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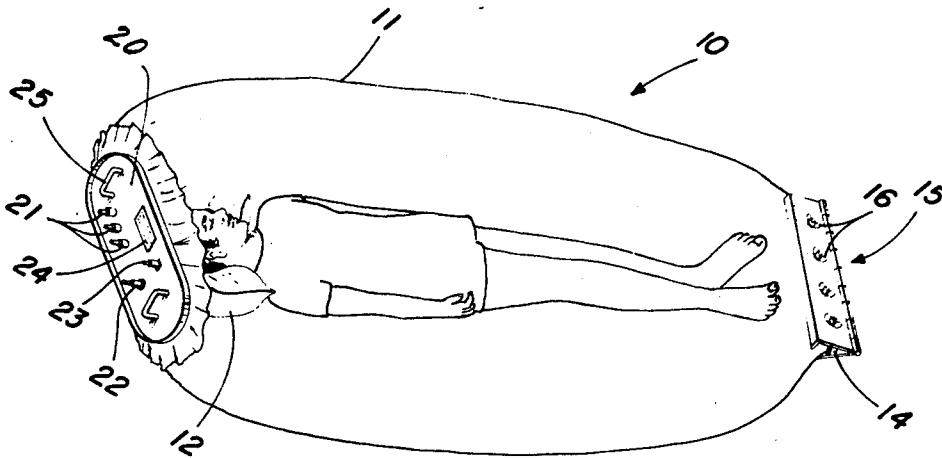
[54] **PORTABLE RECOMPRESSION CHAMBER**
2 Claims, 3 Drawing Figs.

