Sept. 1, 1970 J. BERNHARDT ET AL 3,526,339

DEVICE FOR INFLATING FLOATING BODIES OF LIFE-SAVING EQUIPMENT

Filed Dec. 11, 1968 4 Sheets-Sheet 1

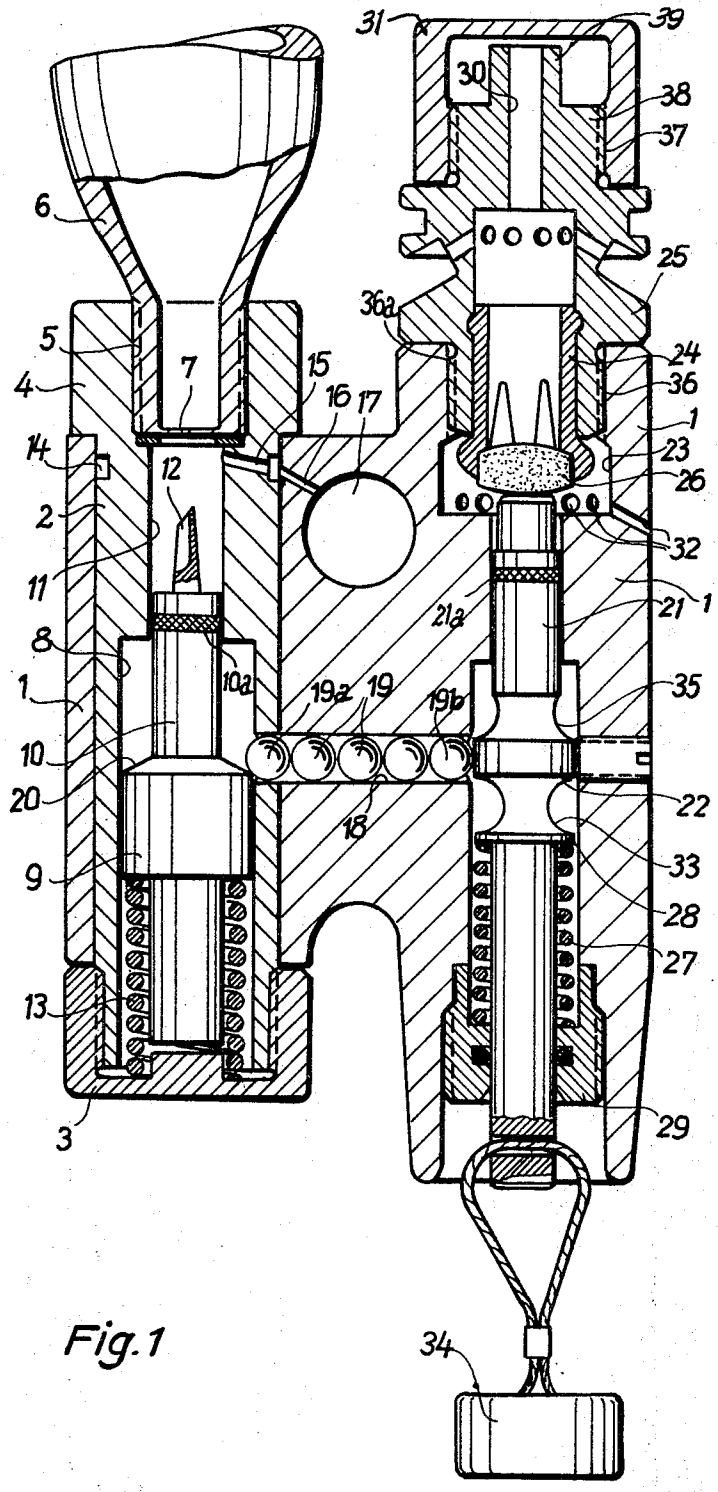

Fig. 1

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Filed Dec. 11, 1968 4 Sheets-Sheet 2

