Dec. 26, 1961 H. J. MORAN 3,014,619

INFLATOR FOR INFLATABLE BODIES

Filed Sept. 17, 1959 2 Sheets-Sheet 1

FIG. 1

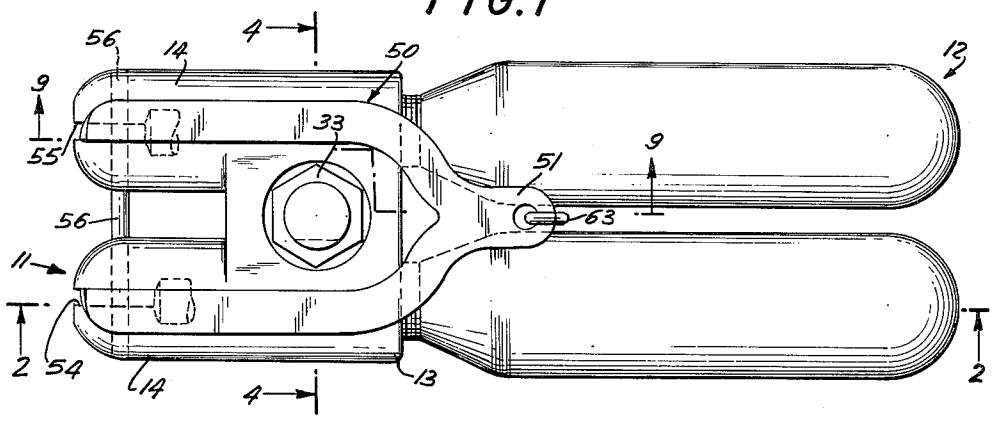


FIG. 2

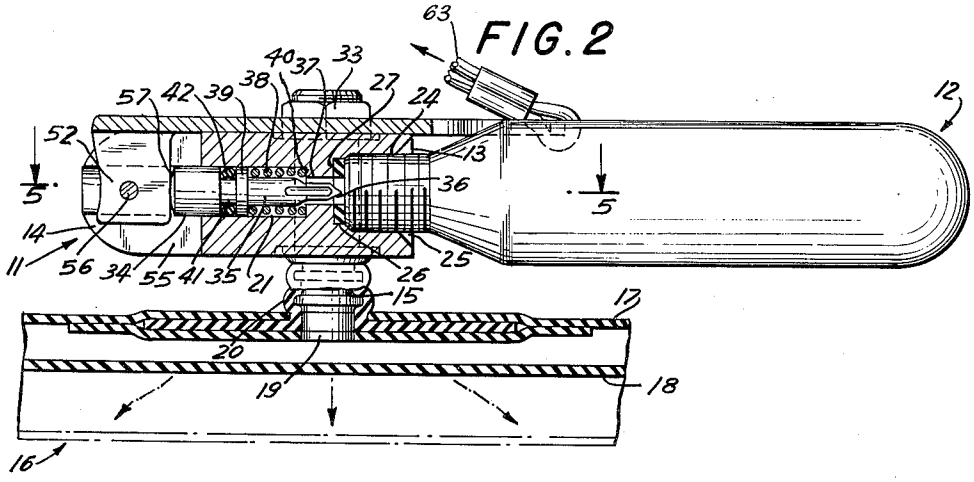


FIG. 3

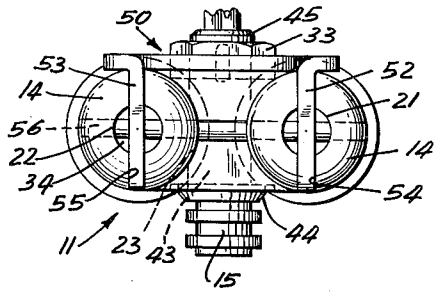
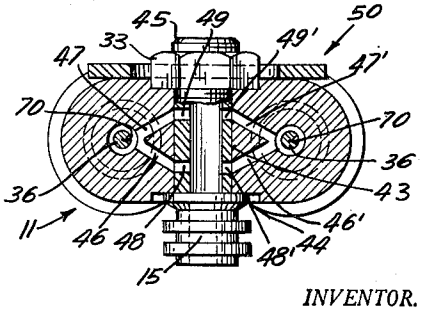


FIG. 4



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Dec. 26, 1961 H. J. MORAN 3,014,619

