Sept. 10, 1968 M. W. TAYLOR 3,400,680

CATAMARAN FOR UNDERWATER EXPLORATION

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Fig. 2

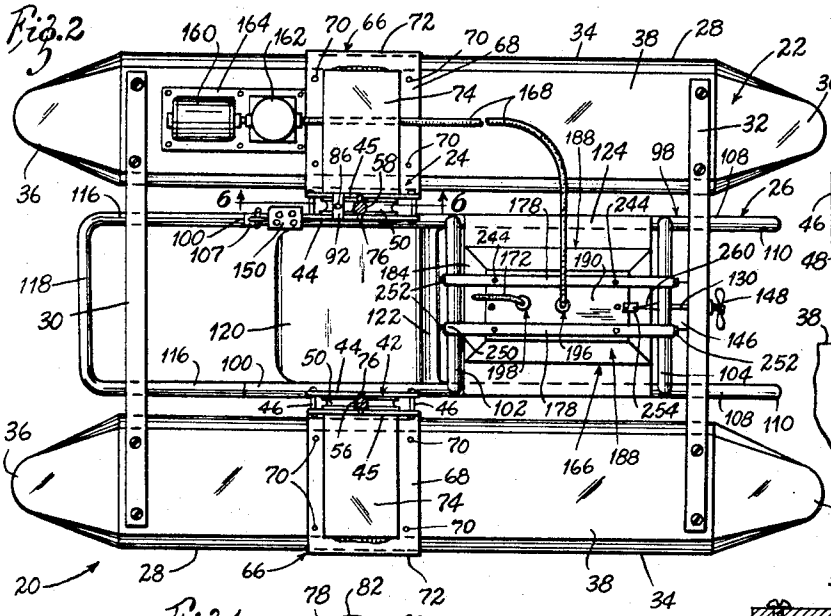

Fig. 6

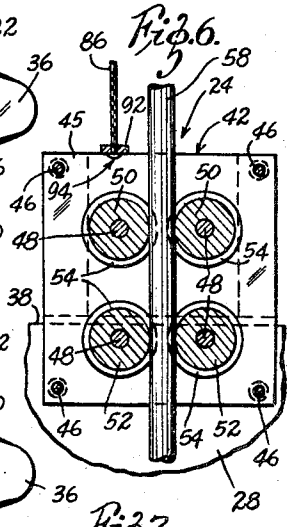

Fig. 7

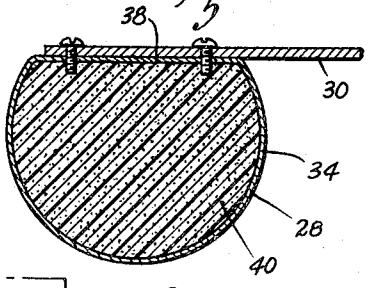

Fig. 1

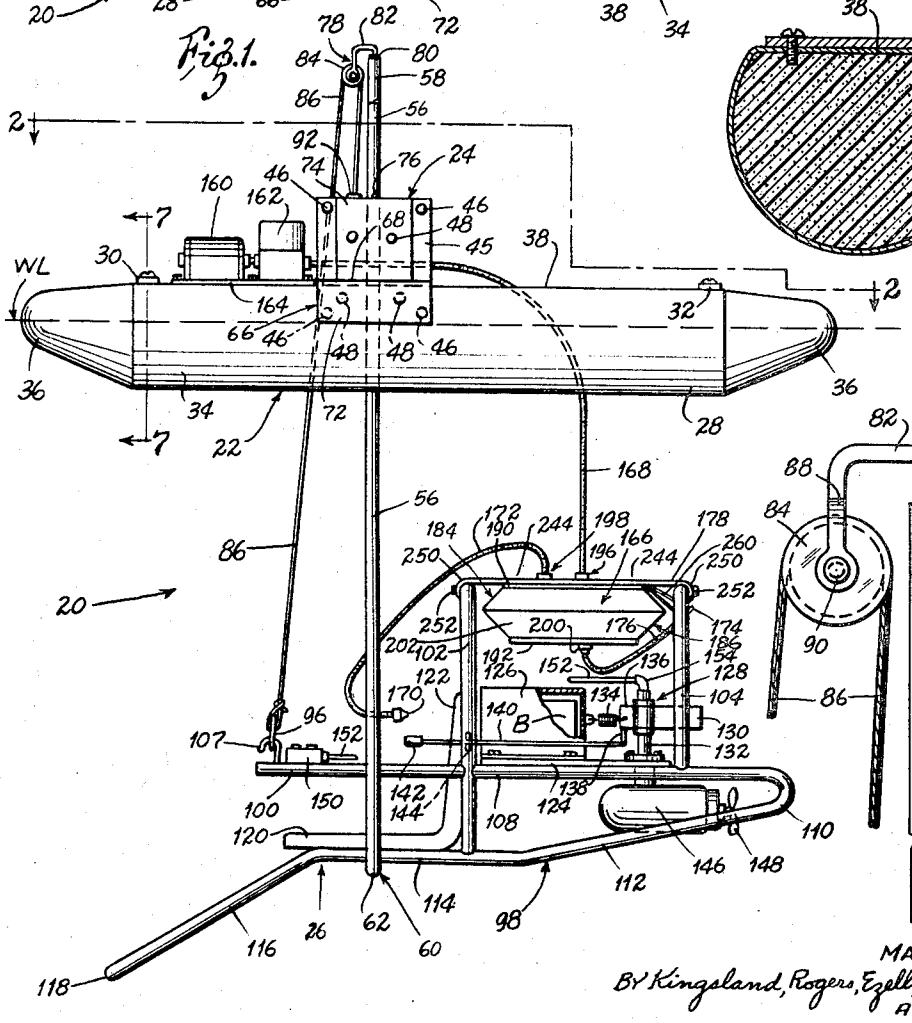

Fig. 8

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Fig. 3.

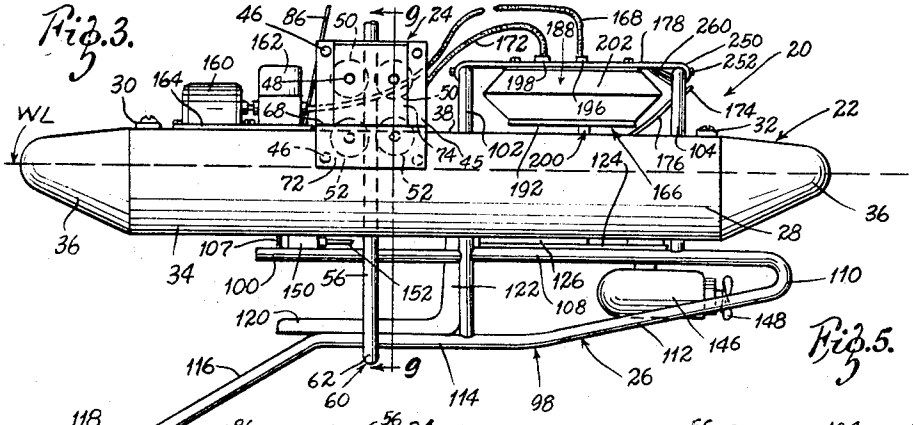


Fig. 5.