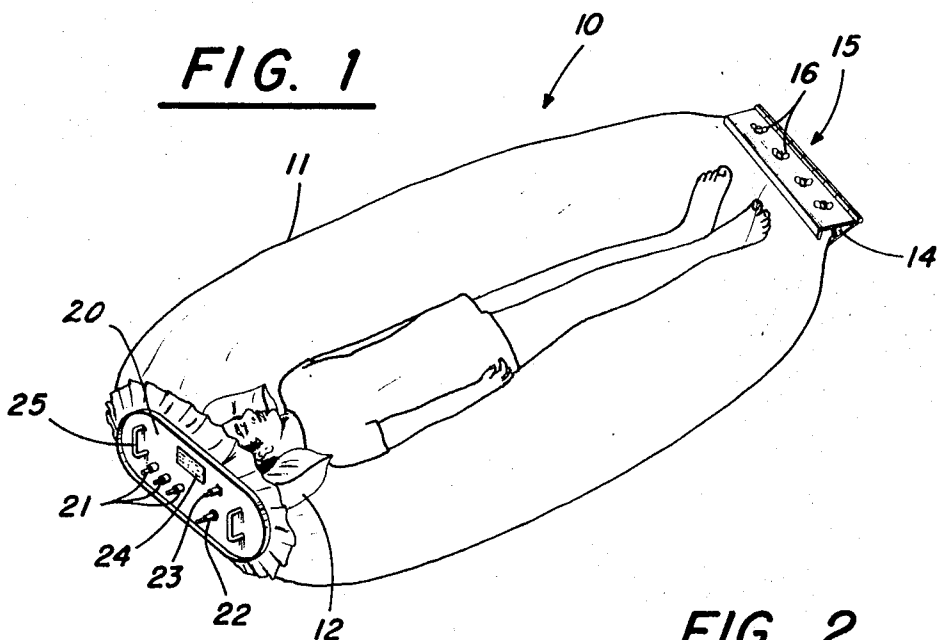
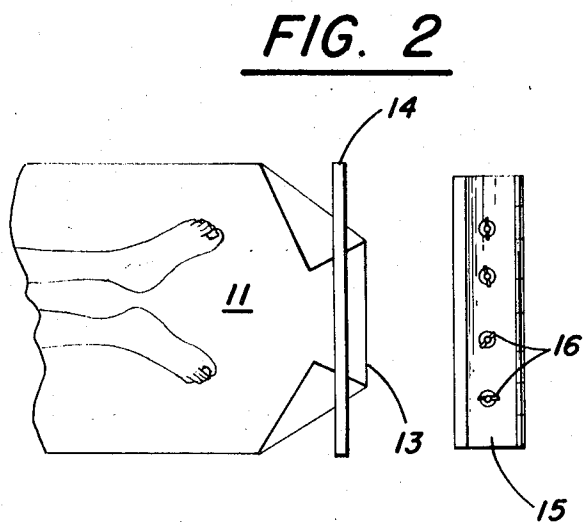
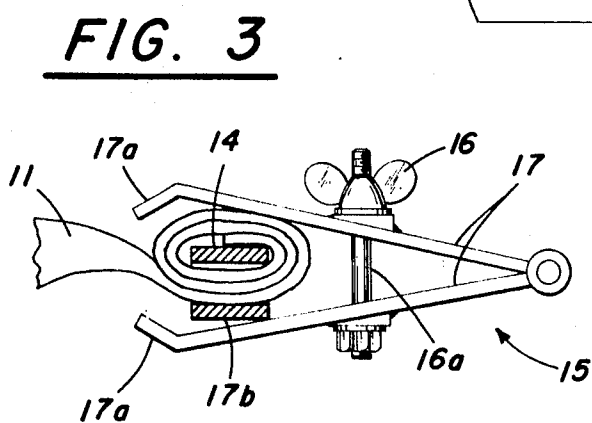
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ABSTRACT: An elongate, flexible, inelastic sleeve is sized to contain a diver suffering a decompression sickness, such as a gas embolism, and terminates in one end in a control panel provided with gas inlet and outlet fittings for transferring pressurized gas to and from the interior. Gauges and additional fittings are optionally provided to facilitate treatment. The opposite end of the flexible sleeve is formed with a large flexible opening closed by a clamp traversing the sleeve's lateral dimensions. Being constructed of a lightweight plasticlike material, which for aiding diagnosis and treatment is transparent, renders the instant invention completely portable and transportable by divers to on-the-job work sites. If a diver suffers an embolism caused by too rapid an ascent, or insufficient decompression, he is immediately placed into the sleeve through the large flexible open end which is then quickly closed by the clamp. Pressurized gas from any of many suitable sources is fed to the interior via the gas inlet fittings, immediately recompressing the diver, such immediate treatment being of the greatest importance to avoid death or permanent injury arising from delayed treatment.





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PORTABLE RECOMPRESSION CHAMBER

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

Divers using scuba gear, or being fed pressurized gas from a surface support unit, work under the ever present threat of misjudgment, equipment failure or unavoidable emergency which may result in an improper surfacing procedure. For example, if a diver resurfaces without adequate decompression dissolved nitrogen in the blood comes out of solution and forms bubbles in the bloodstream. These bubbles are painful and may cause blockages permanent injury. In areas where divers are fortunate to be near a land-based recompression chamber, they still must endure the excruciating pain and increasing permanent physical damage occurring during the time it takes to be transported from the work site to the recompression chamber. Some so-called portable recompression chambers are not so in fact, since their size, weight, and manner of construction prohibits their employment in many diving operations (a representative commercial unit weighs 700 pounds and folds into a cubic yard volume without supportive equipments). All the land-based and so-called portable recompression chambers include a small, rigid opening designed to allow access only by an individual moving on his own and functioning in a rational manner. There is no provision made for quickly and rapidly inserting a diver in a recompression chamber when the diver is either unconscious or contorted with pain. In addition, the known chambers have access hatches secured by a plurality of bolts and otherwise time-consuming, complicated sealing arrangements. There is no provision made for a lightweight, portable recompression chamber, easily carried by one man, permitting its use at substantially all diving locations. Nor is there provision for a chamber able to apply a recompressive pressure from conventional scuba bottles, or having an access opening flexible and large enough to accommodate the passage of an unconscious or contorted diver.