INFLATOR FOR INFLATABLE BODIES

Filed Sept. 17, 1959 2 Sheets-Sheet 2

FIG. 5

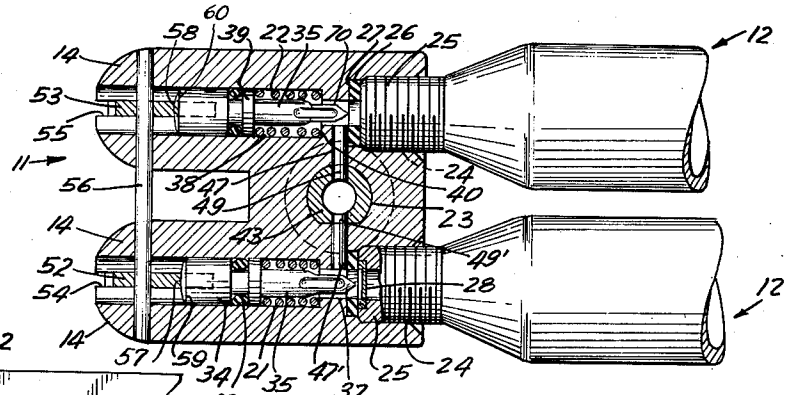


FIG. 6

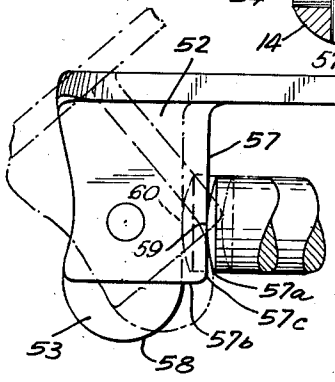


FIG. 7

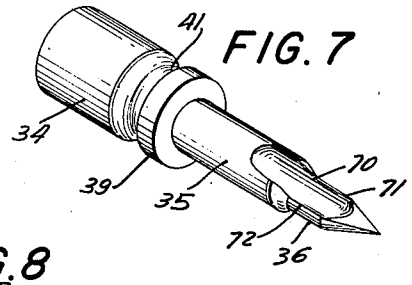


FIG. 8

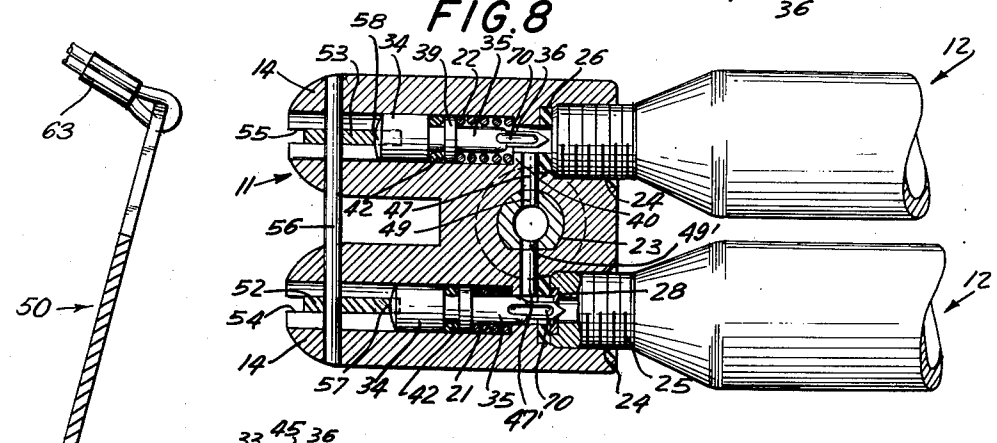
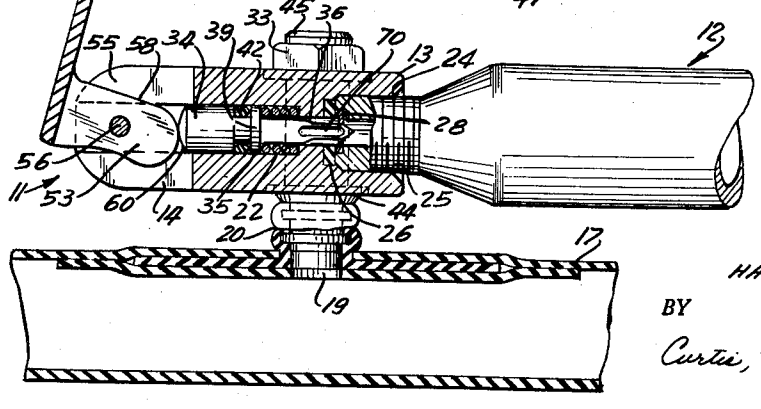


