWNE 2,388,674

DIVING SUIT

Filed Jan. 22, 1942 6 Sheets-Sheet 3

Fig. 4.



Nov. 13, 1945. J. W. BROWNE 2,388,674

DIVING SUIT

Filed Jan. 22, 1942 6 Sheets-Sheet 4

Fig. 6.

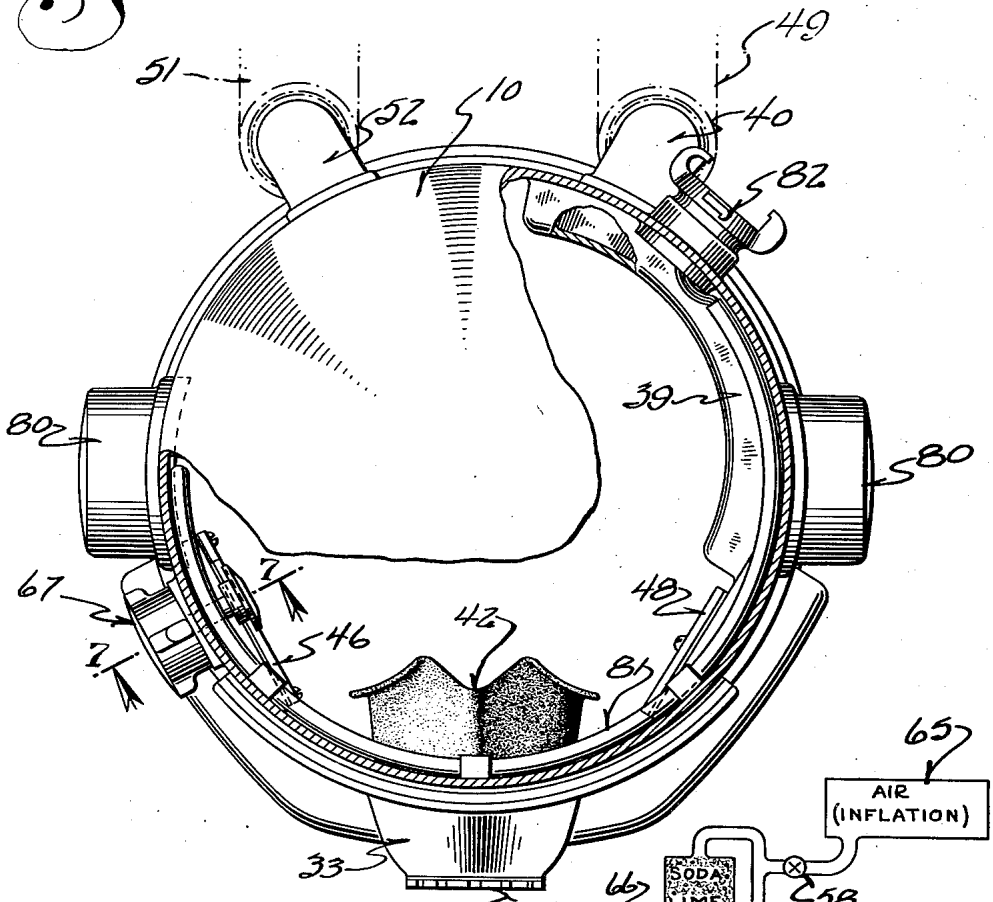


Fig. 14.

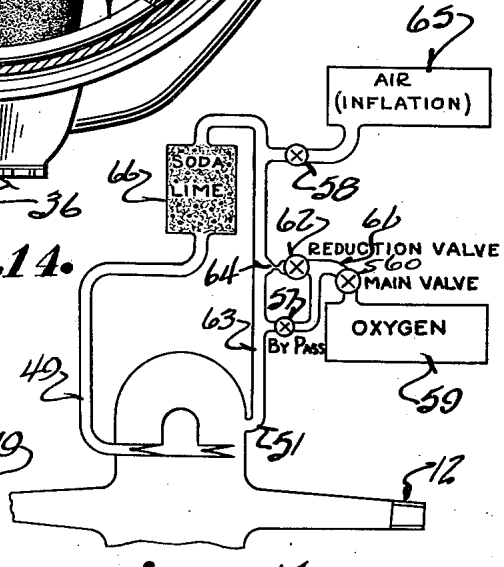
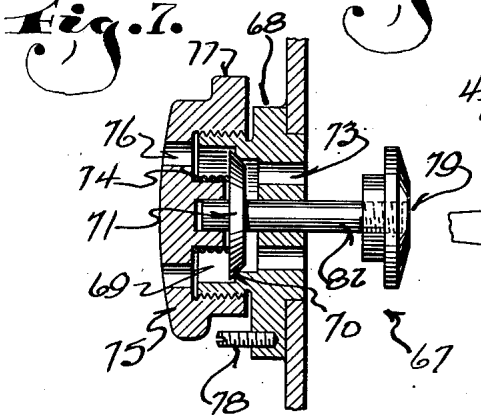