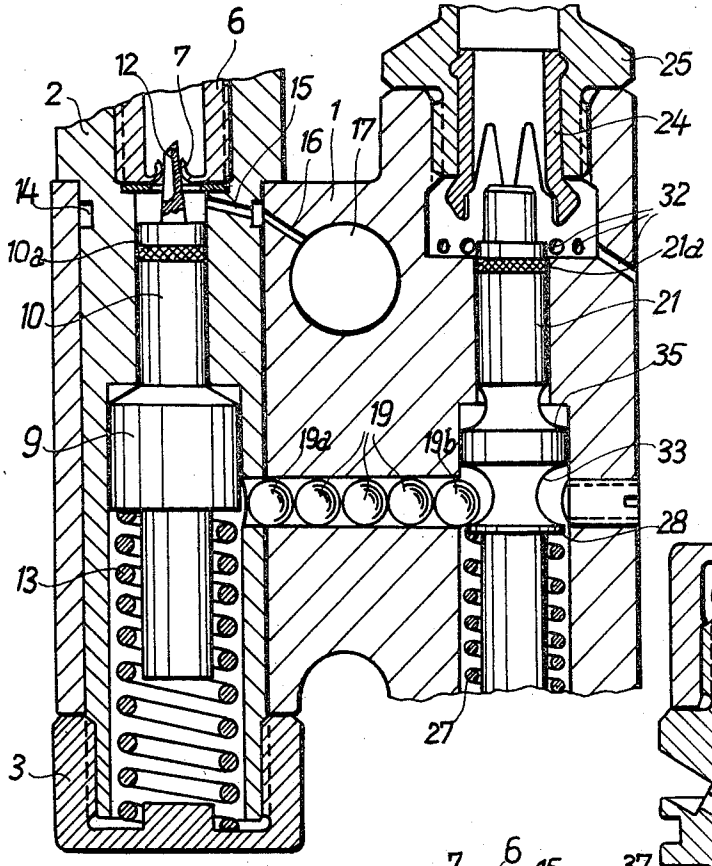

Fig.2

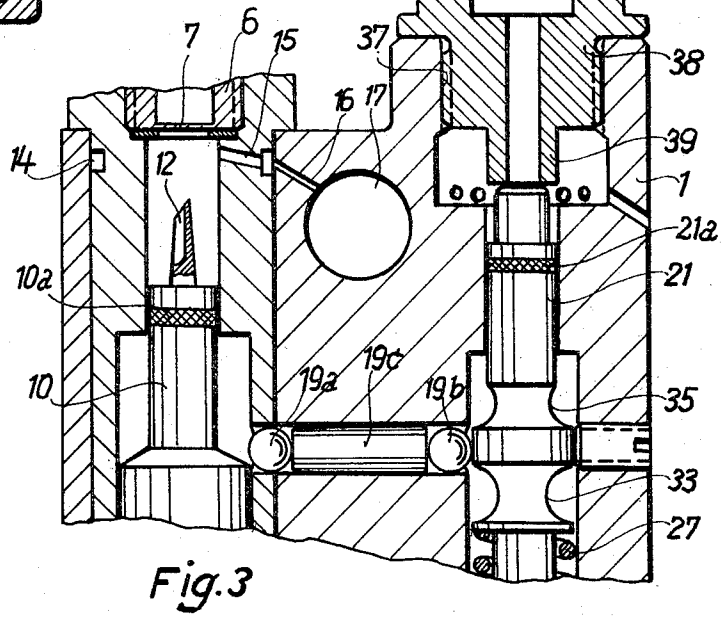

Fig.3

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DEVICE FOR INFLATING FLOATING BODIES OF LIFE-SAVING EQUIPMENT

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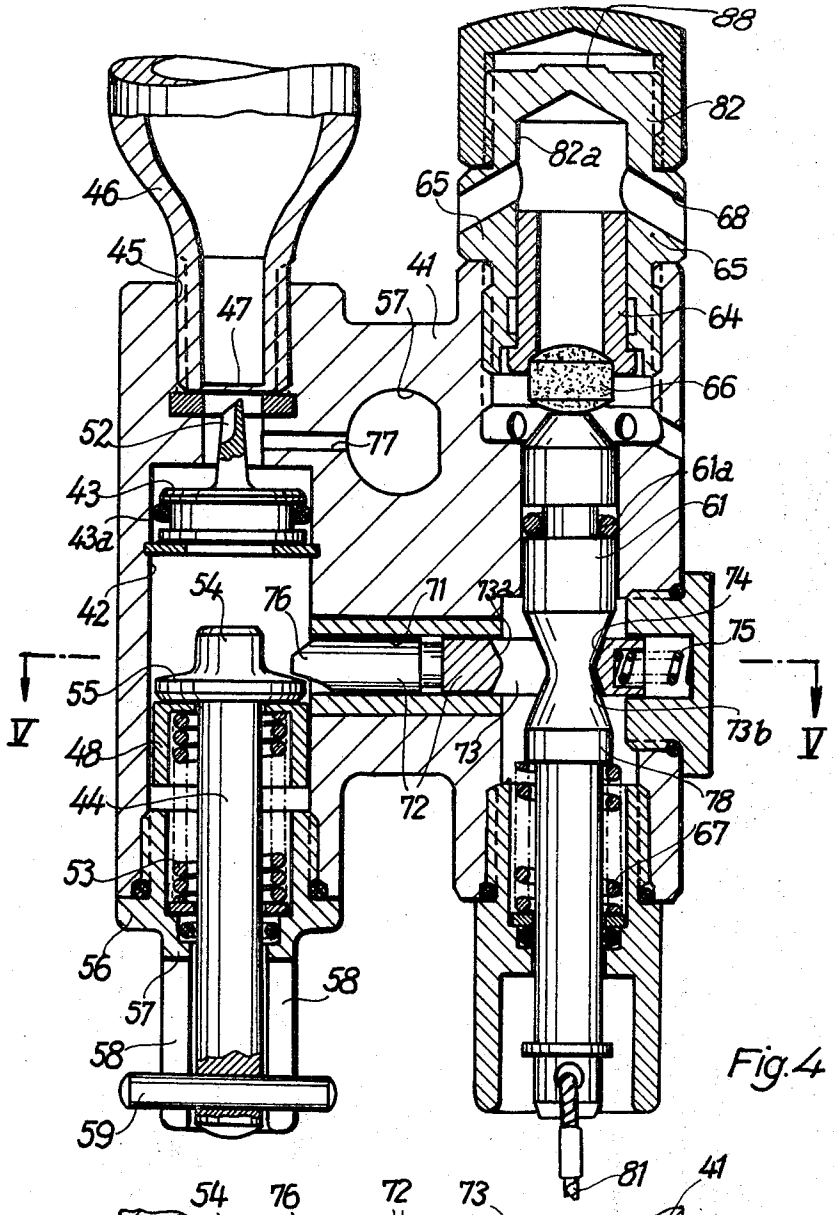