FIG. 9



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INFLATOR FOR INFLATABLE BODIES

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Filed Sept. 17, 1959, Ser. No. 840,556
7 Claims. (Cl. 222—5)

The present invention relates to inflatable devices such as life preservers and the like, and more particularly to a manually operable unit for inflating the device. The present application is a continuation-in-part of my prior application for United States Letters Patent Serial No. 695,560, filed November 12, 1957, entitled Inflator for Inflatable Bodies, now abandoned, and relates back to said application for all common subject matter.

Life preservers and similar inflatable devices having inflatable cells of a flexible impervious material are in common use. Such cells are inflated by a gas, such as carbon dioxide, which is stored in a cylindrical container at high pressure and released directly into the cell or cells. The cylindrical container is mounted in a fitting attached to the cell and has a small frangible diaphragm which seals the gas therein. When the cell is to be inflated, a plunger in the fitting is manually actuated to puncture the frangible diaphragm and release the gas for flow into the cell.

The cylindrical containers of high pressure gas are usually supplied by a different manufacturer than the one who makes the inflatable device and such cylinders are detachably mounted in a socket of the fitting. When a cylinder is applied to the fitting it is impossible to determine whether it contains gas under pressure. For example, the gas may have slowly leaked from the cylinder due to a manufacturing fault or the cylinder may never have been charged with gas due to a personnel error. Also, the manually operable plunger may fail to puncture the diaphragm and release the gas. Therefore, an inflatable device such as a life preserver may fail to perform its essential life saving function in an emergency if any particular gas container is defective. Furthermore, such cylinders many times interfere with the proper folding of the fabric cell into the small compact mass required in a lift belt and do not conform to the contour of the body.

One of the objects of the present invention is to reduce the possibility of any failure of a life preserver or similar inflatable device to inflate in an emergency.

Another object is to provide an improved inflating unit for a device of the type indicated which supplies gas to a cell from a plurality of small containers successively to insure at least partial inflation of the device.

Another object is to provide an inflating unit of the type indicated which facilitates folding of the inflatable device into a compact mass without any rigid extension in one direction.

Another object is to provide an inflating unit of the type indicated which punctures the frangible closures of the plurality of gas containers successively to reduce the force required and utilizes the pressure of released gas from a first container to augment the manual force applied to puncture the frangible closure of another container.

Still another object is to provide an inflatable device of the type indicated which is of simple and compact construction, reliable in operation and adapted for economical manufacture.

These and other objects will become apparent from the following description and drawings in which like reference characters denote like parts throughout the several views. It is to be expressely understood, however, that the drawings are for the purpose of illustration only

and not a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings:

FIGURE 1 is a plan view of an inflating unit incorporating the novel features of the present invention and showing a plurality of gas containers detachably mounted thereon;

FIGURE 2 is a transverse sectional view taken on line 2—2 of FIGURE 1 to show the unit attached to an inflatable cell and a manually operated plunger for releasing gas from one container;

FIGURE 3 is an end elevational view of the unit illustrated in FIGURE 1 and showing the spaced arms of the handle for actuating the plungers;

FIGURE 4 is a transverse sectional view taken on line 4—4 of FIGURE 1 to show the passageways in the unit for directing gas from each of the plurality of cylindrical containers to an outlet nipple;

FIGURE 5 is a sectional plan view taken on line 5—5 of FIGURE 2 to show the relationship of the two plungers actuated by the handle to successively puncture the frangible diaphragms in the two cylinders.

FIGURE 6 is a diagrammatic view of the plungers and actuating cams on the operating handle and illustrating in dot and dash lines the relation of the cams and plungers after one diaphragm has been punctured;

FIGURE 7 is a perspective view of one of the plungers and showing the grooved slot in one side of its pointed end to release gas under pressure when the frangible is first punctured.