SUMMARY OF THE INVENTION

The present invention is directed to providing a portable recompression apparatus including of a rigid end panel mounting gas transfer fittings. The panel is secured onto a flexible, inelastic, cylindrically shaped body member, sized to envelop a diver and formed at its lower end with a similarly constructed flexible sleeve portion being provided with an opening configured for presenting a minimal access restriction for an injured diver. A clamping means is provided for rapidly closing the flexible sleeve portion after a diver has been placed inside the body member to enable his immediate recompression from a suitable gas source connected to the gas transfer fittings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric depiction of the invention treating a diver disposed therein.

FIG. 2 shows a top view of the folded opening prior to application of the clamp.

FIG. 3 is a side view of the clamped opening.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, a portable recompression unit 10 contains an injured diver and is composed of two principal components: an essentially, cylindrically shaped elongate bag 11, and a head panel 20 mounting a variety of gas transfer fittings. The bag is constructed of a lightweight, plasticlike material having a high tensile strength and having a stiffness

modulus not overly affected by temperature changes to retain its flexibility over a range of conceivable operating temperatures. An example of such a material having such characteristics is sold under the trademark "Mylar" or polyethylene, suitably reinforced within the state of the art. A typical thickness of 0.025 to 0.250 mils enables garmentlike flexure to facilitate containing a diver and is of sufficient length to accommodate a diver in comfort. Bag transparency is preferred for observation.

The elongate bag is preferably extruded as an integral unit, however, one or more sheets may be welded together in a seam or glued according to well-known techniques; joinder to a head panel 20 by bonding, welding, or using an annular clamp on the panel's internal surface effects a sealed, continuous connection.

Mounted on the head panel, a plurality of one-way gas inlet fittings 21 are provided to permit the external connection of scuba tanks or suitable sources of pressurized gas used for the recompression process. The fittings are one-way fittings to enable a repeated connection and disconnection of successive, external sources of pressurized gas. Each, optionally has a manual shutoff as a backup to ensure against possible valve failure. One intake fitting is configured to accommodate a regulator when, for example, diver treatment calls for his breathing a special gas mixture, or when the recompressing gas supply is at a premium. Under any other condition a constant purge must be maintained in order to insure proper ventilation of the apparatus. Adjacently disposed on the face of the head panel, an air outlet valve or exhaust valve 22 serves to depressurize the internal volume of the bag or to maintain a preselected internal bag pressure as required by the treatment undertaken and is controlled by an external adjustment on the valve. To allow a sufficient recompression pressure all the valves and the bag itself are capable of containing an internal pressure corresponding to a depth of 165 feet level. Monitoring of the internal pressure is assured by including one or more two-way fittings 23 with manual shutoffs for receiving conventional air pressure gauges.

For convenience sake, recompression tables 24 are mounted on the external face of the head panel to readily make available to attending personnel information leading to the most expedient treatment of the injured diver.

A pair of heavy-duty carrying handles 25 permits carrying of a deflated unit, as well as facilitating the transfer of a diver, undergoing treatment to a permanent recompression facility.

The other end of the bag terminates in a coextensive sleeve portion having an opening 13 sized large enough to accommodate an unconscious or contorted diver and, for this reason, is optionally outwardly flared. An elongate bar 14 is of sufficient length to traverse the bag when collapsed, and a hinged clamp 15 carries a plurality of wingnuts 16 on threaded crossbolts 16 projecting through bores provided in a pair of clamp follower bars 17. Tightening the wingnuts forces jaw surfaces 17a together to clamp down on the layers of the bag wrapped around the elongate bar. A bearing bar 17b is included to ensure a positive, pressure-sealed opening when the wingnuts are tightened.