Fig. 4

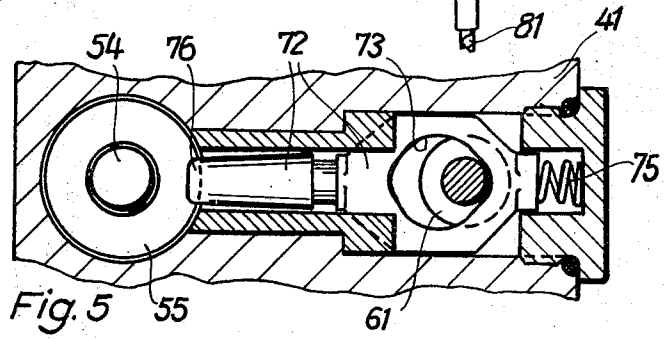

Fig. 5

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DEVICE FOR INFLATING FLOATING BODIES OF LIFE-SAVING EQUIPMENT

Filed Dec. 11, 1968 4 Sheets-Sheet 4

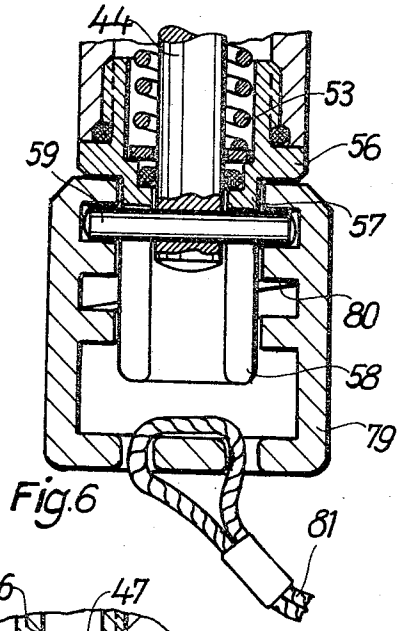

Fig.6

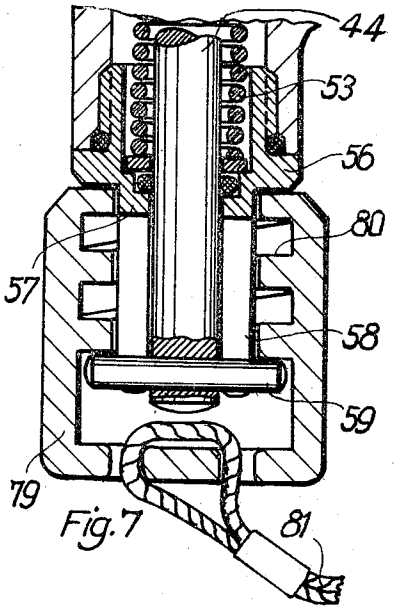

Fig.7

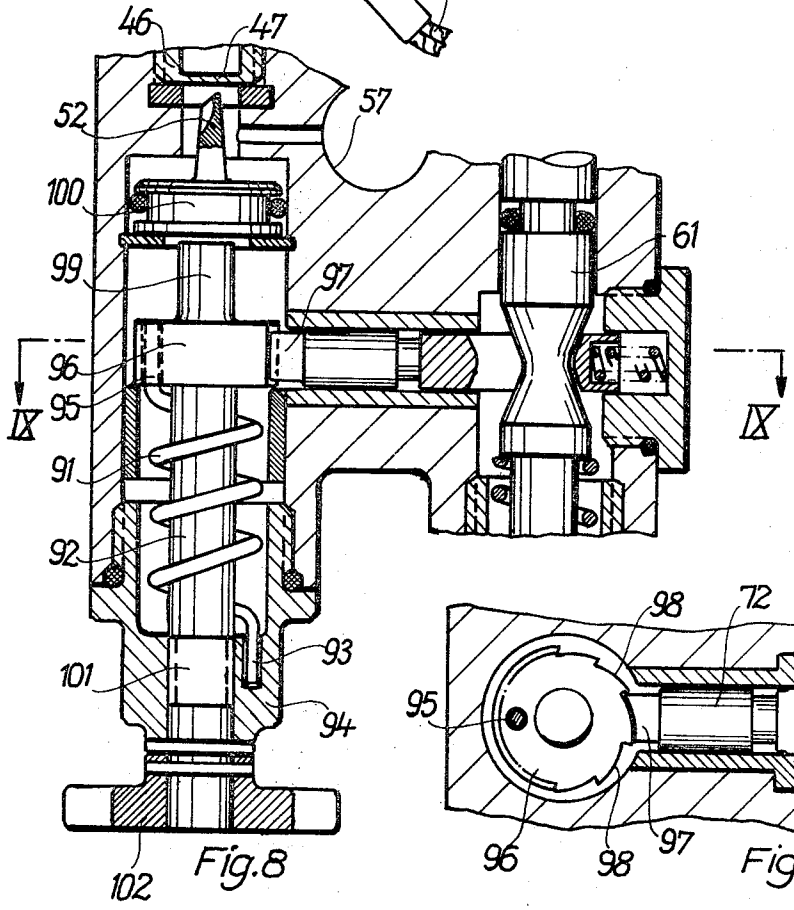

Fig.8

Fig.9

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3,526,339

DEVICE FOR INFLATING FLOATING BODIES OF LIFE-SAVING EQUIPMENT

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Claims priority, application Germany, Dec. 12, 1968, 1,531,673; Nov. 7, 1968, 1,807,384
Int. Cl. B67b 7/24
U.S. Cl. 222—5 11 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for connection with a source of fluid pressure and with inflatable life-saving equipment for controlling the inflation of the latter in which a piercing member operable to pierce the closure member of a compressed air containing container is controlled by a spring-loaded displaceable spindle so as in one position of said spindle to prevent said piercing member from moving into its piercing position and in response to another position of said control spindle to cause said piercing member under the influence of a spring to move into piercing position.

The present invention relates to a device for inflating floating bodies of life-saving equipment and the like as, for instance, inflatable suits, inflatable rafts, and the like, which are inflated by a pressure gas container. The present invention is based on a device of this type in which the path for the gas under pressure is opened by means of a spring-loaded striker opening a wall normally closing said container. The spring is controlled by a body, which under the influence of water, changes its volume and is adapted, in particular, either to dissolve or to expand.

It is an object of the present invention so to design a device of the general type set forth above that it can be released selectively automatically or by hand.

It is another object of this invention to provide a device, as set forth in the preceding paragraph, which is simple in construction and very reliable in operation.

These and other objects and advantages of the invention will appear more clearly from the following specification, in connection with the accompanying drawings, in which:

FIG. 1 diagrammatically shows a section through a device according to the present invention.

FIGS. 2 and 3 show portions of the device of FIG. 1, but in two different positions of operation with regard to FIG. 1.

FIG. 4 shows a modified locking mechanism for use in connection with the control of the striker of the device according to FIGS. 1–3.

FIG. 5 is a section taken along the line V—V of FIG. 4.

FIGS. 6 and 7, respectively, illustrate the lower portion of FIG. 4 in two different positions.

FIG. 8 shows a further modification of the locking mechanism for use in connection with the control of the striker of the device according to FIGS. 1–3.

FIG. 9 is a section taken along the line IX—IX of FIG. 8.

The device for inflating the floating body of life-saving equipment is characterized primarily in that the control