FIGURE 8 is a view similar to FIGURE 5 and showing one plunger puncturing the frangible diaphragm of one of the containers before the other plunger engages the diaphragm of its container; and

FIGURE 9 is a sectional view taken on line 9—9 of FIGURE 1 and showing the frangible diaphragm of the other container being punctured by further movement of the actuating handle augmented by the pressure of gas released from the first container.

Referring now to the drawings, a preferred embodiment of an inflating unit is illustrated as comprising a fitting 11 and a plurality of cylindrical gas containers 12 detachably connected thereto. In the illustrated embodiment, the fitting 11 mounts a pair of the gas cylinders 12, but it will be understood that more than two could be used. Each of the cylinders 12 contains a gas, such as carbon dioxide, at high pressure and is of such size that a pair of the cylinders contain at least the amount of gas required to fully inflate the device when expanded to atmospheric pressure. Therefore, the gas in either cylinder will insure at least partial inflation of the device.

The valve fitting 11 comprises a body member 13 of generally rectangular shape with spaced cylindrical projections 14 extending from one side and a centrally located nipple 15 projecting from the bottom. As illustrated in FIGURE 2, the fitting 11 is mounted on and sealed to a cell 16 constituting the inflatable device and having walls 17 and 18 of an impervious flexible material such as rubberized nylon. To this end, nipple 15 projects through a hole 19 in the wall 17 of cell 16 and is sealed thereto by a neckpiece 20 projecting from the cell and surrounding the nipple.

The body member 13 may be formed as a metal casting having a pair of longitudinal openings 21 and 22, see FIGURE 5, extending therethrough and through the cylindrical projections 14 axially thereof from one side of the body member to the other in parallel arrangement and a transverse opening 23 extending therethrough from the top to the bottom. The openings 21 and 22 at the side of the body member 23 opposite projections 14 are tapped to provide a pair of adjacent screw threaded sockets 24 for receiving the gas cylinders 12. The cylindrical

gas containers 12 each have a reduced neck portion 25 which is externally threaded to adapt it to be screwed into a socket 24. Each cylinder is sealed in the fitting 11 by means of a gasket 26 engaging the end of the neck portion 25 and an annular seat 27 in the fitting at the inner end of the socket. The neck portion 25 of each cylinder 12 is of annular form, see FIGURE 5, and has a frangible diaphragm 28 in its open end for sealing the gas therein at high pressure.

The openings 21 and 22 in extensions 14 at the opposite side of the body member 13 from the sockets 24 are bored to form cylinders in which plungers 34 are slidably mounted. Plungers 34 in the separate openings 21 and 22 are of identical construction and each has a reduced stem 35 with a pointed end 36 projecting through a counter-bore 37 into a socket 24 in alignment with the frangible diaphragm 28. Each plunger 34 closely fits its cylindrical opening and a compression spring 38 surrounds its reduced stem 35 and acts between a shoulder 39 on the plunger and a seat 40 on the fitting 11. Springs 38 tend to move the plungers 34 outwardly of the cylindrical openings 21 and 22 and away from the frangible diaphragm 28 at the end of its gas container 12. The plungers 34 each have an annular recess 41 in which an O-seal 42 is mounted to provide a seal between the plungers in the openings 21 or 22. As shown most clearly in the enlarged perspective view of the plunger 34 in FIGURE 7, the pointed end portion 36 is ground flat on one side to the point and the flat side grooved to form a longitudinally extending slot 70 and sharp cutting edges 71 and 72 at the sides of the point which extend from the point along the sides of the slot. The cutting edges 71 and 72 of the pointed end 36 of each plunger 34 reduces the resistance of the plunger in piercing the diaphragms 28 and contributes much to the ease of operation of the device. The grooved slot 70 provides a passageway through which the high pressure gas may escape from a container 12 into the cylindrical opening 21 or 22 immediately upon puncturing a frangible diaphragm 28. The high pressure gas then acts on the plunger in a manner as later explained in detail to augment the puncturing of the frangible diaphragm of the other container 12.

The nipple 15 constitutes the depending end of a tubular thimble 43 which extends through the transverse opening 23 in the body member 13. Thimble 43 is closed at the top and has a shoulder 44 engaging the bottom of the body member and a screw threaded end 45 projecting from the top. The tubular thimble 43 is held in place on the body member 13 by a nut 33 screwed onto its threaded end against the top of the body member. Before the thimble 43 is inserted in the body member 13, the latter is drilled through the transverse opening 23 at each side thereof to form angular passageways 46, 47 and 46', 47', respectively, which extend from the transverse opening to each of parallel openings 21 and 22. The thimble 43 has ports 48, 49 and 48', 49' which align with the passageways 46, 47 and 46', 47' in the body member 13, respectively.

