

March 12, 1963

B. R. A. REFFELL
INFLATABLE DINGHIES

3,080,582

Filed Dec. 1, 1960

5 Sheets-Sheet 1

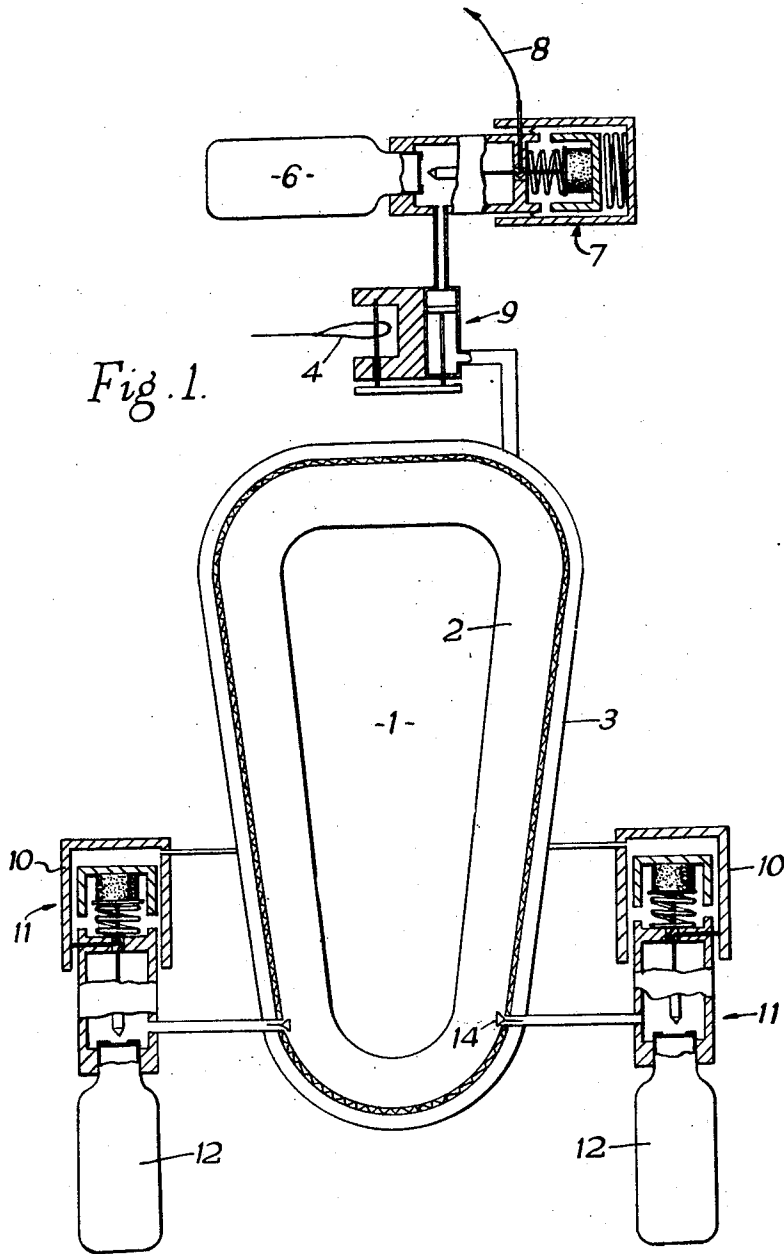


Fig. 1.