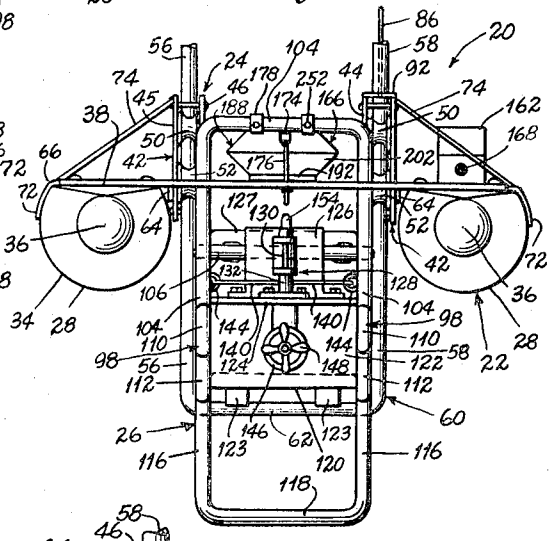


Fig. 4.

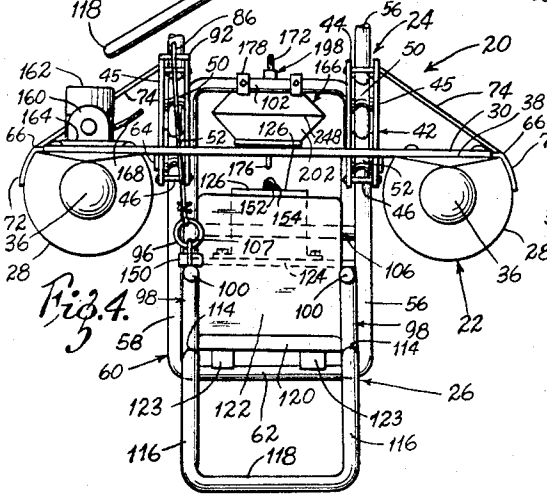
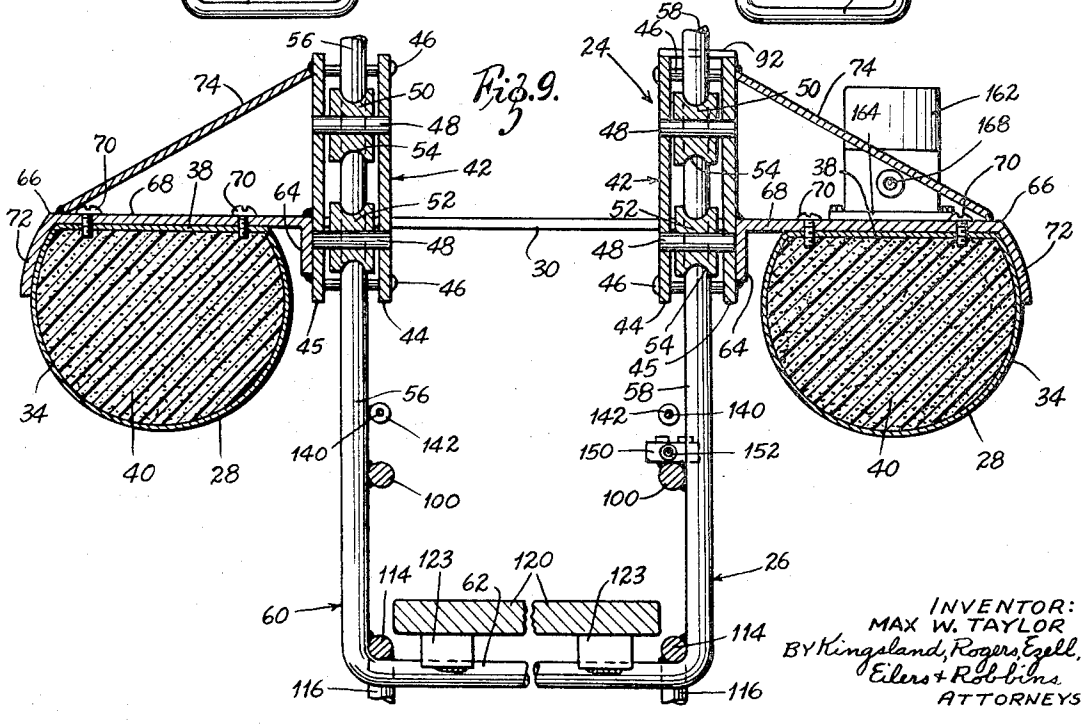


Fig. 9.