The plungers 34 for the separate containers 12 are actuated by a common handle 50 and the handle and plungers are so arranged as to puncture the frangible diaphragms 28 of the containers successively to reduce the manual force required. Furthermore, the construction utilizes the pressure of the gas released from the container 12 first punctured to augment the manual force applied to handle 50 to puncture the frangible diaphragm of the next container to be opened.

Handle 50 is in the form of a bell crank lever having an actuating arm 51 and spaced cam arms 52 and 53 overlying the plungers 34. In the illustrated embodiment, see FIGURES 1, 6 and 9, the handle 50 is of sheet metal punched to form a bifurcated actuating arm 51 with the cam arms 52 and 53 folded at right angles from the ends of the bifurcations. The cam arms 52 and 53 extend through slots 54 and 55 cut through the cylindrical extensions 14 at the axis of the openings 21 and 22 to overlie the ends of the plungers 34. Handle 50 is pivotally mounted on a pin 56 extending through the cylindrical extensions 14 of the body member 13 and the cam arms 52 and 53 at right angles to the latter. Thus, the handle 50 may be rocked from a position overlying one side of the body member as shown in FIGURE 2, to a position at right angles thereto as shown in FIGURE 9.

The edges of the cam arms 52 and 53 overlying the plungers 34 are formed to provide cam faces 57 and 58 engaging the rounded ends 59 and 60 of the plungers. The cam faces 57 and 58 have a suitable configuration to operate the plungers 34 successively. In the illustrated embodiment the cam face 57 on arm 52 is offset inwardly from and parallel to the cam face 58 on arm 53 so that, with plungers 34 of the same length, one plunger will engage and pierce the frangible diaphragm of its container 12 before the other. As shown in FIGURE 5, the plunger 34 engaged by the wider cam face 57 on arm 52 is positioned forwardly of and its pointed end 36 closer to the frangible diaphragm 28 of its container 12 than plunger 36 engaged by the narrower cam face 58 on arm 53. Thus, the plunger 34 actuated by cam face 57 will puncture its diaphragm before the plunger actuated by cam face 58 as illustrated in FIGURE 8 when the handle 50 is rocked from the position illustrated in FIGURE 2 toward the position illustrated in FIGURE 9.

The cam face 57 on arm 52 has angularly related surfaces 57*a* and 57*b* with an apex 57*c* therebetween as most clearly shown in FIGURE 6. The surfaces 57*a* and 57*b* are so arranged that the surface 57*a* will actuate its plunger 34 to the position illustrated in dot and dash lines to puncture its diaphragm and position its apex 57*c* beyond the center of its plunger before the other plunger is actuated to a position to puncture its diaphragm. The high pressure gas escaping from the punctured container 12 through the grooved slot 70 in the pointed end of the plunger then acts on the entire area of the plunger to force it outwardly against the cam face 57 of handle 50. However, the force will be applied to the apex 57*c* at one side of pivot pin 56 and on the face 57*b* tending to rock the handle 50 toward the position illustrated in FIGURE 9. Thus, the force applied to handle 50 by the escaping high pressure gas augments the manual force applied to puncture the frangible diaphragm of the other container 12.

From the above description it will be apparent that the use of two cylindrical gas containers 12 instead of one will reduce the possibility of failure to inflate the device in an emergency and that each of the containers will project from the fitting only one half the distance of a single container. As stated above, the inflatable devices to which the present invention is applied are usually constructed of a thin flexible material such as rubberized nylon adapted to be folded into a compact mass. For example, when the inflatable device is in the form of a life belt it comprises an impervious air cell which is folded and contained in a belt which conforms to the contour of the body. When the gas necessary to inflate the life belt is contained in a single cylinder, the latter does not conform to the body, but instead tends to project tangentially from the body. However, when the gas necessary to inflate the device is contained in two individual cylinders they may be made of shorter length, although having twice the width, so that they will more closely conform to the shape of the body and will pack as well in the belt. While the invention is described with respect to a belt, the plurality of shorter cylinders will insure at least partial inflation of other forms of life preservers such as life vests, chest or back packs or other inflatable devices and will tend to conform more closely to the body than a single and longer cylindrical container.