The instant portable recompression unit is, thusly, quite light and easily stored aboard any vessel carrying a suitable gas source such as scuba bottles or a compressor and qualified personnel to operate the unit. If a diver, after surfacing, exhibits recognizable symptoms of a diving disease requiring recompression, the portable recompression unit is withdrawn from its storage space. The plasticlike bag is quickly unrolled and the diver, having been stripped of his equipment, is immediately placed inside the bag. Whether or not the diver is conscious does not materially detract from the speed with which he is placed in the bag since the large opening 13 and the totally flexible nature of the bag offer minimum resistance. Once inside the bag, opposite corners of the bag adjacent opening 13 are folded inwardly (note FIG. 2) and the elongate bar is placed across the tucked corners. The bag is rolled over the bar and assumes the appearance shown in FIG. 3, and the

hinged clamp 15 is clamped over the rolled portion of the bag. The wingnuts are tightened, securely sealing opening, and a source of pressurized gas is vented through the one-way gas inlet fittings. A pressure gauge carried on fitting 23 permits accurate observation of the pressure within the bag and the internal pressure is maintained by appropriate adjustment of exhaust valve 22. The time spent to begin the recompression operation thus described takes less than 5 minutes from the time a diver surfaces. An internal pressure of up to 75 p.s.i., the starting pressure of current treatment tables, is maintained in the bag while the diver is taken to a permanent recompression chamber attended by physicians. Shipboard, or where appropriate gas sources and qualified personnel are available, a diver may undergo complete treatment within the bag.

When treating a diving disease such as embolism, bends or emphysema, time is the most important factor in preventing permanent damage to the brain, heart and other organs. The instant invention serves to minimize complications arising from delinquent treatment. In the situation where a land-based or permanent recompression facility is not available within a reasonable time, prolonged recompression treatment is possible using the present portable recompression unit. Having the bag and/or head panel formed of a transparent, plasticlike material enables observation and diagnosis of the contained diver, as well as lessening the diver's anxieties by being able to visually communicate with the outside world, the latter being especially important to minimize the possibility of further complicating shock. The essence of the invention resides in its being lightweight, and thus portable, and having an opening allowing the rapid insertion of a diver to minimize any medical complications arising from delayed treatment.

A recompression chamber constructed according to the foregoing teachings weighs less than 100 pounds and is foldable into a suitcase-sized storage pack to accompany divers on substantially all operations. Connection to standard scuba bottles is all that is necessary to commence immediate treatment when permanent decompression facilities or appropriate, known gas supplies are within the time frame of the immediate gas supply.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings, and it is therefore understood that within the scope of the dis-

closed inventive concept, the invention may be practiced otherwise than as specifically described. It is further realized that this invention may be used for treatment of other than diseased divers. Persons suffering from working under high-pressure air such as tunnel builders, or any hospital therapy where hyperbaric oxygen treatment is used serve as examples.

Furthermore, it is realized that future treatment tables using helium/oxygen mixtures may require substitution of implied materials with heliumtight materials.

What is claimed is:

1. In portable recompressing apparatuses having a rigid end panel carrying gas transfer fittings secured to a substantially inelastic, transparent, flexible body member sized to form a pressure chamber for containing a diver suffering an embolism, an improvement therefor is provided comprising:

a substantially inelastic, transparent, flexible sleeve continuously extending from said body member provided with an opening remote from said rigid end panel configured for presenting a minimal access restriction for said diver, said sleeve having a flexibility to allow its being gathered adjacent the panel and pulled down around the diver to envelop him; and

means for sealing said flexible sleeve externally carried thereon including,

an elongate bar about which the portion of said flexible sleeve near said opening is wrapped,

a pair of hinged clamping members having inwardly extending and elements spaced to receive said elongate bar and the wrapped opening portion of said flexible sleeve,

a bearing bar disposed on an inner surface of one of said hinged clamping members, and

means carried on said hinged clamping members for pivotally closing them to tightly compress said wrapped opening portion between said elongate bar and said bearing bar thereby ensuring the rapid sealing of said pressure chamber for the immediate recompression of said diver.

2. An apparatus according to claim 1 in which the pivotally closing means is a plurality of crossbolts each reaching through the pair of hinged clamping members and a wingnut carried on each crossbolt, upon the tightening thereof, securely sealing said pressure chamber.

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