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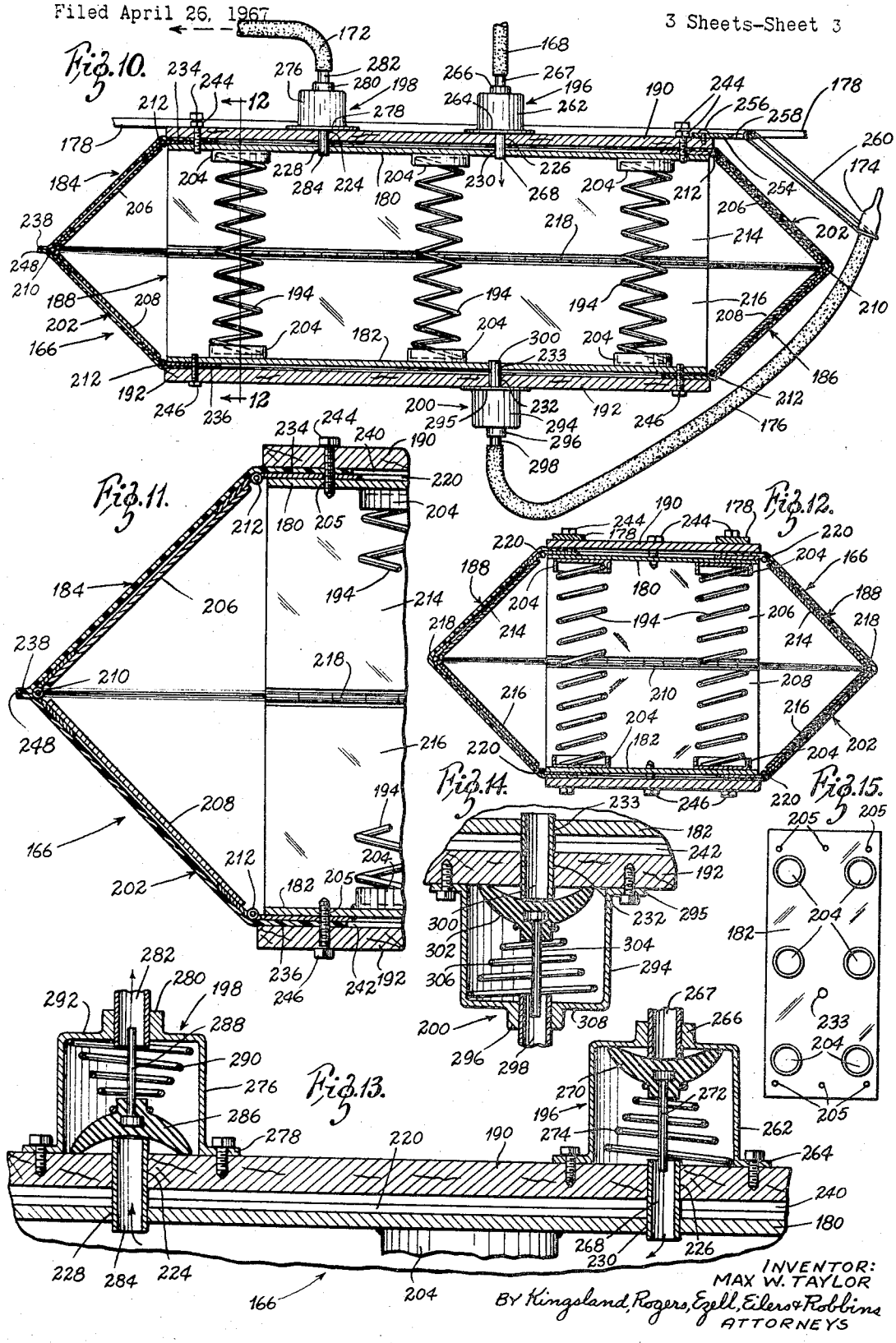

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CATAMARAN FOR UNDERWATER EXPLORATION

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Filed Apr. 26, 1967, Ser. No. 633,909
15 Claims. (Cl. 114—16)

ABSTRACT OF THE DISCLOSURE

A novel device comprised of two laterally spaced side-by-side connected pontoons mounting apparatus for lowering between them, a normally floating passenger seating structure to an underwater position, and means for releasably maintaining said structure and a passenger seated thereon in such position. A motor driven compressor provides a continuous supply of breathing air to an associated reservoir, the passenger drawing on this supply via tubing and a thereto attached mouthpiece. Means for exhausting excess air from the resrevoir, an outboard motor driven propeller, and manually operable rudder means are provided.

Summary of the invention

The present invention is designed for water sports entertainment purposes, but may be employed to great advantage also for scientific purposes in the realm of underwater exploration. Generally, the invention is comprised of a catamaran unit, an elevator assembly mounted on and supported from the spaced pontoons included in the catamaran unit, and a skeletal structure of integrated rod members that support a chair-like passenger seat having an associated footrest.

The framework also supports a novel air reservoir suspended in a plane that would approximate that occupied by the head of a seated passenger. A continuous or constant supply of air is supplied to the reservoir via a flexible tube that leads thereto from a conventional motor and compressor unit mounted on one of said pontoons, above the water line.

The novel breathing air reservoir includes three one-way valves, these being an intake valve, an output valve, and an exhaust valve for excess pressure develpoed in the reservoir in consequence of the constant supply delivered by the compressor via the intake valve aforesaid. The valves are automatically operative as will appear, and a spiral spring arrangement is provided within the air reservoir for automatically obviating its collapse whether or not air under pressure from the compressor is being supplied thereto, and whether or not said reservoir is submerged. The air supply from the compressor enters the reservoir via the intake valve and as required for proper breathing by the passenger, is withdrawn from the reservoir via a suitable mouthpiece attached to the free end of a flexible conduit in communication at its opposite end with said output valve.

The framework also supports a platform having a battery-enclosing container mounted thereon rearwardly of the backrest of the passenger seat. The platform also dependingly supports an outboard motor and its associated propeller, whereby the entire device comprising the invention may be driven forwardly at a selected speed up to approximately four miles per hour. A variable speed control box is provided within easy reach of the passenger. A manually operable rudder arrangement is mounted atop the platform, preferably above the outboard motor.

Included in the framework aforesaid, is a pair of transversely spaced upwardly projecting vertical post members,

each of which is adapted to travel upwardly and downwardly between one of a pair of guide roller arrangements included in the elevator apparatus. The platform thereof functions as a raft, so that normally said framework and all the elements associated therewith above the platform, are floatingly disposed between the pontoons of the catamaran unit. In such position, the passenger seat would be approximately twelve inches below water level, and the vertical post members would extend ten feet or more above the guide roller arrangement aforesaid.

Affixed to the upper extremity of one of the vertical post members is a pulley device. Trained over the pulley of said dveice is a rope or cable. One end of the cable is affixed to the structure rigid with the adjacent pontoon. The opposite end is equipped with means adapted to cooperate with complemental means on the framework to releasably maintain the seated passenger in underwater position. In order to submerge himself, a seated passenger pulls the free end of the rope downwardly until interengagement of said complemental submerged position means may be effected.

The invention includes various features that will be treated more elaborately hereinafter. For example, in the event the compressor or its associated motor should cease functioning, a two minute supply of breathing air is always stored in the reservoir, thus affording the passenger ample time to release the submerged position retaining means. In other words, instantaneously following such release, the framework will automatically rise in the water, the vertical post and guide wheel arrangements serving to insure a smooth ascent. It will, of course, be understood that passengers would wear appropriate apparel, and goggles for eye protection.

The primary object of the invention, therefore, is to provide a novel device incorporating the structure generally referred to above, and explained in more detail below. The invention is illustrated on three sheets of drawings that accompanying this specification, and features not specifically mentioned thus far will be apparent or pointed out in the description that follows with reference to said drawings.