When an emergency arises and the device is to be inflated, a single pull of the lanyard 63 will rock the handle 50 on the pivot pin 56 and actuate the plurality of plungers 34 to release gas from the cylinders 12 successively. The plunger 34 actuated by cam face 57 on arm 52 will first puncture the diaphragm 28 of its container 12 and the cutting edges 71 and 72 facilitate the puncturing operation. The pressure of the gas escaping from the first container through slot 70 in the plunger immediately produces a force on surface 57*b* of the cam arm to augment the manual force applied to the handle to puncture the diaphragm of the other container 12. It will be understood that the handle 50 is initially actuated by one quick motion and the puncturing of both diaphragms is insured by the successive actuation of the plungers and augmenting force of the high pressure gas on the reversely inclined cam face 57*b*. The gas flows from the containers 12 through the parallel openings 21 and 22 and then through the passageways 46, 47 and 46', 47' into the hollow thimble 43 and then through the depending nipple 15 directly into the cell 16. These passages provide a sufficient initial resistance to provide an instantaneous reactive force on the plunger 34. The gas is prevented from escaping from the fitting by the sealing engagement of the gaskets 26 with the ends of the gas cylinders 12 and by the O-seals 42 on the plungers 34. The plungers 34, in turn, are prevented from movement outwardly from the openings 21 and 22 in the body member 13 by engagement with the cam faces 57 and 58 on the arms 52 and 53 of the lever handle 50. Thus, all of the gas from the cylinders 12 is delivered to the cell 16.

The cylinders 12 are so dimensioned so as to contain the proper amount of gas to fully inflate the cell 16 when the gas is expanded to atmospheric pressure. However, should one of the gas cylinders 12 be defective, the other cylinder will provide sufficient gas to at least partially inflate the cell 16. Thus, the construction of the present invention constitutes a safety device for insuring at least partial inflation should one of the cylinders fail to contain any gas.

It will now be observed that the present invention provides a unit for controlling the inflation of an inflatable device which reduces the possibility of failure of the device to inflate in an emergency and reduces the overall length of the unit. It will further be observed that the present invention provides an inflating unit of the type indicated which at least partially inflates the device. It also will be observed that the present invention provides a control device which punctures the frangible diaphragms of a plurality of gas containers successively to reduce the manual force required and utilizes the pressure of the released gas to augment the manual force. It will still further be observed that the present invention provides an inflating unit of the type indicated which is of simple and compact construction adapted for economical manufacture, and one which is reliable in operation.

While a single embodiment of the invention is herein described and illustrated, it will be understood that changes may be made in the construction and arrangement of elements without departing from the spirit or scope of the invention. Therefore, without limitation in this respect, the invention is defined by the following claims:

1. Apparatus for controlling the inflation of an inflatable device comprising a single fitting attached to said device, a plurality of individual gas containers mounted on said fitting in sealing engagement therewith, each of said gas containers having a frangible diaphragm for sealing gas in said container under pressure, plungers in said fitting in alignment with said containers and having pointed ends for puncturing the frangible diaphragms, a common actuator pivotally mounted on said fitting for rocking movement and having cam faces offset in the direction of movement of the actuator for operating the plungers one after the other to puncture the frangible diaphragms of the plurality of containers successively, each of the plungers having a slot with sharp cutting edges extending from the point along the sides of the slot to facilitate the puncturing of its diaphragm and provide an opening through which gas may escape when the diaphragm is punctured, and passageways in said fitting for delivering the released gas from the plurality of containers to said device.

2. Apparatus for controlling the inflation of an inflatable device comprising a single fitting attached to said device, a plurality of individual gas containers mounted on said fitting in sealing engagement therewith, each of said gas containers having means for sealing a gas therein at high pressure, a plunger for each container slidably mounted in said fitting, means including a common actuator mounted on said fitting and having cam faces offset in the direction of movement of the actuator for operating the plungers successively to open the sealing means of the plurality of containers one after the other, at least one of said cam faces being inclined at opposite sides of an apex and its plunger utilizing the pressure of the gas released from its container and acting on the reversed inclined face of its respective cam to augment the movement of the actuator to open the sealing means of the next container, and passageways in said fitting for delivering the released gas from the plurality of containers to said device.