Fig. 7.



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Nov. 13, 1945. J. W. BROWNE 2,388,674

DIVING SUIT

Filed Jan. 22, 1942 6 Sheets-Sheet 5

Fig. 8.

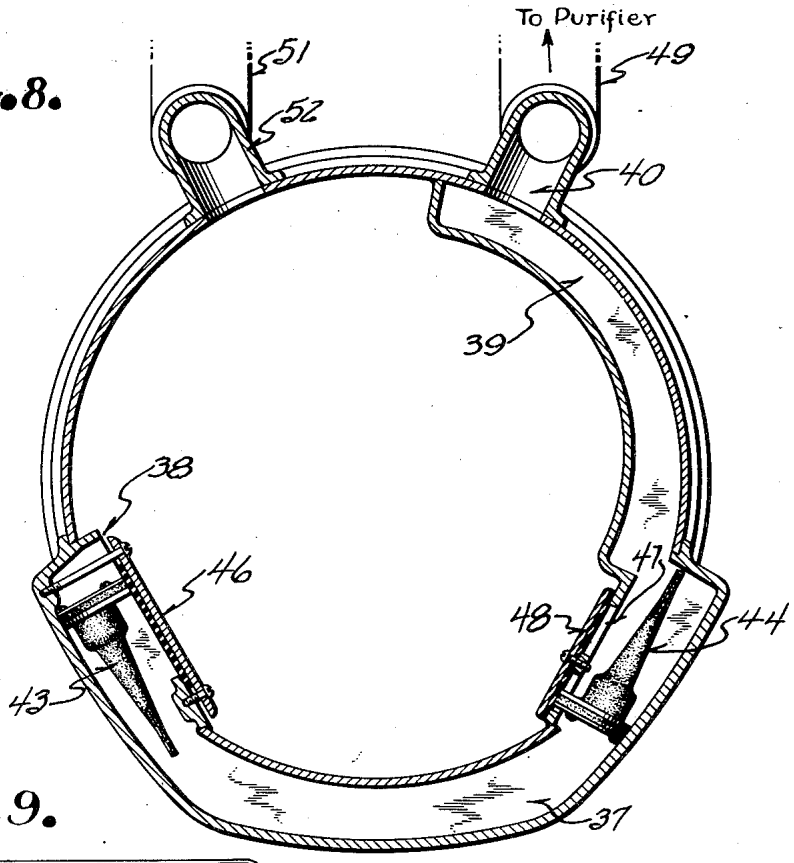


Fig. 9.

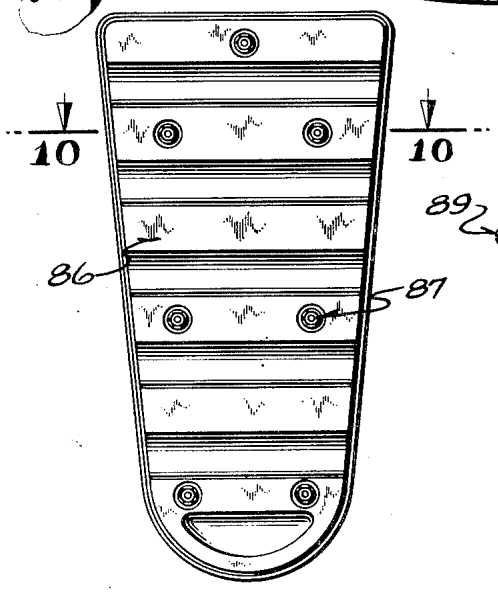
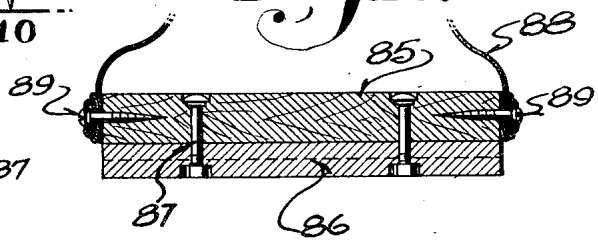


Fig. 10.