Brief description of the drawings

FIGURE 1 is a side elevational view of a device constructed in accordance with the teachings of the present invention, some of the included structure being shown in underwater or operative disposition;

FIGURE 2 is a top plan view thereof partly in section, the view being taken as indicated by the line **2—2** of FIGURE 1;

FIGURE 3 is a view similar to FIGURE 1, all of the structure being shown in floating or inoperative disposition;

FIGURE 4 is a front elevational view of the device as it appears in FIGURE 3;

FIGURE 5 is a rear elevational view of the device as it appears in FIGURE 3;

FIGURE 6 is an enlarged fragmentary vertical sectional view taken on the line **6—6** of FIGURE 2;

FIGURE 7 is an enlarged vertical sectional view taken on the line **7—7** of FIGURE 1;

FIGURE 8 is an enlarged reproduction of the uppermost portion of FIGURE 1;

FIGURE 9 is an enlarged transverse sectional view taken on the line **9—9** of FIGURE 3;

FIGURE 10 an an enlarged longitudinal sectional view through the air reservoir structure of the invention;

FIGURE 11 is an enlarged reproduction of the left end portion of FIGURE 10;

FIGURE 12 is a transverse sectional view taken on the line 12—12 of FIGURE 10;

FIGURE 13 is an enlarged reproduction of the upper central portion of FIGURE 10;

FIGURE 14 is an enlarged vertical sectional view of the exhaust or relief valve appearing in the lower portion of FIGURE 10; and

FIGURE 15 is a top plan view on a reduced scale, of the bottom plate included in the air reservoir structure.

Description of the preferred embodiment

The complete device of the present invention is indicated by the numeral **20** in FIGURES 1–5. The device **20** includes as its major components: a catamaran unit generally designated **22**, what will be termed an elevator assembly **24**, and a skeletal framework **26** associated with the elevator assembly.

As shown particularly in FIGURES 1, 4 and 5, the unit **22** includes a pair of spaced side-by-side pontoons **28** that are connected near their front ends by a transverse bar **30** and near their rear ends by a similar bar **32**. Preferably, the pontoons **28** are of the configuration shown in the drawings, and each is comprised of an elongated generally cylindrical thin metallic shell **34** having closed rounded ends **36**, and a flat upper surface portion or deck **38**. The pontoons are filed with light plastic material **40** such as high density foamed polystyrene or the like.

The elevator assembly **24** includes a pair of identical transversely spaced guide wheel mechanisms each designated generally by the numeral **42**. With attention directed particularly to FIGURES 6 and 9, each mechanism **42** is comprised of a pair of inner and outer rectangular plates **44** and **45**, respectively, that are maintained in horizontally spaced status by rivets or the like **46**. Rotatably mounted between the plates on shafts **48** is a pair of upper horizontally spaced guide wheels **50**, and a pair of lower horizontally spaced guide wheels **52**. All of the guide wheels have arcuate grooves **53** of a determined radius.

The elevator assembly **24** further includes the vertical leg members **56** and **58** of a U-shaped rod **60**, the bight portion **62** of which supports the skeletal framework **26** and elements therewith associated, as will be more fully explained. The leg members **56** and **58** comprise guide posts and each of them extend through one of the guide wheel mechanisms **42** in engagement with the arcuate grooves **54** aforesaid of an upper and lower pair of guide wheels **50** and **52**, respectively, as best seen in FIGURE 6.

Reverting to FIGURE 9, it will be noted that the guide posts **56** and **58** and the roller mechanisms **42** that guide the vertical movements thereof, are disposed slightly inwardly of the pontoons **28**. To this end of the outer plate **45** of each guide roller mechanism is rigidly secured by welding as suggested, or otherwise, to the inner downturned vertical flange **64** of an angle bracket **66**. The horizontal segment **68** of each bracket is secured to the deck **38** of the therebelow pontoon **28** by screws **70**, and terminates in an arcuate depending flange **72** in firm engagement against a portion of the outermost peripheral surface of said pontoon, as shown. Numerals **74** each designate an angularly disposed brace plate having one end portion thereof welded to the upper region of a plate **45**, and its other end portion welded to the outer region of the horizontal segment **68** of a bracket **66**.

In view of the immediately foregoing, the rigid mounting arrangement of the guide roller mechanisms **42** should be apparent. It will, of course, be understood that these mounting arrangements may be modified somewhat and are not limited to the precise structural details illustrated and described. Rigid mounting arrangements, however, are most important to insure smooth up and down movements of the posts **56** and **58**, downward movements of them being limited by a pair of transverse stop pins **76**, each press-fitted into the upper end portion of one of said posts.

The elevator assembly **24** also includes the pulley and cable mechanism, generally designated **78**, that appears in FIGURE 1 and is best seen in FIGURE 8. It includes a circular base **80**, a forwardly projecting inverted U-shaped arm **82** integral therewith, a pulley **84**, and a rope or flexible cable **86** trained over said pulley. The base **80** is welded to the top face of the upper extremity of the post **58**, and the arm **82** terminates in a bifurcated end segment **88** that supports a pivot pin **90** whereon the pulley **84** is rotatably mounted, as should be understood without additional illustration.

As shown in FIGURE 1 and more particularly in FIGURE 6, the guide roller mechanism **42** associated with the guide post **58** is provided with a cross bar **92** whereto the rearward end of the cable **86** is appropriately anchored, as indicated at **94**. The crossbar **92** spans the space obtaining therebetween and has its ends welded to the top surfaces respectively of the inner plate **44** and the outer plate **45** of that guide roller mechanism **42**. The forward normally free lower end of the rope or cable **86** is equipped with a ring **96** as shown in FIGURES 1 and 4.

The framework **26** includes the bight portion **62** of the U-shaped rod **60**, the adjacent lower portions of its upwardly projecting legs or posts **56** and **58**, a pair of transversely spaced side frame members **98**, a pair of similarly spaced arm extensions **100**, a forward inverted U-shaped member **102**, a rearward inverted U-shaped member **104**, and a crossrod **106**.

The side frame members **98** each include a horizontal upper segment **108** having a rounded end portion **110** that merges into an angularly downwardly and forwardly extending segment **112**. The segment **112** merges into a forwardly extending horizontal segment **114** that in turn merges into an angularly downwardly and forwardly projecting segment **116**. As best seen in FIGURES 2 and 4, a crossbar **118** integral with the lower end portions of the segments **116** provides a footrest for a passenger occupying the seat **120** also included in the framework **26**. The seat **120** has an integral backrest **122**.

It will be understood that all of the described components of the framework, including the seat structure, are integrated to form a rigid unitary structure. Thus, as suggested for example in FIGURE 9, the arms **100** are welded to the posts **56** and **58**, the horizontal segments **114** are welded to said posts and to the bight portion **62** of the U-shaped rod **60**, and depending lugs **123** of the seat **120** are also welded to said bight portion **62**. As shown in FIGURE 5, the crossrod **106** extends between the posts **56** and **58**, and has the backrest **122** welded thereto. A hook **107** rigid therewith projects upwardly from the front extremity of one of the arm extensions **100**.