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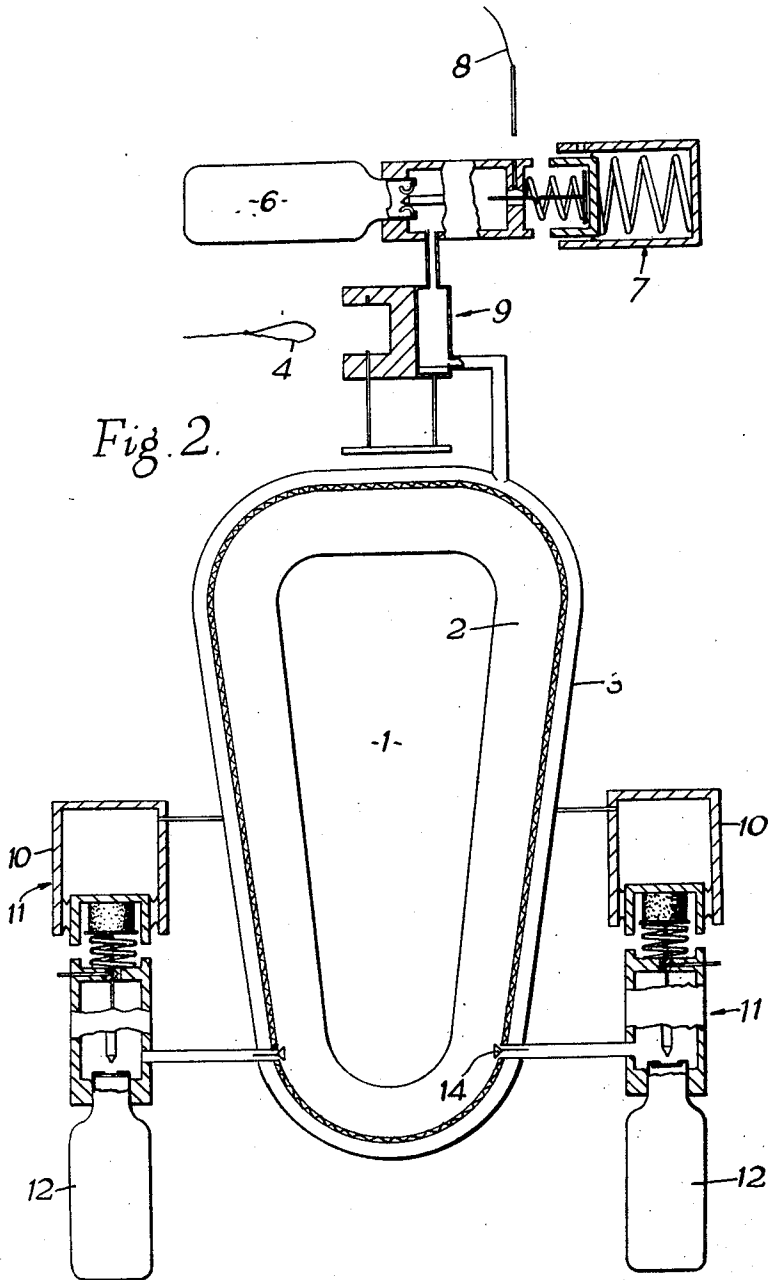


Fig. 2.