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Nov. 13, 1945. J. W. BROWNE 2,388,674

DIVING SUIT

Filed Jan. 22, 1942 6 Sheets-Sheet 6

Fig. 11.

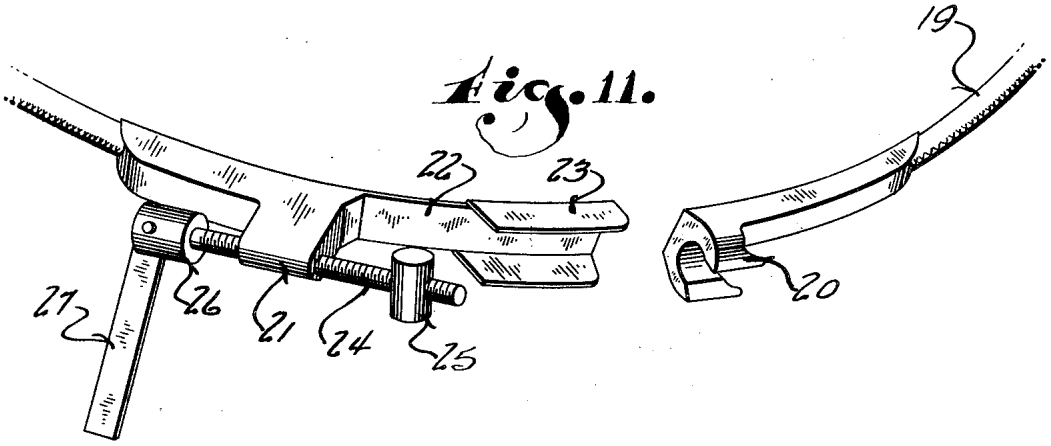


Fig. 12.

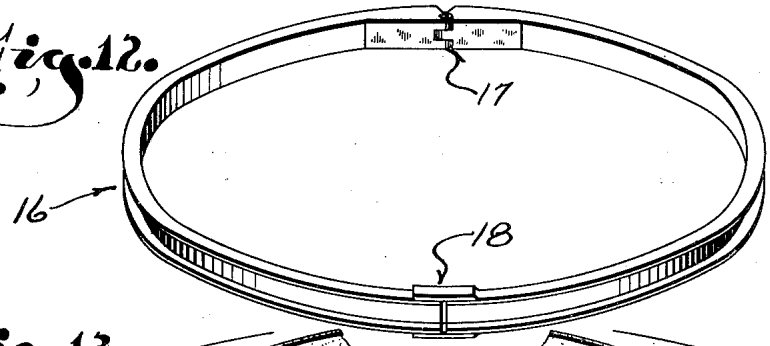
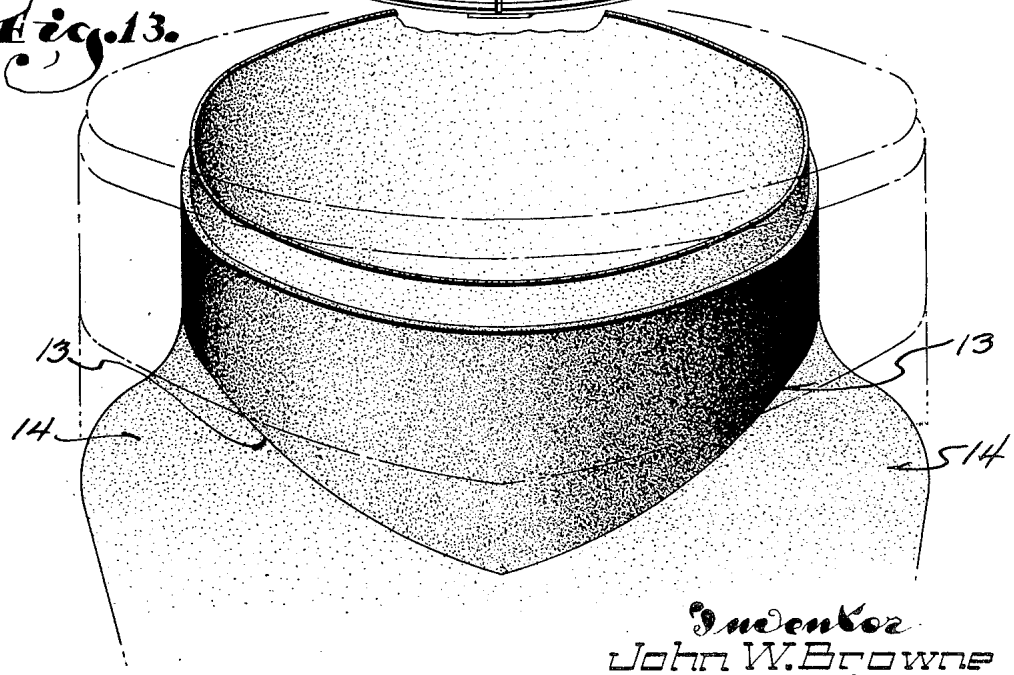