Extending between the horizontal segments **108** and rigidly secured to them is a rectangular platform **124**. Mounted on said platform slightly rearwardly of the backrest **122** is a watertight or sealed container **126** that encloses a storage battery B (FIGURE 1). Also mounted on the platform **124** rearwardly of said container is a rudder mechanism generally designated **128** that includes a rudder **130** rotatably mounted on a standpipe **132**. A short compression spring **134** secured at one end to a lug on the container **126** and at its opposite end to a forward extension **136** of the rudder **130**, normally serves to maintain said rudder in non-steering position. Numeral **138** indicates a lug depending from the rudder extension **136**, said lug having attached thereto the rearward ends of a pair of cables each designated **140** and having an operating handle **142** (FIGURE 1) affixed to its forward end. As should be clear from an inspection of FIGURE 5, the cables **140** extend forwardly from the lug **138** in divergent fashion and each passes freely through one of a pair of oppositely disposed guide lugs **144** that project inwardly from the vertical leg segments of the inverted U-shaped member **102**.

The platform **124** also dependingly supports an out-

board motor **146** equipped with a propeller **148**, whereby the entire device **20** may be driven forwardly when desired, at variable speeds up to approximately four miles per hour. A control box **150** within easy reach of the passenger is affixed to one of the arm members **100** and appropriate electrical wiring leads therefrom to the battery B and the motor **146**. Necessarily, all of the wiring is encased in waterproof sheathing **152** only some portions thereof appearing in the drawings. It will also be understood that watertight sealing means (not shown) are provided about the sheathing at the point of exit from the control box **150** at the point of entry into the battery enclosing container **126** at the point of entry into the elbow **154** atop the standpipe **142** and, in fact, wherever necessary to protect the wiring from the water. The standpipe **132** provides a passage for the wiring leading to the motor **146**. The control box **152** is also waterproof and contains a start and stop switch for the motor **146** and a rheostat device for varying the speed thereof.

One of the most important features of the present invention is the provision of means adapted to enable a passenger to breathe normally while submerged.

Accordingly, incorporated in the device **20** are the following: a motor **160** and a compressor **162** comprising a unit mounted on a base plate **164**; a novel air reservoir device designated in its entirety by the numeral **166**; a first flexible conduit or hose **168** leading from the compressor to the air reservoir **166**; a mouthpiece **170**; a second flexible conduit or hose **172** leading from the reservoir **166** to said mouthpiece; an excess air venting device **174**; and a third fleixble conduit or hose **176** leading from the reservoir **166** to the device **174**.

The base plate **164**, whereto the motor **160** and compressor **162** are affixed, is rigidly mounted on the forward end deck portion **38** of one of the pontoons **28** slightly rearwardly of the front pontoon connecting bar **30**. The novel air reservoir device **166** is suspended, in a manner to be described in more detail below, above the sealed container **126** and the rudder mechanism **128** from a pair of identical strap members **178**. Said first flexible hose **168** is necessarily of sufficient length to automatically adapt itself to both the normal or floating disposition of the framework **26** as well as to the submerged disposition thereof. The mouthpiece **170** is a conventional item and no claim thereto per se is made. It incorporates valving for first inhaling and thereafter exhaling breathing air supplied thereto via said second flexible hose **172**. The excess air venting device **174** is also a conventional item and no claim thereto per se is made. It incorporates exhaust valving only, said valving being adapted to function whenever an excessive volume of air pressure existent within the reservoir **166** is delivered to said device via said third flexible hose **176**.

The components of the air reservoir device **166** together with the hereinabove numerically designated elements associated therewith are illustrated on an enlarged scale in FIGURES 10–14. As shown in these views, the device **166** includes: a rectangular internal metallic upper plate **180**; a similar lower plate **182**; a forward hinged wall generally designated **184**; a similar rearward wall generally designated **186**; opposite hinged side walls each generally designated **188**; a rectangular wooden external top plate **190**; a similar bottom plate **192**; a plurality of compression springs **194**; an air intake valve mechanism **196**; an air output valve mechanism **198**; an excess air discharge valve mechanism **200**; what will be termed an envelope of pliable, impervious plastic material generally designated **202**; and elements associated with or incorporated in the above-named components.

Generally, the metallic top and bottom plates **180** and **182** are counterparts, a top plan view of the bottom plate appearing on a reduced scale in FIGURE 15. Each said plate has a plurality of correspondingly spaced cup elements **204** rigidly secured thereto by welding or otherwise, and is provided near each end with a transverse row of tapped holes **205**. In the assembled status of the device **166**, the compression springs **194** each have their opposite end portions seated in one of a pair of aligned cup elements **204**, thus preventing collapse of the device, even when increasing water pressure is exerted thereagainst as it descends to submerged disposition.

The forward and rearward walls **184** and **186** are identical, each being comprised of a pair of divergently disposed rectangular thin metallic plates **206** and **208**, each plate being rigid at one end with a transverse piano hinge **210**, and at its opposite end with one of a pair of transverse piano hinges **212**, as clearly illustrated in FIGURE 11.

The side walls **188** are also identical, each being comprised of a pair of divergently disposed rectangular thin metallic plates **214** and **216**, each plate being rigid at one end with a longitudinal piano hinge **218**, and at its opposite end with one of a pair of longitudinal piano hinges **220**.

The wooden external top and bottom plates **190** and **192** are each provided with a pattern of apertures in correspondence with that of the tapped holes **205** formed in said upper and lower internal metallic plates **180** and **182**. Furthermore, the top plate **190** has formed therein a pair of longitudinally spaced circular openings **224** and **226** in correspondence with a similar pair of openings **228** and **230** formed in the plate **180**. Also, the bottom plate **192** has formed therein a circular opening **232** in alignment with a similar opening **233** formed in the plate **182**.

Prior to presenting a detailed description of the valve mechanisms **196**, **198** and **200**, attention is directed to the novel means whereby the internal elements included in the air reservoir **166** are waterproofed in consequence of being enclosed within the envelope **202**. The envelope **202** before its incorporation into the assembly of the device **166** comprises a flat bag of pliable plastic material, the dimensions whereof are determined by the size of said device. Included in the bag are an upper layer **234**, a lower layer **236**, and an open end portion **238**. Opposed rectangular openings **240** and **242** are provided in the upper and lower layers **234** and **236**, respectively.

