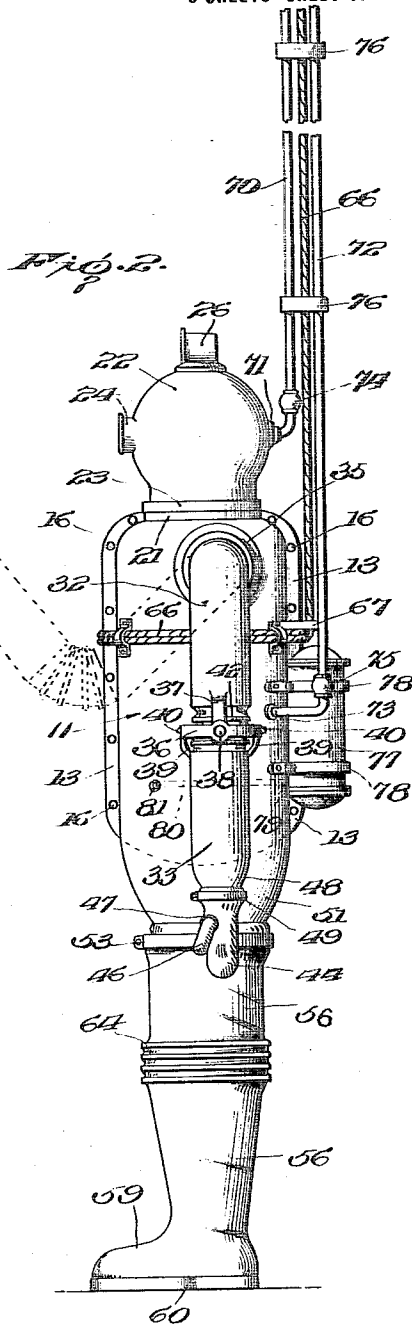
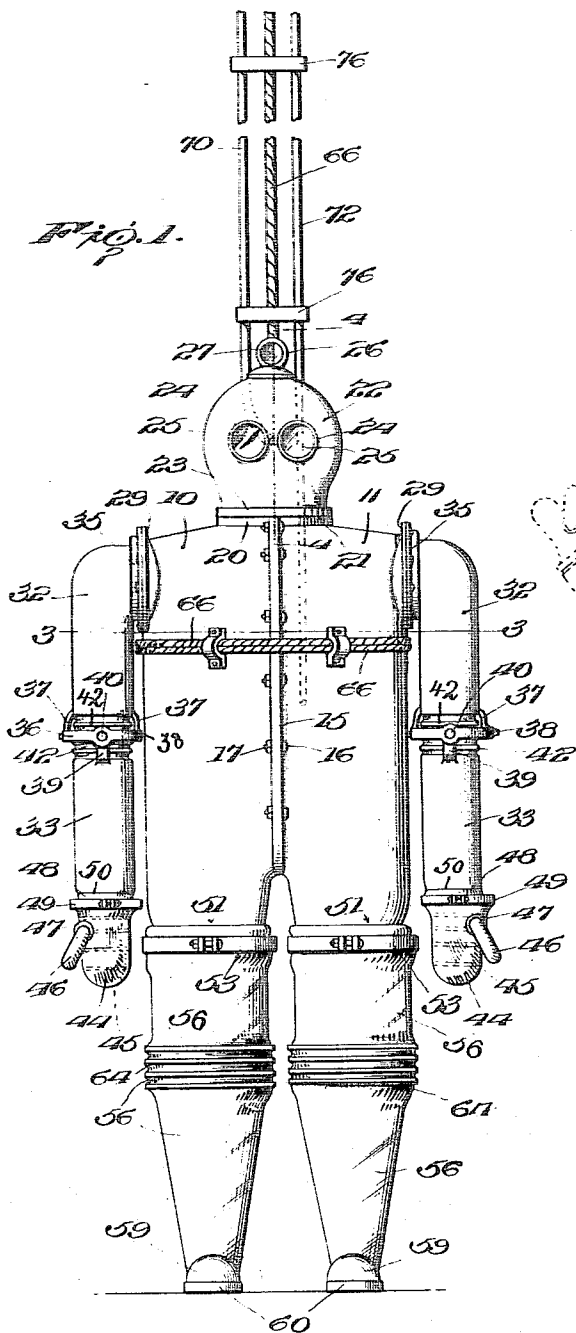


1,305,656.

Patented June 3, 1919.