Fig. 13.



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Patented Nov. 13, 1945

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UNITED STATES PATENT OFFICE

2,388,674

DIVING SUIT

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Application January 22, 1942, Serial No. 427,736

7 Claims. (Cl. 61—70)

This invention relates to improvements in diving suits.

The conventional present-day commercial diving equipment consists of a suit or diving dress of flexible waterproof material open at the neck sufficiently to enable the diver to step into the suit. The large neck opening is thereafter closed by a metal plate on which the helmet is

tory system. It is, therefore, another object of this invention to provide a diving suit equipped with means for purifying the air exhaled by the diver, that is, removing the carbon dioxide from the exhaled air and returning the same to the suit interior.

Another object of this invention is to provide a

actuator button so located that the valve may be opened by the diver by pressing his head against

is customary, are complete with closed foot portions over which the shoes 11 are drawn.

The arms of the shirt have sleeve cuffs 12 of

outer face of the bearing bracket as will be readily apparent.

The attachment of the helmet to the neckband of the shirt is similar to the manner in which

valves 43 and 44, respectively, are mounted in the passage 37.

These valves as best shown in Figure 5 have

The oxygen used up by the diver is replaced by the constant admission of oxygen through the restricted orifice 64.

Ordinary air may be used for the inflation gas but if desired, helium or some other gas may be used for admixture with oxygen or even another cartridge of oxygen may be used for the inflation gas.

In any event the diver controls the amount of inflation gas entering the suit by means of the valve 58 so that his buoyancy is at all times under his own control. He is, therefore, enabled to locate the level of collapse at the point taught best by experience. During descent the air inside the suit is compressed by the water pressure so that the suit collapses. The level of collapse rises from the feet toward the helmet. By adjusting the valve 58 and admitting inflation gas, this level of collapse is maintained at the desired point, and when a diver reaches the bottom or the extent of his descent and he has adjusted the valve 58 to suit his comfort no further adjustments thereof are required.

Thereafter the functions of the apparatus are automatically performed to maintain the air in proper condition. Oxygenation and purification continue without attention from the diver who is thus enabled to direct his entire attention to whatever work he has been sent to do.

At the upper portion of the helmet is a pressure relief valve indicated generally by the numeral 67. This valve as shown in detail in Figure 7 comprises a flange 68 secured in a hole in the upper side wall of the helmet. The outer portion of this flange is bored to provide a valve pocket or chamber 69, the side wall of which is stepped to form a valve seat 70.

A valve plug 71 is slidably guided by a stem 72 passing through the flange 68 for movement to and from a closed position engaging the valve seat 70, and ports 73 through the flange 68 communicate the valve pocket or chamber 69 with the interior of the helmet so that when the valve plug is lifted from its seat a pressure relief opening is provided.

The valve plug is yieldingly urged to its closed position by a spring 74 confined between the plug and a cap 75 threaded onto the flange 68, the cap being provided with ports 76. This cap 75 also has a central boss bored to receive the adjacent end of the valve stem and so positioned that when the cap is screwed all the way onto the flange the valve plug is positively held down on its seat.