As should be apparent from the drawings (particularly FIGURE 11), the envelope **202** is applied over the internal structure of the device **166** prior to the application thereto of the top and bottom wooden plates **190** and **192**. When in place, pointed setscrews **244** that extend through said top plate **190**, the adjacent regions of the upper layer **234** that define the rectangular opening **240** therein, and the horizontal sections of the upper hinges **212** and **220**, engage in the tapped openings **205** of the internal upper plate **180**. In like fashion, pointed setscrews **246** that extend through said bottom plate **192**, the adjacent regions of the lower layer **236** that define the rectangular opening **242** therein, and the horizontal sections of the lower hinges **212** and **220**, engage in the tapped openings **205** of the internal lower plate **182**. As indicated at **248** in FIGURE 11, the aforesaid open end portion **238** of the envelope is heatsealed about the adjacent piano hinge **210**.

From the foregoing description directed thereto, it should be apparent that the plastic envelope **202** together with the external top and bottom plates **190** and **192**, combine to prevent entry of water into the device **166** even when it occupies a completely submerged position.

It should be observed with attention directed especially to FIGURES 1, 2, and 12, that certain of the setscrews **244** also extend through the pair of transversely spaced strap members **178** whereby to suspend the air reservoir device **166** therefrom as hereinabove indicated. The straps members **178** terminate in arcuate end segments **250** that overlie the bight portions of the inverted U-shaped members **102** and **104**, and are rigidly secured thereto as by setscrews **252** or otherwise.

It is desirable to maintain the air venting device **174** at a level above or at least approximately above the head of a passenger occupying the seat **120**. To this end as

best seen in FIGURE 10 a small plate **254** is secured to the rearward end of the external top plate **190** as by a screw **256**. Passing through an opening **258** in the projecting end of said plate and fastened to the device **174** is a length of flexible wire or the like **260**. It will be understood that other suitable means may be substituted for the arrangement shown.

The details of the intake valve mechanism **196** appear in FIGURE 13. As there illustrated said mechanism includes an inverted cup-shaped housing **262** having a laterally projecting lower annular flange portion **264** secured atop the plate **190**, and an upper boss portion **266** wherein the delivery end of a relatively short pipe **267** is pressfittedly mounted. The housing **262** is concentric with the pipe **267** and a short delivery pipe **268** that is pressfittedly mounted in the spaced openings **226** and **230**. A cup-shaped valve member **270** molded of flexible plastic material and having the head portion of a guide stem **272** imbedded therein, is biased to sealing position about the discharge end of the pipe **267** by a compression spring **274**.

The spring **274** is interposed within the housing **262** about the guide stem **272** between the valve member **270** and the external plate **190** as shown. The upper or inlet end of the pipe **267** is pressfitted into the discharge end portion of the hose **168**. Consequently, air under pressure from the compressor **162** will depress the valve member **270** against the upward bias of the spring **274** thus enabling said air to enter and permeate the interior expanse of the device **166** as should be apparent.

The details of the valve mechanism **198** also appear in FIGURE 13. As there illustrated, said mechanism includes an inverted cup-shaped housing **276** having a lower annular flange portion **278** secured atop the plate **190**, and an upper boss portion **280** wherein the intake end of a relatively short pipe **282** is pressfittedly mounted. The housing **276** is concentric with the pipe **282** and another relatively short pipe **284** that is pressfittedly mounted in the spaced openings **224** and **228**. An inverted cup-shaped valve member **286** molded of flexible plastic material and having the head portion of a guide pin **288** imbedded therein is biased to sealing position about the outlet or discharge end of the pipe **284** by a compression spring **290**.

The spring **290** is interposed within the housing **276** about the guide stem **288** between the valve member **286** and the top wall **292** of the housing as shown. The upper or outlet end of the pipe **282** is pressfitted into the intake end portion of the hose **172**. Air pressure built up within the interior expanse of the device **166** via the valve mechanism **196** is insufficient to unseat the valve member **286** inasmuch as will be explained below with respect to the valve mechanism **200**, the volume of air under pressure within the device **166** is limited. However, each time the passenger inhales via the mouthpiece **170**, the suction thus engendered within the housing **276** will unseat the valve member **286**, thus allowing a deep breath air escape via the pipe **282** to the hose **172** and thence to said mouthpiece.

At this point it is believed apropos to direct attention to the compression springs **274** and **290**. In accordance with the concepts of the present invention, the biasing forces of these two springs are equal. Inasmuch, however, as the compressor **162** operates continuously, the buildup of air pressure within the device **166** would overcome the resistance of the spring **290** and consequently unseat the valve member **286** were it not for the provision of the valve mechanism **200**.

The details of the valve mechanisms **200** appear in FIGURE 14. As there illustrated, said mechanism includes a cup-shaped housing **294** having an upper annular flange portion **295** secured to the bottom plate **192** and a lower boss portion **296** wherein the intake end of a relatively short pipe **298** is pressfittedly mounted. The housing **294** is concentric with the pipe **298** and another relatively short pipe **300** that is pressfittedly mounted in the spaced openings **232** and **233**. A cup-shaped valve member **302** molded of flexible plastic material and having the head portion of a guide pin **304** imbedded therein is biased to sealing position about the outlet or discharge end of the pipe **300** by a compression spring **306**. The spring **306** is interposed within the housing **294** about the guide stem **304** between the valve member **302** and the bottom wall **308** of the housing as shown.

Attention is directed to the spring **306**. In accordance with the present invention, this spring is lighter than the spring **290** and consequently its biasing force is reduced relatively to that of the aforesaid spring. As a result, the determined air pressure buildup within the device **166** will be controlled automatically by the valve mechanism **200**. In other words, any excess air pressure that would otherwise tend to unseat the valve member **286** is delivered to the venting device **174** via the hose **176** as should be apparent.

From the foregoing description augmented by inspection of the drawings, it is believed that an adequate disclosure has been presented. Although not illustrated in detail nor deemed necessary, it is to be understood with reference, for example, to FIGURE 1, that the battery B and all of the electrical wiring leading from the control box **150** to said battery and to the motor **146** is appropriately waterproofed as is the internal mechanism of said control box. Furthermore, suitable sealing material is applied about the entry and exit regions of the flexible conduits **168**, **172** and **176** and so on.

Stated otherwise, it should be understood that wherever required suitable sealing means against water contact are contemplated within the purview of the present invention relatively to structure and elements associated therewith subject to immersion below the water level WL. The floating disposition of the pontoons **28** included in the catamaran unit **22** will, of course, always remain partially above and below the water level WL, as shown. It will also be understood that seat belts of conventional design (not illustrated in the drawings) would be associated with the seat **120**.

Use

With the device **20** in the normal position thereof illustrated in FIGURES 3–5, a passenger would seat himself with his feet braced against the footrest bar **118** and his back against the backrest **122**. The passenger would, of course, be wearing appropriate attire and goggles. After fastening the seat belts, he would next insert the device **170** into his mouth and familiarize himself with its mode of operation, it being understood that the motor **160**-compressor **162** unit had been energized.