3 SHEETS—SHEET 1.



Witness

By

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3 SHEETS—SHEET 2.

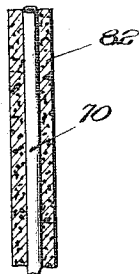
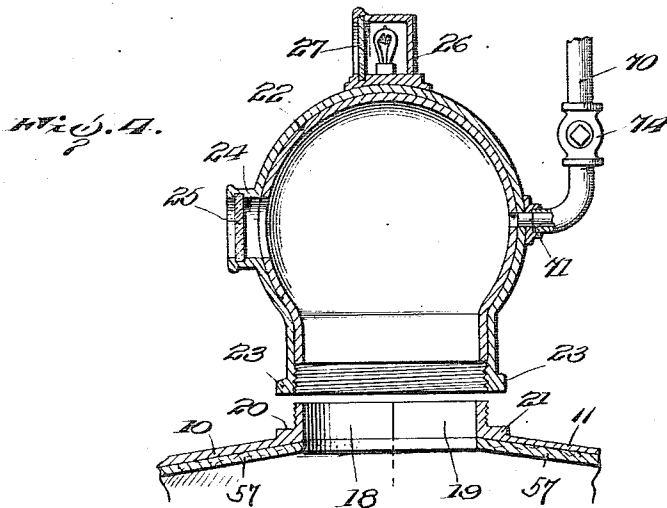
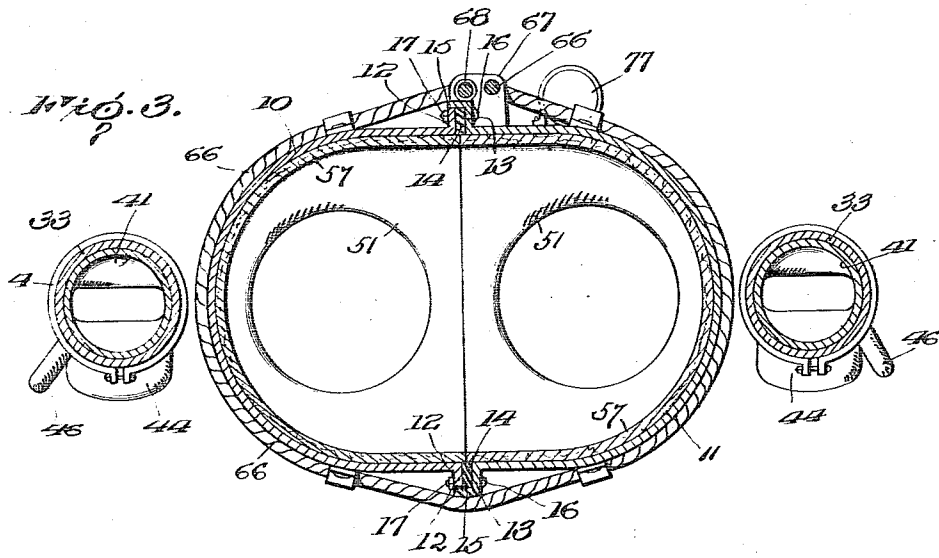


Fig. 5.