of the striker spring is effected by a spring-loaded displaceable spindle which, by means of a body adapted to be influenced by water, is held in a position in which the striker is blocked, said spindle being adapted independently from said body which forms a supporting member, to occupy a position in which it relieves said striker to permit the latter to act.

The spring acting upon the control spindle may be arranged completely independently of the striker spring and may be pre-loaded in such a way that on one hand it will establish a power connection between the spindle and said body or supporting member until said body or supporting member has changed its volume by the influence of water, and on the other hand when releasing the device by hand the preload of the spring can easily be overcome by pulling the control spindle out of its housing. The said preload may expediently be so selected that it initiates the displacement of the control spindle when the supporting member loses its pressure resistance, for instance, when in view of the water effect said supporting member begins to disentegrate, whereby the automatic response of the device will be accelerated.

The release of the device is also possible by means of a supporting member in which the change in volume caused by the influence of water consists in an expansion which displaces the control spindle. The preload of the spring is to be adapted to the forces occurring in this connection.

According to a further development of the present invention, the control spindle is arranged adjacent to and particularly parallel to the striker in such a way that the control spindle will be able to displace a locking member arranged transverse to said striker. To this end, the spindle is provided with a protrusion associated with the locking position and with two recesses which make possible an escape of the locking member for releasing the striker. Expediently, the locking member is mounted in a passage which establishes connection between the control spindle and the guiding means for the striker. For purposes of reducing the friction, the locking member is advantageously provided with balls as engaging bodies.

According to a modification, the locking mechanism provided between the control spindle and the striker may comprise a latch forming a locking member which is likewise transversely displaceable, but is prevented from rotating in the housing of the device and has one of its ends in engagement with a cam of the control spindle while its other end extends into the path of the striker. The spring-loaded latch assures the start and transfer of the releasing movement from the control spindle to the striker inasmuch as it forms a rigid member which is effected solely by the movement of the control spindle and is independent of the tension of the striker spring. When the device occupies its releasing position, the control spindle keeps the transversely displaceable latch outside the path of the striker, thereby making possible its return to the loaded position. To this end, in conformity with the present invention, the shank of the striker is axially displaceably arranged in the housing of the device but is nonrotatably guided and is provided with protrusions for engaging a nut which is nondisplaceable relative to the housing.