At this time, of course, the ring **96** would be free of the hook element **107**, and the pulley **84** would be disposed in a relatively high plane above the catamaran unit **22**. Although such disposition of the pulley **84** is not illustrated, it should be apparent from a comparison of FIGURES 1 and 3. In other words, the ring **96**, and adjacent free end of the rope or cable **86** whereto it is secured, would hang within easy reach of the passenger.

Assuming now that the passenger were ready for submergence, he would first grasp the ring **96** and the adjacent portion of the cable **86**, and then pull them downwardly until the stop pins **76** would arrest further downward movement of the posts **56** and **58**. At this point, the passenger would effect the interengagement of the ring **96** and the hook **107**, such interengagement status being clearly shown in FIGURE 1. Consequently, both hands of the passenger would be free. Should he desire to explore other areas he can effect energization of the motor **146** via the control box **150** thus initiating a forward movement of the entire device **20** driven by the propeller **148** as is understood. The passenger can furthermore vary the speed of travel via said control box, it being re-

membered that the size and power of the motor **146** is such that travel speeds of the device **20** up to approximately four miles per hour may be effected. Having the free use of both hands, the passenger by means of the operating handles **142** may also vary the disposition of the rudder **130** whereby to steer the advance of the entire device **20** in a selected direction.

Should the passenger desire to linger in order to more intently observe a particular area, he may do so by de-energizing the motor **146** via the control box **150**. Should the passenger at any time and for any reason decide to rise from his underwater position to an above the water position, he would simply disengage the ring **96** from the hook element **107**. Thereupon his ascent would be automatic as is understood. The provision of the elevator assembly **24** with its included guide wheel mechanisms **42** insures the passenger against injury as his head approaches the water level WL and thereafter.

The novel air reservoir device **166** and the one-way valve mechanisms **196**, **198** and **200** associated therewith constitute a predominant feature of the present invention. So long as the motor **160**-compressor **162** unit is in operation, a two minute supply of breathing air is present within said reservoir **166**, and consequently available for use by the passenger via the conduit **172** and mouthpiece **170**. Therefore, in the event that for any reason motor-compressor operation should cease, the passenger would have ample time wherein to shut off the propelller motor **146**, release the ring **96**, and ascend without interruption of normal breathing.

Various changes and modifications may be made within the purview of this invention as will be readly apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What is claimed is:

1. A catamaran for underwater exploration comprising a frame, buoyant means for floating the frame on a body of water, a passenger support, means to vertically reciprocate the passenger support relative to the frame to move the support through selectively different levels of submersion under water on which the frame floats while maintaining the passenger support joined to the frame, an air reservoir supported by the support, means to supply air to the air reservoir, means to permit inhalation of air from the air reservoir by a person carried by the support, and means to vary air pressure within the air reservoir according to variation in depth of the air reservoir below the surface of water, the last-named means comprising a pressure regulating outlet valve communicating with the reservoir, the reservoir having means in its construction permitting alternate expanding and collapsing of the net internal volume of the reservoir with changing external pressures on the reservoir, with means to resist collapsing of the reservoir, the means to permit inhalation of air from the air reservoir including another outlet valve openable in response to a pressure difference inside and outside the reservoir greater than the pressure difference required to open the first-named valve.

2. The apparatus of claim **1** wherein the air reservoir is mounted on the support at substantially the same elevation as the general elevation of the head and chest of a person carried by the support to provide substantially the same water pressure against the reservoir as is applied against the head and chest of the person regardless of the depth of submersion of the support.

3. A device for use in underwater exploration, including in combination a catamaran unit comprised of pontoon means, an elevator assembly mounted on and supported from the pontoon means, a guide wheel mechanism incorporated in the elevator assembly, a framework including an upwardly projecting guide post extending through the guide wheel mechanism of the elevator assembly, means to vertically reciprocate the elevator assembly relative to the pontoon means while the guide post is guided vertically by the guide wheel mechanism, a passenger support on the elevator assembly and movable to varying submerged positions beneath the surface of a body of water on which the pontoon means floats, an air reservoir device supported by the elevator assembly, a motor-compression unit and a conduit leading from the compressor to the air reservoir device for delivering thereto a continuous supply of air, means for limiting the air under pressure built up within the reservoir device to a determined value, a mouthpiece employable by a person occupying said passenger support for breathing when submerged, and means responsive to an inhalation action for delivering to said mouthpiece and thus to the lungs of said person a normal supply of breathing air from said reservoir device.

4. The combination of claim **3** including a pulley assembly rigidly mounted atop said guide post, said assembly including a freely rotatable pulley having a cable of determined length trained thereover, one end of the cable being anchored to said pontoon means, the other free end of the cable being equipped with a ring element, an upwardly projecting hook element on the elevator assembly for interengagement with said ring element when the elevator assembly is in submerged status.

5. The combination of claim **3** including a battery supported by the pontoon means, a motor and propeller supported by the elevator assembly, and a control box supported by the elevator assembly accessible to a passenge on the passenger support for actuating and deactuating the motor and propeller.

6. A device for use in underwater exploration, including in combination a catamaran unit comprised of two laterally spaced side-by-side pontoons connected by a pair of transverse bars, an elevator assembly mounted on and supported from the pantoons, said assembly being disposed between said pontoons, a pair of identical transversely spaced guide wheel mechanisms incorporated in the elevator assembly, a skeletal framework of integrated rod members including a pair of transversely spaced upwardly projecting guide posts each extending through one of the guide wheel mechanisms of the elevator assembly, a pulley assembly rigidly mounted atop one of said guide posts, said assembly including a freely rotatable pulley having a cable of determined length trained thereover, one end of the cable being anchored to one of said pontoons, the other free end of the cable being equipped with a ring element, a passenger seat having an integral backrest integrated with the framework, said framework including a pair of spaced arm rest extensions projecting forwardly from said backrest, an upwardly projecting hook element on the forward extremity of one arm rest extension for interengagement with said ring element when the skeletal framework is in submerged status, a horizontally disposed platform supported by the framework between a pair of longitudinally spaced inverted U-shaped members of the framework, a battery enclosed in a waterproof container mounted atop said platform, a motor equipped with a propeller dependingly supported from said platform, a control box mounted on one of said armrest extensions and waterproofed wiring leading from the control box to said battery and to said motor whereby the motor may be energized to drive the propeller and thus advance the device in the water, rudder mechanism mounted atop the platform above said depending motor, and manual means for operating the rudder mechanism when said motor is driving the propeller, an air reservoir device suspended above the platfom rearwardly of the seat backrest from a pair of strap members having their ends rigid with the bight portions of said pair of longitudinally spaced inverted U-shaped members of the framework, a motor-compressor unit mounted atop one of the pontoons, and a flexible conduit leading from the compressor to the air reservoir device for delivering thereto a continuous supply of air via an air intake valve mechanism, means for limiting the air under

pressure built up within the reservoir device to a determined volume, a mouthpiece employable by a person occupying said passenger seat for breathing when submerged, and means responsive to an inhalation action for delivering to said mouthpiece and thus to the lungs of said person a normal supply of breathing air from said reservoir device.