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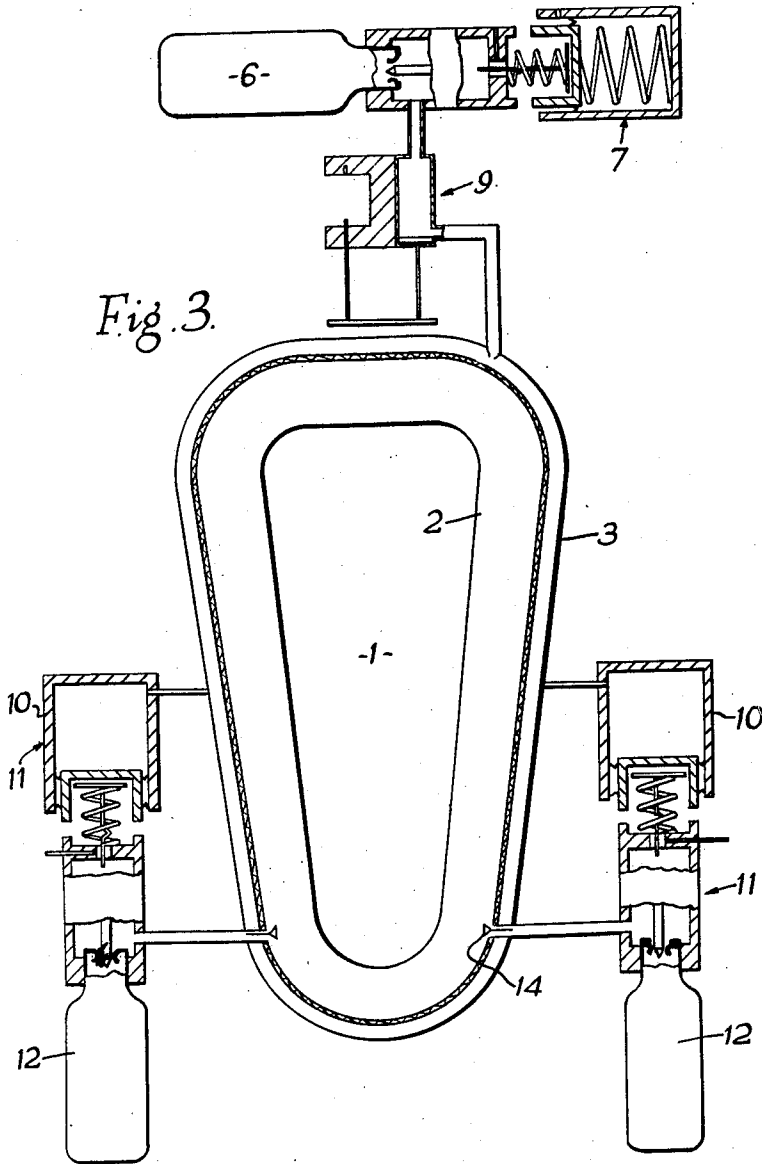
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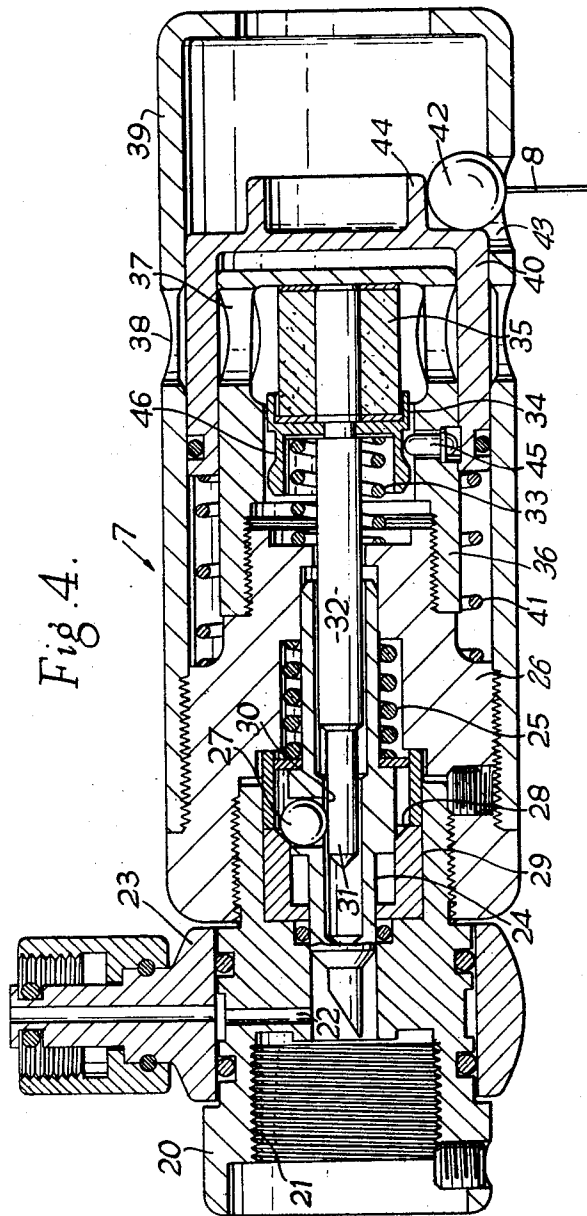


Fig. 4.