It is particularly advantageous for this purpose to employ a handle which is operatively connected to the control spindle for selectively releasing the device manually,

said handle being adapted to remain connected to the control spindle when returning the striker spring.

According to a further modification of the invention, the striker may be driven forward by a torsion spring which is tensioned by a rotary movement, while the latch under the influence of the control spindle engages a ratched wheel which is nonrotatably mounted on the striker. Between said striker and the housing of the device there are provided inclined guiding means which impose upon the rotary movement of the striker a forward movement of the striker in view of the relaxation of the torsion spring.

The device may have a housing, for instance, of synthetic material in which the control spindle is guided while the striker with its spring is held in a metallic insert to which the pressure gas container is detachably connected. However, if desired, the housing may together with said insert form a single integral piece and may be made entirely of metal, especially light metal.

In addition to being able automatically or by hand to be released, the device according to the invention may also be so designed that it can be released exclusively by hand while still permitting automatic release. To this end, the bearing for the control spindle is designed as closure member which selectively with both ends may be inserted in the housing and, more specifically, in such a way that it comprises at one end, holding means for the supporting member and at the other end merely an abutment for the spring-loaded control spindle. The operation of the device will also, in this instance, consist of withdrawing the spindle by hand from the housing and thus is the same as is the case where it may be released selectively by hand or automatically.

Referring now to the drawings in detail, and more specifically to FIGS. 1–3 thereof illustrating different operational positions of the device, it will be seen that the device comprises a housing **1** of, for instance, synthetic material having inserted thereinto a metallic cylinder **2**, said cylinder **2** being held in said housing by means of a threaded cap **3**. A bottle **6** is threaded into a centrally located thread **5** of the upper cylinder portion **4**. The said bottle **6** contains a gas under pressure, for instance, air under pressure and has its opening closed by a diaphragm **7**. The cylinder **2** has a first or main bore **8** in which is reciprocably located a piston **9** having an extension **10** which is reciprocably guided in a secondary bore **11**. The said extension **10** carries a pin **12**, for instance, of a V-shaped cross section, said pin pointing toward said diaphragm **7**. As will be seen from the drawing, the piston **9** is under the preload of a strong helical spring **13**, one end of which rests against the threaded cap **3**.

An annular recess **14** in cylinder **2** communicates with the bore **11** of said cylinder through the intervention of one or a plurality of passages **15** and furthermore communicates with a chamber **17** through one or more passages **16** in the housing **1**. The chamber **17** is adapted to be connected to the floating body of a life-saving device, for instance, an inflatable life jacker or the like.

The housing **1** is furthermore provided with a second bore or chamber **23** and a third bore **18** which is substantially perpendicular to the bore **8** of the cylinder **2** and leads into the said bore **8**. The bore **18** is filled with a row of balls of which the ball **19***a* engages a taper **20** of piston **9** when the ball **19***b* at the opposite end of bore **18** engages a collar **22** of a spindle **21** which is longitudinally displaceable in the second bore **23** of the housing **1**. Instead of the central balls **19**, also a cylindrical bolt **19***e* (see FIG. 3) may be interposed between the balls **19***a* and **19***b*.

Housing **1**, as above mentioned, comprises the bore or chamber **23** which is substantially coaxial with the spindle **21**. In a sleeve **24** held by an insert **25** there is provided a body **26** which when in dry condition has a certain pressure resistance, but disintegrates quickly when coming into contact with water. The insert **25** is threaded into a correspondingly threaded bore **36** while simultaneously closing said threaded bore.

When the spindle **21** occupies the position shown in FIG. 1, it is held in this position due to the fact that the spring **27** which has one end in engagement with the plug **29** has its other end in engagement with the flange **28** and thus presses the spindle **21** against the body **26** which, as mentioned above, is held by a sleeve **24** and the insert member **25**. The bore **30** of the insert **25** is tightly closed by a protective cap **31**. A plurality of passages **32** lead from the chamber **23**, which receives the body **26**, to the outside of the housing **1**. The extension **10** of piston **9** and the spindle **21** are respectively provided with seals **10***a* and **21***a*.

FIG. 1 shows the device according to the present invention in condition of readiness. As will be seen from FIG. 1, the piston **9** is held in its loaded condition with spring **13** compressed, due to the fact that the ball **19***b* engages the collar **22** of spindle **21** while the ball **19***a* engages the taper **20** thereby preventing the spring **13** from moving the piston **9** into its effective position. It will be evident that the pressure exerted by collar **22** on the ball **19***b* is conveyed by the balls **19** to the ball **19***a*.