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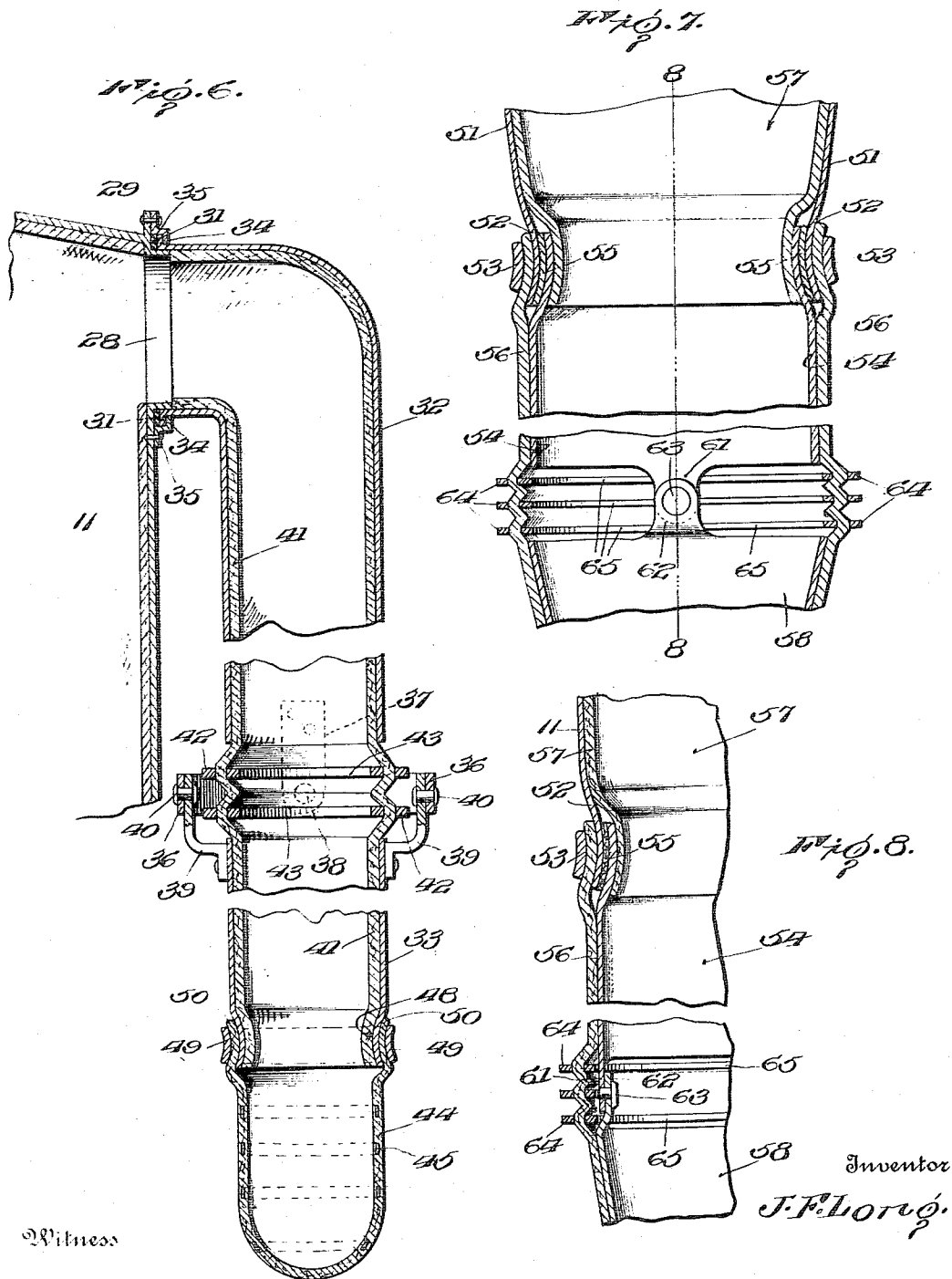
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3 SHEETS—SHEET 3.



Witness

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UNITED STATES PATENT OFFICE.

JAMES F. LONG, OF SAN ANTONIO, TEXAS.

DIVING-ARMOR.

1,305,656.

Specification of Letters Patent.

Patented June 3, 1919.

Application filed June 12, 1917. Serial No. 174,348.

To all whom it may concern:

Be it known that I, JAMES F. LONG, a citizen of the United States, residing at San Antonio, in the county of Bexar and State of Texas, have invented certain new and useful Improvements in Diving-Armor, of which the following is a specification.

This invention relates to diving armor, and has for one of its objects to provide a device of this character especially adapted to protect the occupant from abnormal pressure when submerged in deep water, and to enable submarine operations and observations to be conducted at unusual depths.

Another object of the invention is to provide a device of this character having appliances whereby the operator may move about, and with shields or guards for the arms and hands to enable the latter to be moved so that the operator can perform tasks of various kinds while submerged.

Another object of the invention is to provide a device of this character wherein air is supplied to the occupant of the device from the outside, or under ordinary atmospheric pressure.

Another object of the invention is to provide a device of this character having a tank for oxygen or the like under pressure and with means whereby the occupant of the device can release a sufficient quantity of the oxygen in event of the cutting off of the supply of air from above.

With these and other objects in view, the invention consists in certain novel features of construction, as hereinafter shown and described and then specifically pointed out in the claims; and in the drawings illustrative of the preferred embodiment of the invention—

Figure 1 is a front elevation of the improved apparatus.

Fig. 2 is a side elevation.

Fig. 3 is a transverse section enlarged on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged vertical section of the head armor and adjacent portions of the torso members on the line 4—4 of Fig. 1.

Fig. 5 is an enlarged sectional detail of a portion of one of the air tubes, illustrating the construction of the protecting armor therefor.