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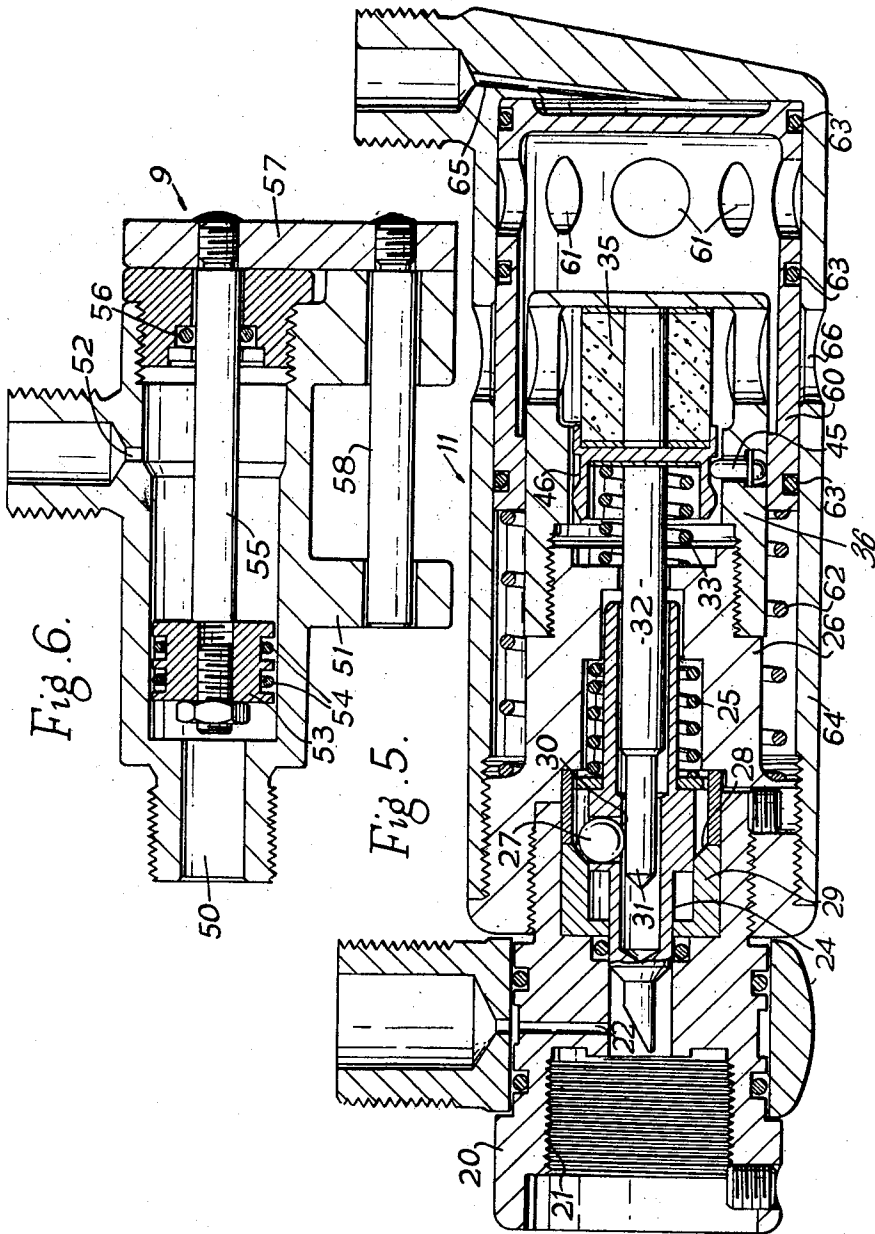


Fig. 6.

Fig. 5.

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INFLATABLE DINGHIES

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6 Claims. (Cl. 9-2)

The present invention relates to inflatable dinghies and in particular to inflatable dinghies of the type which are secured to an airman in a deflated condition as a personal pack.

Dinghies of this type at present in use require to be boarded from the water after inflation and in the event of the wearer being seriously wounded, unconscious or numbed, it would be impossible for him to carry out the necessary operations for inflating and boarding his dinghy.

It is an object of the present invention to provide a dinghy which on inflation by the release of gas to it from a gas storage, automatically spreads out beneath the wearer and is automatically inflated so that it is unnecessary for him to board the dinghy.

It is well-known that a rolled-up flexible tube has a tendency to straighten out when gas pressure is built up within it. The dinghy of the present invention makes use of this phenomenon.

The dinghy of the present invention comprises a peripheral buoyancy tube of relatively large cross section, a tube of relatively small cross section and adapted to withstand high internal pressure secured to the buoyancy tube, and extending substantially around the periphery of the buoyancy tube, means for releasing gas from a storage and leading it to said high pressure tube to inflate the same to a high pressure, said release means being adapted to operate automatically on immersion in water, means for releasing gas to the buoyancy tube from a separate storage, said means being arranged to operate at an interval after the operation of the high pressure tube inflating means, said interval being sufficient to permit the dinghy to unfold from a folded condition by reason of the inflation of the high pressure tube.

Preferably the buoyancy tube is inflated by admission of gas at points on opposite sides of the dinghy, so as to overcome the tendency of a dinghy to overturn by reason of initial inflation of the buoyancy tube on one side only.

In the construction of the dinghy of the present invention there is no direct communication between the high pressure tube and the buoyancy tube, so that gas cannot pass through the high pressure tube into the buoyancy tube and thus cause partial inflation of the buoyancy tube before the dinghy has straightened out fully.