The automatic release of the device according to the invention is brought about, for instance, when the carrier of the lifesaving equipment which has the device according to the invention connected thereto through chamber **17**, is in the water. It will be appreciated that the water will then pass through passages **32** into the chamber **23** and in a minimum of time causes disintegration of the supporting body **26**. As soon as the body **26** disintegrates, the spring **27** will push the spindle **21** into the position shown in FIG. 2. As will be seen from FIG. 2, the ball **19***b* has entered the fillet **33** due to the fact that when the spindle **21** moves upwardly fillet **33** became aligned with the transverse bore **18**, and due to the fact that the ball **19***a* also now able under the influence of the pressure exerted by spring **13** on the piston **9** to move toward the right with regard to FIG. 2 while also pushing toward the right the balls **19** and **19***b*. In this way the piston **9** is no longer held in its FIG. 1 position so that the spring **13** now throws the piston **9** upwardly with the result that the pin **12** pierces the diaphragm **7** thereby establishing communication between the interior of the bottle **6** and the chamber **17** through passages **14**, **15**, and **16** with the result that the compressed air can pass from the bottle **6** through chamber **17** into the life saving equipment, for instance, an inflatable jacket.

If the collar **22** instead of being cylindrical is designed conically for engagement with the ball **19***b*, the pressure exerted by the spring **13** through piston **9** onto the locking balls **19**, **19***a*, **19***b* will, depending on the direction of the taper either aid the spring **27** or aid the supporting body **26** in counteracting the spring **27**.

If it is desired to release the device according to FIGS. 1 to 3 by hand, it is merely necessary to provide the control spindle **1** with a handle **34** which is to be connected to the lowermost end (with regard to FIG. 1) of the spindle **21**. It will be appreciated that if a person pulls the handle **34** in downward direction (with regard to FIG. 1) against the thrust of spring **27** the fillet **35** comes into alignment with the bore **18** so tht the row of balls **19***b*, **19**, **19***a* will free the piston **9** as described above and the pin **12** will pierce the diaphragm **7** and compressed air from the bottle **6** will pass through chamber **17** into the life saving equipment to be inflated.

If it is desired to have the device shown in FIGS. 1 and 2 operated only manually, but not automatically, the device of FIG. 1 can easily be correspondingly converted without requiring additional equipment. It is merely necessary to unscrew the insert **25** and to remove the cap **31** whereupon the extension **38** whose thread **37** is the same as the thread **36***a* is screwed into the threaded bore **36**. This position is shown in FIG. 3 from which it will be seen that the protrusion **39** of the extension **38**

now holds the spindle **21** in the position in which the latter was held according to FIG. 1 by the body **26**.

If the spindle **21** is now by pulling the handle **34** moved downwardly as describing above in connection with FIG. 1, the diaphragm **7** will be pierced by the pin **12**, and compressed air will pass from the bottle **6** through chamber **17** into the inflatable life-saving equipment.

The supporting body **6** may be any material which while being pressure resistant in dry condition will quickly disintegrate when coming into contact with water. Such material may have its outer surface hardened when in contact with air while the inner material remains soft. Magnesium has proved particularly suitable for the supporting body **26**.

Referring now to FIGS. 4–7, the arrangement shown therein comprises a compressed air containing bottle **46** having its neck **45** threaded into a housing **41** while the mouth of said bottle is closed by a diaphragm **47**. Opposite said neck **45** in the upper portion of the housing **41** there is provided a bore **42** having longitudinally displaceably arranged therein a disc valve body **43** with a needle **52**. Said body **43** is under the influence of a striker **44** which in its turn is under the influence of a strong helical spring **53**. More specifically, the spring **53** has one end in engagement with a sleeve **48** resting against a flange **55** of a striker body **54**, whereas the other end of spring **53** engages a washer which in its turn engages a shoulder **56***a* of an insert **56** which is firmly threadedly connected to the housing **41** and has a sleeve-shaped extension **57**. The said sleeve-like extension **57** is provided with two diametric slots **58** in which is guided a transverse pin **59** located in a bore **44***a* at the lower end of the striker bolt **44**.

The housing **41** is furthermore provided with aligned bores arranged in parallel spaced relationship to the bore **42** and containing the control and release mechanism for the device of FIG. 5. This control and release mechanism comprises primarily a longitudinal displaceable spindle **61** which is held in engagement with a body **66** by a preloaded spring **67**. The body **66** may be of the same type as the body **26** of FIG. 1 which means it will be pressure resistant in dry condition to the extent of withstanding the pressure of the spring **67**, but when coming into contact with water will quickly dissolve and disintegrate. The body **66** is held in its position on one hand by the spring-loaded spindle **61** and on the other hand by a hollow sleeve **64**, the bore **64***a* of which communicates through bore **82***a* and passages **68** with the outside so that when the carrier of the device is in the water, water may pass through passages **68**, bore **82***a* and bore **64***a*, to the body **66** to bring about its disintegration. Also in this instance, members **43** and **61** are respectively provided with seals **43***a* and **61***a*.