Hence, by controlling the extent the cap 75 can be unscrewed, it is possible to regulate the degree of opening of the pressure relief valve, and to this end a lug 77 projects radially from the cap to collide with a stop 78.

On the inner end of the valve stem 72 is a button 79 so positioned that the diver may press against it with the side of his head when he desires to open the valve, providing, of course, that the cap 75 has been unscrewed to allow such opening.

Another novel innovation in diving equipment resides in the provision of a microphone and earphone built into the helmet. For this purpose, the helmet has two cup-shaped caps 80 secured thereto over openings in its opposite side walls. One of these cup-shaped caps houses a microphone and the other has an earphone positioned therein. These phones are electrically connected through suitable conductors 81 with the terminals of a socket 82 in the upper portion of the helmet. This socket is adapted to have the terminal plug of a combination telephone cable and lifeline 83 readily detachably but securely connected thereto.

Attention is directed to the manner in which this combination lifeline and telephone cable is applied. As shown in Figures 1 and 2, it is looped about the chest of the diver and secured by cleats 84 so that a pull on the line will not detach the terminal plug 83.

The end of the cable extends from the cleats 84 over the right shoulder and around the rear of the helmet for connection with the socket 82.

In case the combination telephone cable and lifeline becomes hopelessly tangled with a submerged object, the diver can disconnect the cable from the socket 82 and undo the cleats 84 to completely free himself of the line. He is, of course, then cut off from surface communication but can effect ascent under his own control by merely increasing his buoyancy through the admission of added inflation air.

The shoes 11 also embody novel features of construction as is clearly shown in Figures 9 and 10. The soles of these shoes consist of an inner sole 85 of wood or like material and an outer tread 86 of lead or other heavy metal. Bolts 87 or other suitable securing means hold the treads to the soles 85.

The uppers 88 of the shoes are preferably made of canvas and are secured to the soles by screws 89 or other fastening means passing through the marginal edges of the uppers and threaded into the wooden soles 85.

Attention is particularly directed to the formation of the toes of the shoes. As best shown in Figure 9, the toes are square and have substantial width. This materially reduces the tendency of the feet to rock as the diver walks over a submerged surface and thus minimizes the danger of tipping over.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides a diving suit or apparatus having many valuable advantages over diving equipment heretofore in use.

What I claim as my invention is:

1. In a diving helmet, an air passage built into the wall of the helmet and disposed substantially horizontally with a medial portion thereof extending across the front of the helmet and end portions at the sides of the helmet, a breathing port opening into the helmet through an inner wall of the medial portion of the passage, a mask connected to the breathing port and through which the diver breathes; the inner wall of the air passage at opposite sides of the breathing port having openings of substantial size leading to the interior of the helmet, and an outer wall of one end portion of the air passage having an outlet port leading to the exterior of the helmet; an outlet valve inserted into the air passage through the opening in that end of the air passage which leads to the outlet port and disposed across the air passage to open only upon exhalation; a closure for said opening; an inlet valve inserted into the air passage through the other one of said openings and disposed across the air passage to open only on inhalation; a partial closure for said opening leaving an inlet port from the air passage into the interior of the helmet between which and said breathing port the inlet valve is located, and means for feeding life sustaining air into the helmet.

2. In a diving apparatus, a helmet made of

metal and having an air passage built into a wall thereof so as to be unitary with the helmet, said air passage being disposed horizontally in the lower portion of the helmet with a part thereof extending across the front of the helmet, a breathing port in said front part of the air passage opening to the interior of the helmet; an inlet port in an inner wall of the air passage also opening to the interior of the helmet, an exhaust port in an outer wall of the air passage opening to the exterior of the helmet, a mask connected with the breathing port through which the diver inhales and exhales from and into said air passage, an inlet valve interposed between the breathing port and the inlet port opening only on inhalation, and an outlet valve in the air passage between the breathing port and the exhaust port opening only on exhalation.