3. Apparatus for controlling the inflation of an inflatable device comprising a single fitting attached to said device and having sockets at one side thereof, individual gas containers each having a neck portion projecting into a socket in sealing engagement therewith, each of said gas containers having a frangible diaphragm in the socket for sealing gas in said container under pressure, plungers in said fitting in alignment with said sockets and having pointed ends for puncturing the frangible diaphragms of the containers therein, a common actuator mounted to rock on said fitting and having separate cams offset with respect to each other in the direction of movement of the common actuator for operating the plungers one after the other and thereby puncture the frangible diaphragms of the plurality of containers, successively, and passageways in said fitting for delivering the released gas from the plurality of containers to said device.

4. Apparatus for controlling the inflation of an inflatable device comprising a fitting attached to said device, said fitting having a body member with openings extending therethrough in parallel arrangement, individual gas containers mounted in said openings at one side of the body member in sealing engagement therewith, each of said gas containers having means for sealing a gas therein at high pressure, a plunger in each opening at the opposite side of the body member from the gas containers, said plungers having means for operating on the sealing means of the containers to release gas therefrom, a common actuator mounted to rock on said fitting and having separate cams offset in the direction of movement of the common actuator for actuating said plungers one after the other to open the containers successively, and passageways in said fitting extending from each opening between the container and plunger for delivering gas to the device.

5. Apparatus for controlling the inflation of an inflatable device comprising a fitting attached to said device, said fitting having a body member with openings extending therethrough in parallel arrangement, individual gas containers mounted in said openings at one side of the body member in sealing engagement therewith, each of said containers having means for sealing a gas therein at high pressure, a plunger in each opening and having means for operating on the sealing means of the respective container mounted in said opening to release gas therefrom, a common actuator mounted to rock on said fitting and having separate offset cams for actuating said plungers, one after the other, to open the containers successively during movement of the actuator, the cam for actuating the plunger for opening the first container having adjacent

faces with reversed slopes and an apex therebetween, the pressure of the gas released from the first container acting on the plunger and reversed slope of the cam for applying a force on the actuator to augment the force required to open the sealing means of the next container, and passageways in said fitting for delivering the released gas from the plurality of containers to said device.

6. Apparatus for controlling the inflation of an inflatable device comprising a fitting having a nipple attached to said device, said fitting having a body member with a plurality of longitudinal openings extending therethrough in parallel arrangement and a transverse opening extending through the body member between the parallel openings at right angles thereto, a hollow thimble in said transverse opening and projecting from the body member to form the nipple attached to said device, individual gas containers mounted in said longitudinal openings at one side of the body member in sealing engagement therewith, each of said gas containers having a frangible diaphragm for sealing a gas therein at high pressure, plungers mounted in the longitudinal openings of said body member and having pointed ends in alignment with said containers for puncturing the frangible diaphragms to release gas therefrom, said plungers having a slot in the side of the pointed end providing an opening through which gas may escape, a common actuator mounted for movement on said fitting and having offset cams for actuating said plungers successively, and the cam for actuating the plunger for the container first opened having a reversed slope engaged by plunger after the diaphragm has been punctured and applying the pressure of the escaping gas to augment the movement of the actuator to puncture the diaphragm of the next container, and passageways in said fitting between the parallel openings and hollow thimble so that gas from either or both fittings is delivered to said nipple.

7. Apparatus for controlling the inflation of an inflatable device comprising a single fitting attached to said device, a plurality of individual gas containers mounted on said fitting in sealing engagement therewith, each of said containers having a frangible diaphragm for sealing gas therein at high pressure, a plunger for each container slidably mounted in the fitting and pointed at one end for puncturing a diaphragm, spring means acting between shoulders on the fitting and plunger for holding the pointed ends of the plungers spaced from the diaphragms, a common actuator pivotally mounted on said fitting and having spaced arms overlying the ends of the plungers, respectively, with offset cam faces for engaging and actuating the plungers, one after the other, to puncture the diaphragms of the containers, successively, and the face of the cam for actuating the plunger which punctures the first container having a reverse slope acted on by the plunger to augment the operation of the actuator in the same direction of movement.

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