Housing **41** furthermore comprises a rectangular transverse passage **71** in which a locking member **72** is longitudinally, but nonrotatably displaceable. As will be seen from FIGS. 4 and 5, the locking member **72** is provided with an opening **73** the confining walls **73***a*, **73***b* of which surround a constriction **74** in approximately the central portion of the spindle **61**. The profile of the opening **73** corresponds substantially to the profile of said constriction **74** which has the shape of a rounded-off double cone. A helical spring **75** holds the confining wall **73***b* in engagement with the spindle **61** and more specifically the constriction **34** thereof. By means of a nose **76** the locking member **72** extends into the bore **42** and when in position of readiness as shown in FIG. 4 extends over the flange **55** of the striker body **54** thereby holding the latter and consequently the striker bolt **44** and its spring **53** in the loaded position.

When the body **66** after the admission of water loses its pressure resistance, the spring **67** throws the spindle **61** forwardly so that the lower conical surface of the constriction **34** slides over the surface of the confining wall **73***b* thereby moving the locking member **72** toward the right so that its nose **36** is withdrawn from the flange **55** of the striker body **45** and the loaded spring **53** throws the striker bolt **44** with the striking body **54** against the valve body **43** so that the pin **52** thereof pierces the diaphragm **47**. Compressed air then passes from the bottle **46** through passages **77** and **57** which are sealed relative to the housing **41** by the valve body **43** and passes into the life saving equipment to be inflated. The collar **78** of the spindle **61** which collar is now in the opening **73** retains the locking pin **72** in its releasing position.

In order in the position of the locking pin **72** to place the device in readiness after a new compressed air bottle has been connected to the housing **41**, there is provided a bushing **79** (see FIGS. 6 and 7) with an inner thread **80** by means of which the bushing is brought into engagement with the transverse pin **59** of the striker bolt **44** and by turning said bushing **79** it pulls the striker bolt **44** back into the loaded position according to FIG. 7. The bushing **79** rests against the insert **56** and the pin **59** of the striker bolt **44** moves in the slots **58**. After the insert **65** has been unscrewed and a new supporting body **66** has been inserted into the holding bushing **64**, the insert **65** is again screwed onto the housing **41** and the spindle **61** is returned to its position of readiness according to FIG. 4. This may be aided by pulling at a cord **81** or the like connected to the lower end (with regard to FIG. 4) of the spindle **61**. During this displacement of the spindle **61**, the spring **75** moves the locking member **72** to its locking position in which the nose **76** of the locking member **72** extends over the flange **55** of the striker body **54** and thus secures the striking bolt **44** in its position of readiness so that the bushing **79** can be unscrewed and removed from the device.

According to another suggestion in conformity with the invention, the bushing **79** may be connected to the end of the cord **81** and form, so to speak, the trigger for the spindle **61** to thereby also permit the operation of the device by hand. During a manual operation, the above described releasing operation takes place with the only difference that instead of the collar **78**, the central portion of the spindle **61** moves the locking member **72** to its releasing position. Prior thereto, the now effected elimination of the body **66** is compensated for by the fact that the upper portion **82** of the insert **65** is screwed into the housing **42**. In this way, a correspondingly dimensioned protrusion **83** forms the counterbearing for the upper end of the spindle **61** so that the spindle will, for manual operation, occupy the same position of readiness as is illustrated in FIG. 4 for the automtic release.

Referring now to FIGS. 8 and 9, the embodiment shown therein illustrates the possibility of employing a torsion spring for driving the striker bolt. More specifically, a torsion spring **91** surrounds the striker bolt **92** and has its lower end **93** located in a stationary housing part **94**. The upper end **55** engages a ratchet wheel **69** (see also FIG. 9) which is nonrotatably mounted on the striker bolt **92** and more specifically at the level of the locking member **72** which latter is designed and arranged and the control of which by spindle **61** is the same as in FIGS. 4 and 5. A difference exists merely in that the head **97** of the locking member **72** is so designed that it is able in the manner of a pawl to engage the teeth **98** of the ratched wheel **96**, as is clearly shown in FIG. 9. The upper portion **99** of the striker bolt **92** extends nearly below the valve body **100** which corresponds to the part **43** of FIG. 4, so that the striker bolt **92** requires only a short stroke for piercing the diaphragm **47** by means of the pin **52**. This stroke is imparted upon the striker bolt **92** by the fact that the locking member **72** as soon as it is moved toward the right (with regard to the drawing) by the

control spindle **61** during the axial displacement thereof will by means of its head **97** free the ratched wheel **96**. The torsion spring **91** in its tendency to relax will then carry out a rotary movement which by inclined means **101** in the housing portion **94** will be converted into an axial displacement of the bolt **92** whereby the bolt **92** by means of the valve body **100** and the pin **52** pierces the diaphragm **47** of the compressed air containing bottle **46**. The inclined guiding means **101** may, as indicated in FIG. 8, form a helical path but may also be designed in a different way, for instance, in the form of fixed protrusions or in the form of rolling bodies which are mounted on the bolt **92** or therein and guided in an ascending groove of the housing part **94**. After the releasing movement, the striking bolt **92** can be returned to its position of readiness by tensioning the torsion spring **92**. This may be effected by turning the bolt **92** by means of a fixed or loose handle **102** while the locking member **72**, **97** through the ratched wheel **96** holds the bolt **92** or spring **91** in position of readiness.