Fig. 6 is an enlarged vertical section illustrating the construction of the joint between the arm and torso portions, the elbow joint, and the "mitten" or hand armor.

Fig. 7 is an enlarged vertical section illustrating the construction of the joints between the torso and leg portions of the device.

Fig. 8 is a section on the line 8—8 of Fig. 7.

The improved device is constructed of a metal shell or casing of sufficient thickness and strength to withstand any pressure to which it may be subjected, and having a lining of suitable water proof and pressure resisting fabric such as rubber reinforced by layers of canvas or the like, and with jointed armor for the arms and legs to enable the occupant to walk about and perform tasks which require the movement of the arms. The improved device likewise includes gloves or mittens formed of reinforced flexible material or fabric of sufficient strength to resist the pressure, and attached to the fore-arm sections. The improved device includes in general a torso portion formed of coacting sections 10 and 11 conforming substantially to the torso portion of a human body, and united preferably at front and rear by detachable joints, with suitable pressure and water resisting packings at the joints, for instance gaskets of lead or the like. In its preferred form one of the torso sections, for instance the section 10, is provided with outwardly directed flanges 12, while the other section 11 is provided with corresponding outwardly directed flanges 13 which bear face to face against the flanges 12 with a gasket of lead or like material 14 between the flanges. The flanges 13 are provided with lateral wings 15 which overlap the flanges 12 and bear over the outer edges of the gaskets.

The flanges 12 and 13 are secured together by suitable detachable means such as bolts 16 and nuts 17, so that the torso sections may be readily connected and disconnected, as hereafter explained.

At their upper ends the torso sections 10 and 11 are provided with half collars or semicircular attaching flanges 18 and 19 whose confronting edges are in alinement with the confronting edges of the members 10 and 11 and continue the same. The collars 18 and 19 are half circular in outline so that when the torso sections are united the members 18 and 19 form a complete circular collar and project from the upper ends of the torso sections. The members 18 and 19 are externally threaded and provided re-

spectively with semi-circular stop collars 20 and 21. The head armor of the improved device comprises a metal shell, represented as a whole at 22, and approximately conforming in outline to but considerably larger than the head of the occupant, and internally threaded at the neck portion to engage the threaded outer surfaces of the members 18 and 19. At its lower end the head armor is preferably formed with an outturned flange 23 which engages the stop collar portions 20 and 21 with a suitable packing of lead or the like between the flange and the stop collar. By this means the head armor 22 may be secured air and water tight upon the torso sections, and likewise operates to assist in holding the torso sections united.

The head guard armor 22 is provided with projections 24 in line with the eyes of the occupant, and supplied with transparent members 25 of glass or like material or compound of sufficient strength to withstand the pressure. Located upon the upper side of the head armor is a casing 26 having a transparent front 27 of glass or the like, of sufficient thickness to withstand the pressure, and within the casing an electric light bulb is installed.

Formed respectively upon the torso sections 10 and 11 are socket devices to which the armor for the arms and hands are mounted for rotation. The armor for the hands and arms of the improved device are substantially alike and the description of one will suffice for both.

Each of the torso sections is provided with an opening for the arms of the occupant of the armor device and each opening is surrounded by an outwardly directed flange 28 and a vertical outer flange 29, the juncture of the flanges providing a seat to receive a packing ring 31 of lead or the like. The armor for the arms includes an upper arm section represented as a whole at 32, and a lower arm section represented as a whole at 33. The portions 32 and 33 are of metal, preferably of the same gage as the metal portions of the torso members, and substantially cylindrical transversely. At its upper end each of the members 32 extends laterally and terminates in an out-turned annular flange 34 which engage rotatably upon the flanges 28 of the torso members and against the packings 31. Surrounding the flange 34 is an annular bearing member or clamping ring 35 which engages the flange 34 and is riveted or otherwise secured to the flange 29. By this means the upper arm sections are mounted for rotation upon the torso portions of the device. Each of the lower arm sections 33 is coupled to its coacting upper arm section by a flexible joint which enables the lower arm section to be moved in all directions by the arm of the operator. An approved means for accomplishing the uni-