7. The structure and elements associated therewith recited in claim 6 wherein each of the two pontoons includes a flat upper surface deck portion wherein each of said guide wheel mechanisms of the elevator assembly is supported from an angle bracket rigidly secured atop one of said pontoons, and wherein an angularly disposed brace plate is rigid at its upper end with a component of said mechanism, and at its lower end with the outermost region of said bracket.

8. The structure and elements associated therewith recited in claim 6 wherein each of said pair of identical transversely spaced guide wheel mechanisms incorporated in the elevator assembly is comprised of an inner and an outer rectangular plate maintained in horizontally spaced relationship by a plurality of rivet elements, a pair of upper horizontally spaced guide wheels rotatably mounted between said plates on a shaft having its ends supported by said plates, and a pair of lower horizontally spaced guide wheels rotatably mounted between said plates on a shaft also having its ends supported by said plates, said upper and lower guide wheels being disposed in vertical alignment, and having arcuate peripheral grooves adapted to engage against diametrically opposed surfaces of the pair of transversely spaced upwardly projecting guide posts included in said skeletal framework.

9. The structure and elements associated therewith recited in claim 6 and a pair of transverse stop pins pressfitted into the upper end portions of the pair of transversely spaced upwardly projecting guide posts included in said skeletal framework for limiting downward movements of said posts and framework to a determined underwater position.

10. The structure and elements associated therewith recited in claim 6 wherein the rudder mechanism mounted atop said platform and the manual means for operating said mechanism includes a rudder rotatably mounted on a standpipe and having a forward extension integral therewith, a relatively short compression spring secured at one end to said extension and at its opposite end to a lug provided therefor on said battery enclosing container, said spring normally serving to maintain the rudder in non-steering position, a lug depending from said rudder extension, a pair of cables each having their rearward ends attached to said lug and extending forwardly therefrom in divergent fashion, each to pass freely through one of a pair of oppositely disposed guide lugs that project inwardly from the vertical leg segments of the forward one of said pair of longitudinally spaced inverted U-shaped members of the framework, and an operating handle affixed to the forward extremity of each cable.

11. The structure and elements associated therewith recited in claim 6 wherein the air reservoir device includes a rectangular internal metallic upper plate, a rectangular internal metallic lower plate, a forward hinged wall, a rearward hinged wall, and opposed hinged side walls, each of said walls being comprised of a pair of divergently disposed rectangular thin metallic plates rigid at one end with a common piano hinge, and at the opposite end with one of a pair of vertically spaced upper and lower piano hinges, said upper hinges being rigid with the metallic upper plate, said lower hinges being rigid with the metallic lower plate, a plurality of correspondingly spaced cup elements rigidly secured to said upper and lower metallic plates, the cup elements on the upper plate being in vertical alignment with the cup elements on the lower plate, a plurality of compression springs each having its opposite end portions seated in one of a pair of aligned cup elements, rectangular wooden external top plate, a rectangular wooden external bottom plate, sealing means enclosing all of the internal elements of said air reservoir device whereby to prevent entry of water thereinto, and a plurality of fastening elements securing said external top and bottom plates to the device.

12. The air reservoir device of claim 11 wherein the sealing means enclosing all of the internal elements thereof comprises an originally flat rectangular envelope of pliable plastic material including integral superimposed upper and lower layers having corresponding rectangular openings formed therein, and having one open end portion, said open end portion being heat-sealed about one of the common piano hinges aforesaid, said fastening elements that secure the external top and bottom plates to the device passing through the adjacent regions of the upper and lower layers of said envelope that define the rectangular openings thereof.

13. The structure and elements associated therewith recited in claim 6 wherein the air intake valve mechanism for delivering to the air reservoir device a continuous supply of air by means of a flexible conduit leading from the motor-compressor unit includes an inverted cup-shaped housing having a laterally projecting lower annular flange portion secured to an external wooden top plate included in said device, and an upper boss portion wherein the air delivery end of a first pipe is pressfittedly mounted in vertical alignment with a second pipe leading to the interior of the air reservoir device, the housing being concentric with both pipes, and the inlet end of the first pipe being pressfitted into the discharge end of said flexible conduit, a cup-shaped valve member molded of flexible plastic material and having the head portion of a guide stem imbedded therein, and a compression spring interposed within the housing about said guide stem biasing the valve member to sealing disposition about the delivery end of said first pipe.

14. The structure and elements associated therewith recited in claim 6 wherein the means for limiting the air under pressure built up within the reservoir device to a predetermined volume comprises an exhaust valve mechanism that includes a cup-shaped housing having an upper annular flange portion secured to an external wooden bottom plate included in said device, and a lower boss portion wherein the intake end of a first pipe is pressfittedly mounted in vertical alignment with a second pipe leading from the interior of the air reservoir device, the housing being concentric with both pipes, and the outlet end of the first pipe being pressfitted into the inlet end of a flexible conduit having an excess air venting device associated with its free opposite end, means for maintaining said venting device in a determined plane above the valve mechanism, a cup-shaped valve member molded of flexible plastic material and having the head portion of a guide stem imbedded therein, and a light compression spring interposed within the housing about said guide stem biasing the valve member to sealing disposition about the outlet end of said second pipe.

15. The structure and elements associated therewith recited in claim 6 wherein the means for delivering a normal supply of breathing air to said mouthpiece from said air reservoir device includes an inverted cup-shaped housing having a laterally projecting lower annular flange portion secured to an external wooden top plate included in said device, and an upper boss portion wherein the air withdrawal end of a first pipe is pressfitedly mounted in vertical alignment with a second pipe leading from the interior of the air reservoir device, the housing being concentric with both pipes, and the outlet end of the first pipe being pressfitted into the intake end of a flexible conduit having said mouthpiece attached to its other end, an inverted cup-shaped valve member molded of flexible plastic material and having the head portion of a guide stem imbedded therein, and a compression spring interposed within the housing about said guide stem biasing the valve

member to sealing disposition about the outlet end of said second pipe.

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