It is, of course, to be understood that the present invention is, by no means, limited to the showing in the drawings, but also comprises modifications within the scope of the invention.

What we claim is:

1. An apparatus for connection with a source of fluid pressure and with inflatable life saving equipment for controlling the inflation of the latter, which includes: housing means having a main bore, a first portion of said bore being adapted detachably to receive the mouth portion of fluid pressure container means with a closure member closing said mouth portion, plunger means reciprocably mounted in a second portion of said bore, piercing means likewise reciprocable in said main bore and movable by said plunger means from an ineffective position into said first portion for piercing the closure member of a fluid pressure container received in said first bore portion, spring means continuously urging said plunger means to move said piercing means into said first bore portion, control means normally locking said plunger means in an ineffective position for preventing said plunger means from moving said piercing member into said first bore portion, and means operable to bring about a displacement of said control means to unlock said plunger means thereby permitting said spring means to move said plunger means so as to cause the latter to move said piercing member into said first bore portion for piercing the closure member of pressure container means in said first bore portion, said housing means also being provided with passage means communicating with said main bore and adapted to be connected to the equipment to be inflated, a second bore and also a third bore having its axis intersecting the axes of said main bore and said second bore, said control means including a control spindle reciprocable in said second bore and also including reciprocable means in said third bore for locking said plunger means in its ineffective position in response to a first position of said control spindle and to unlock said plunger means in response to said control spindle moving out of said first position to another position.

2. An apparatus according to claim **1**, in which said plunger means has a tapered portion tapering in the direction toward said piercing member, and in which said reciprocable means is formed by ball means pressed by said control spindle into said main bore and against said taper when said control spindle is in said first position, said control spindle also being provided with recess means to receive a portion of said ball means for relieving the pressure thereon when said spindle moves out of said first position to thereby permit said plunger means under the influence of said spring means to displace said ball means out of said main bore and to move said piercing member into its piercing position.

3. An apparatus according to claim **2**, in which said recess means of said control spindle are formed by two fillets spaced from each other in axial direction of said control spindle, the spindle portion between said two fillets being operable to engage said ball means and to exert pressure thereon.

4. An apparatus according to claim **1**, which includes abutment means for holding said control spindle in said first position.

5. An apparatus according to claim **4**, which includes additional spring means continuously urging said control spindle out of its first position toward said abutment means, and in which said abutment means is formed by a body adapted in dry condition to hold said control spindle in its first position and to disintegrate in wet condition to thereby permit said control spindle to move out of its first position, said housing means including passage means leading from the outside of said housing means to said abutment means.

6. An apparatus according to claim **5**, which includes plug means having a first end portion with holding means detachably insertable into said housing means for holding means for holding said body adapted to disintegrate in wet condition, said plug means also having a second end portion likewise detachably insertable into said housing means and having a water resistant extension operable to act as abutment means in the absence of said body disintegrating in wet condition for abutting said control spindle in said first position of said spindle.

7. An apparatus according to claim **1**, in which said reciprocable means in said third bore is formed by a latch member having one end portion provided with a longitudinal opening the defining walls of which surround said control spindle, said longitudinal opening extending in the longitudinal direction of said latch member and having a dimension in this direction which is greater than the extension of said latch member in said last mentioned direction, the other end portion of said latch member being provided with a head portion operable in a first position of said latch member to extend into said main bore for preventing said plunger means from moving said piercing member into piercing position, and auxiliary spring means continuously urging said latching member head into said main bore, said control spindle being provided with cam means operable to act upon a wall portion defining said longitudinal opening in said latch member and also being operable in response to a displacement of said control spindle to withdraw said latch member away from said plunger means to permit the latter to move said piercing means into piercing position.

8. An apparatus according to claim **7**, in which the wall defining said longitudinal opening in said latch member corresponds in contour to the contour of the surface of said cam means of said control spindle.

9. An apparatus according to claim **8**, which includes means for preventing rotation of said latch member.

10. An apparatus according to claim **7**, which includes ratched wheel means fixedly connected to said plunger means, and torsion spring means forming said spring means for urging said plunger means to move said piercing means into piercing position, said torsion spring means having one end connected to said ratched wheel means and having its other end fixedly connected to a stationary part of said housing means, rotatable means connected to said plunger means for rotating the latter and thereby said ratched wheel means, the head portion of said latching member being operable in the manner of a pawl to engage said ratched wheel means, said torsion spring means when in loaded condition being operable in response to the withdrawal of said latch member head portion from said ratched wheel means to rotate said plunger means, and means associated with said plunger means and operable in response to the rotation of said plunger means by said torsion spring means to move said plunger means into position for actuating said piercer member.

11. An apparatus according to claim 7, in which that portion of said plunger means which is remote from said piercing member is provided with radially protruding means guided by said housing means so as to be movable in axial direction only of said plunger means while being prevented from turning about the axis of said plunger means, said apparatus also including nut means with high-pitch thread engaged by said protruding means, said thread being non-selflocking, said nut means being movable relative to said protruding means for effecting a return of said plunger means to its ineffective position.

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