versal movement of the lower arm sections is illustrated in Figs. 1 and 6, and includes a gimbal ring 36 with which ears 37 depending from the upper arm section 32 are pivotally united at 38, while ears 39 extending from the lower arm section 33 are pivotally united at 40 to the same ring at points midway between the pivots 38 of the upper arm section. Located within the arm sections 32 and 33 is a lining represented as a whole at 41, of suitable water and pressure proof fabric such as rubber reinforced by canvas or the like. The lining member 41 extends over the space between the adjacent terminals of the members 32 and 33 and is larger in diameter within this space, and the enlarged portion is reinforced by outer annular metal rings 42 and inner annular metal rings 43. The rings 42 are spaced uniform distances and attached to the outer face of the member 41 while each of the inner rings 43 is attached to the inner face of the member 41 and in transverse alinement with one of the outer rings 42. By this means the loose portion of the member 41 which is located between the terminals of the members 32 and 33 is reinforced and supported, while at the same time this loose portion folds into accordion like contour, so that as the lower arm portion of the armor is moved laterally the portion 41 will yield and permit this movement, while at the same time held from collapsing or displacement by the supporting members 42 and 43. The reinforcing members do not interfere with the flexibility of the movements, while at the same time they prevent collapse of the parts under pressure.

The armor for the hands is formed of suitable fabric, such as rubber reinforced by layers of canvas and represented as a whole at 44, and preferably provided with a plurality of metal bands 45 embedded in the material 44. By this means the armor portion 44 effectually resists the pressure to which it will be subjected, while at the same time it is sufficiently flexible to yield to the movement of the fingers of the occupant of the device similar to the movement of an ordinary mitten or glove. Each of the hand armor devices is provided with a thumb receiving extension 46 coupled at 47 to the member 44. At its lower end each of the sections 33 is reduced and preferably formed in elliptical shape with an inwardly curving portion 48 between which and a divided clamping band 49 the upper edge of the hand armor portion 44 is engaged as shown in the lower portion of Fig. 5. It will thus be obvious that by applying strain to the band 49 the member 44 will be firmly secured in place air and water tight upon the lower arm section.

By this means it will be obvious that the movement of the arm and hand armor corre-

spond closely to the natural movement of the arm both at the shoulder, the elbow, and at the wrist, and enables the occupant of the device to move his arms substantially in a natural manner, while the flexible hand armor portion permits him to grasp objects or to perform tasks of various kinds while submerged.

At their lower ends the torso sections 10 and 11 are reduced and circular in cross section, as shown at 51, with an inwardly curving portion 52, a divided clamping band 53 surrounding the said inwardly curving portion.

The leg armor portion of the device comprises an upper leg section represented as a whole at 54 with its upper portion curved to correspond substantially with the curved portion 52 of the torso sections and extending for a distance within the latter. Disposed between the overlapping portions of the members 51 and 54 is a suitable packing gasket 55 of lead or the like. The leg armor section 54 is incased in a fabric member, represented as a whole at 56, which extends at its upper end over the inwardly curving portion of the torso section. The clamping band 53 extends around the outer face of the upper portion of the fabric covering 56, so that when the strain is applied to the band 53 the members 51-54 and 56 will be firmly clamped together, rendered air and water tight, and capable of resisting the pressure to which they will be subjected. The torso sections 10 and 11 are provided with linings of fabric material such as rubber reinforced by layers of canvas and represented as a whole at 57, the fabric lining extending through the reduced portions 51 and overlapping the upper ends of the upper leg sections 54, as shown in Figs. 6 and 7.

The lower leg sections are represented as a whole at 58 and each formed of metal, preferably the same gage as the other metal portions, and each extended to form a foot receiving extension portion 59, each foot extension being provided with a sole member 60 of sufficient thickness to withstand the strains to which it will be subjected. The fabric covering 56 of the upper leg section extends over the lower leg section 58 and likewise over the foot receiving enlargement 59.

The confronting terminals of the members 54 and 58 are disposed in spaced relation and provided respectively with ears 61 and 62 at each side, the ears being pivotally united, as shown at 63. By this means the lower leg section is flexibly coupled to the upper leg section at a point opposite the knee joint of the occupant of the device. The portion of the fabric member 56 which is located opposite the space between the confronting ends of the members 54 and 58 is reinforced by outer annular rings 64 and

inner annular rings 65 to which the fabric material is connected in substantially the same manner as previously described for the elbow joint of the arm and hand armor portions. By this means the lower leg sections may be caused to swing in the same manner as the natural leg at the knee, while at the same time the fabric lining is supported and prevented from being collapsed by the pressure, and free to move with the movements of the lower leg section. An effectual "knee joint" is thus produced which permits all the movements of the natural limb.