3. In a diving apparatus, a helmet made of metal and having an air passage built into a wall thereof so as to be unitary with the helmet, said air passage being disposed horizontally in the lower portion of the helmet with a part thereof extending across the front of the helmet, a breathing port in said front part of the air passage opening to the interior of the helmet, an inlet port in an inner wall of the air passage also opening to the interior of the helmet, an exhaust port in an outer wall of the air passage opening to the exterior of the helmet, a mask connected with the breathing port through which the diver inhales and exhales from and into said air passage; an inlet valve interposed between the breathing port and the inlet port opening only on inhalation, an outlet valve in the air passage between the breathing port and the exhaust port opening only on exhalation, the exterior wall of the air passage adjacent to the breathing port having a surface breathing port, and a removable plug closing said surface breathing port.

4. In a diving apparatus, a metal helmet formed with a protuberance in its front portion and windows adjacent thereto, said windows extending a substantial distance to the sides of the helmet, the forward protuberance on the helmet enabling the diver's face to be positioned well forward in the helmet so as to increase the angle of side vision without necessitating turning the head, an air passage built into the helmet as an integral part thereof and extending from the protuberance substantially horizontally in opposite directions, said air passage having open connection with the interior of the protuberance, a breathing port in said protuberance; a mask connected to said breathing port through which the diver exhales and inhales into and from the air passage, a valved inlet port connecting one end portion of the air passage with the interior of the helmet and opening only on inhalation so that the diver breathes air from inside the helmet, and a valved outlet port leading from the other end of the air passage to the exterior of the helmet and opening only on exhalation.

5. A diving suit of the character described comprising: a flexible diving dress having a neck band; a helmet; a fluid tight connection between the helmet and the neck band of the diving dress; a mask inside the helmet through which the diver breathes; a valved inlet for the mask through which the diver breathes air from inside the suit, said inlet opening only upon inhalation; a valved outlet for the mask opening only upon exhalation; an air purifier connected with the valved outlet and the interior of the suit for purifying the air exhaled by the diver and returning it to the suit; a pressure tank containing life sustaining gas; a pressure tank containing inflation gas also suitable for life sustenance; duct means connecting both said tanks with the interior of the suit so that gas from either one or both tanks may be admitted into the suit; a pressure reducing valve through which the tank containing the life sustaining gas is connected with said duct means to continuously replenish the oxygen used up by the diver; a bypass around said pressure reducing valve; individual valves readily accessible to the diver for controlling said bypass and the flow of gas from the tank containing the inflation gas so that the diver has at his command two sources of life sustaining gas as well as a source of buoyancy producing gas; and a normally closed exhaust valve in the helmet adapted to be opened by pressure applied to the actuator of the valve by means of the diver's head so that the diver also has at his command means for adjusting his buoyancy and maintaining the level of collapse of the suit at the most comfortable point.

6. A diving apparatus comprising: a flexible diving dress having a neck band; a helmet; a fluid tight connection between the helmet and the neckband of the diving dress; a mask inside the helmet through which the diver breathes; a valved inlet for the mask through which the diver inhales air from inside the suit, said inlet opening only on inhalation; an inlet port on the helmet opening directly to the interior thereof; an outlet port on the helmet; an air passage in the helmet connecting the mask with said outlet port; an outlet valve in said passage opening only on exhalation; a tank containing life sustaining gas; a tank containing inflation gas under pressure; an air purifier cannister; means for supporting said tanks and the cannister on the back of the diver outside the diving dress; a flexible hose connection leading from the outlet port on the helmet to the inlet of the air purifier cannister; a single flexible hose connection leading from the outlet of the air purifier cannister and from both tanks to the inlet port on the helmet; and valves for controlling flow from said tanks into the helmet whereby oxygen supply and buoyancy may be controlled by the diver.

7. In a diving apparatus: a metal helmet formed with a protuberance in its front portion and windows adjacent thereto, said windows extending a substantial distance to the sides of the helmet; the forward protuberance on the helmet enabling the diver's face to be positioned well forward in the helmet so as to increase the angle of side vision without necessitating turning the diver's head, an air passage built into the helmet as an integral part thereof, said air passage connecting with the protuberance and having a breathing port in said protuberance leading to the interior of the helmet, a mask connected to the breathing port through which the diver exhales and inhales to and from said air passage; means for exhausting exhaled air from said passage; and means for admitting fresh air to said passage.

JOHN W. BROWNE.