By this arrangement the operator can move his legs substantially in the same manner as when walking, and is enabled thereby to move about upon the bottom of the sea, or upon the decks, or within the holds of vessels or other submerged structures.

Surrounding the torso sections 10 and 11 at any suitable point, preferably just beneath the arm sockets, is a supporting cable, represented at 66 of suitable strength, and preferably wound twice around the torso sections. The cable leads from the torso sections preferably at the rear, and for the purpose of illustration a clip device 67 projects from the torso section 11 at the rear and is perforated to receive one end of the cable, as shown at 68, and likewise perforated to receive the main length of the cable. The cable thus leads upwardly to the hoisting apparatus upon the tender which floats above the point where the apparatus is submerged, the tender containing the air controlling apparatus and the hoisting apparatus. By this means the safety of the device and its occupant is assured. In the improved apparatus means are provided for exhausting the air from the interior and permitting air from the outside under atmospheric pressure to replace the exhausted air, and thus supply fresh air to the occupant of the device. The exhaust or suction tube is represented as a whole at 70 and leads from the head piece 22 as represented at 71, while the tube for furnishing the fresh air, represented at 72, is connected to one of the torso members, for instance 11 as represented at 73. The member 70 is provided with a suitable outwardly opening check valve 74, while the supply pipe 72 is provided with a suitable inwardly opening check valve 75. A suitable suction device, such as an air pump, is located upon the tender which floats above the submerged apparatus, and a suitable hoisting device is likewise located upon the tender to actuate the hoisting and lowering cable, but the tender and pumping and hoisting apparatus are not shown as they form no part of the present invention. The cable 66 and the air tubes 70 and 72 are preferably located in close proximity as shown, and are prefer-

ably connected loosely at suitable intervals by holding devices 76. Any required number of the devices 76 may be employed and located any required distance apart, but will generally be located about twelve feet apart. Attached to one of the torso sections is a retort or tank 77 to contain a supply of oxygen or the like under pressure, and held in place by suitable strap devices 78 attached to the adjacent torso section. A controlling valve indicated at 79 leads into the interior of the adjacent torso section and is controlled by a rod 80 having a handle or an actuating device 81 at the outer end projecting externally of the torso section and in position to be actuated by one of the armor members. By this means in event of the failure of the supply of fresh air through the inlet 72, or in event of the supply of air being interfered with or vitiated, the operator can reinvigorate the air from the tank 77 by manipulating the controlling member 79 as before described.

The illuminating bulb within the casing 26 may be supplied with electric current in any suitable manner, for instance by suitably insulated conductor wires associated with the cable or with one of the air conductors 70 or 72.

The conductor members 70 and 72 are incased in suitable protecting material, as indicated at 82, in Fig. 5.

Having thus described the invention, what is claimed as new is:

1. A diving armor including arm and leg sections disposed in spaced relation at their confronting ends, a continuous fabric shield to said arm and leg sections and extending over the space between their confronting ends, a plurality of annular supporting members engaging the interior of the fabric shield between the confronting ends of the arm and leg sections, a plurality of annular supporting members engaging the exterior of the fabric shield and in transverse alinement respectively with the first mentioned

supporting members, and a supporting connection between the sections permitting pivotal movement thereof.

2. A diving armor including a torso portion having reduced extensions with transversely curved annular seats, upper leg sections having transversely curved annular seats corresponding to and underlying the seats of the torso extensions, a band transversely curved to correspond to the curvature of said seats, and means for clamping said band around the seat portions.

3. In a diving armor, arm portions having transversely recessed seats encompassing one end, a hand armor of flexible material engaging said seats, a band transversely recessed to correspond to the recesses of the arm portion and engaging around the hand armor, and means for clamping said band around the flexible hand armor and the seat portion of the arm armor.

4. A diving armor including limb armors composed of sections having overlapping ends and provided in said ends with transversely curved annular seats, and a clamping band secured around and conforming to said seats.

5. A diving armor including torso sections and upper and lower arm and leg sections coacting with the torso sections, said arm and leg sections disposed in spaced relation at their confronting ends, a continuous fabric shield to said arm and leg sections and extending over the space between their confronting ends, a plurality of annular supporting members engaging the interior of the fabric shield between the confronting ends of the arm and leg sections, a plurality of annular supporting members engaging the exterior of the fabric shield and in transverse alinement respectively with the first mentioned supporting members, and coacting ears extending from said sections and pivotally united.

In testimony whereof I affix my signature.

JAMES F. LONG. [L. s.]