It is preferred to arrange that the operation of the automatic means for inflating the buoyancy tube is initiated by gas under pressure from the high pressure tube. The admission of gas to the high pressure tube may be utilised to initiate the operation of the time delay means which, after a predetermined interval, permits the admission of gas to the buoyancy tube.

Inflation devices which release gas from a storage when the device is immersed in water are already known. The operation of such an inflation device may depend upon the solution of a soluble plug or upon the expansion of a material which swells in water to release a spring-loaded plunger which opens the gas storage. In the dinghy system of the present invention a water actuated inflation device of the above type is provided to release gas from the first storage to the high pressure tube and this particular inflation device is constructed with a locking arrangement which holds it against actuation until the air-

man has separated from some part of the aircraft, usually an ejector seat. After release of the locking arrangement, a short immersion (about 10 seconds) of the inflation device in water causes it to release gas to the high pressure tube. Since the pressure of gas in a storage container is usually much higher than pressure which the high pressure tube can withstand, the quantity of gas in the first storage must be calculated so as not to overstress the tube on release.

Preferably the buoyancy tube is inflated by release of gas from two separate storages which communicate respectively with points on opposite sides of the peripheral buoyancy tube. Each of these storages is provided with a release device which is very similar in principle to that used with the first storage. It includes a water sensitive element which is adapted to release a spring-loaded plunger after exposure to water for a predetermined time. The water sensitive element is, however, shrouded to prevent admission of water and this shroud is adapted to be moved to expose the water sensitive element by means of a piston in a cylinder connected to the high pressure tube. Thus, the admission of gas from the first storage to the high pressure tube depresses the piston to expose the water sensitive element and thus initiates the operation of the inflator so that gas is released to the buoyancy tube after a predetermined interval which is sufficient to permit the dinghy to be unfolded by the inflation of the high pressure tube.

It will readily be appreciated that this system, using three water sensitive inflation devices, will always operate readily because the dinghy pack is carried strapped to the airman and must necessarily be submerged in the event of a descent into the sea.

Reference is hereinafter made to the accompanying drawings wherein:

FIGURE 1 is a diagrammatic drawing of the dinghy system of the invention in the uninflated state,

FIGURE 2 is a diagrammatic drawing of the dinghy system during the inflation of the high pressure tube,

FIGURE 3 is a diagrammatic drawing of the dinghy system at the completion of the inflation of the buoyancy tube,

FIGURE 4 is a longitudinal section of the release device for the inflation of the high pressure tube of the dinghy,

FIGURE 5 is a longitudinal section of one of the release devices for the inflation of the buoyancy tube of the dinghy,

FIGURE 6 is a longitudinal section of the dinghy pack clasp release device.

The system of the present invention is not limited in its employment to any one particular construction of foldable inflatable dinghy and any inflatable dinghy of the type having a peripheral buoyancy tube may be adapted to the system of the present invention.

It will be appreciated that the self-unfolding and self-inflating system for dinghies provided by the present invention is particularly useful for one-man dinghies carried on the person by aircrew, but may also be applied to larger dinghies.

The system illustrated in the drawings is applied to a one-man dinghy.

The dinghy comprises a floor 1 and a peripheral, low pressure, buoyancy tube 2 in conventional manner. A flexible tube 3 of high pressure material, adapted to withstand an internal pressure of, say, 100 pounds per square inch, is secured around the periphery of the buoyancy tube 2.

The dinghy would ordinarily be folded and secured within a releasable pack or cover when in the uninflated condition. The clasp of such a pack is indicated diagrammatically at 4.

The construction and arrangement of a dinghy pack is well known in the art and forms no part of the present invention.

The release of the pack clasp 4 and the inflation of the high pressure tube 3 is effected by the release of gas from a storage container 6, the contents of which are carefully matched to the capacity of the high pressure tube 3. The release of gas from the container 6 is effected by a water-actuated release device 7, shown in FIGURE 4, and described in detail below. The device 7 includes a soluble plug, which is held shrouded against the entrance of water until a lock is withdrawn by a line 8, usually secured to the ejector seat of the aircraft, so that the shroud lock is withdrawn as soon as the airman separates from his ejector seat.

The release of gas from the container 6 is timed to take place after approximately fifteen seconds immersion and is first of all operative to actuate a dinghy pack clasp release device 9, later described in detail with reference to FIGURE 6 and this device prevents admission of gas to the high pressure tube 3 until it has been brought to a pack clasp releasing position. When the device has reached this position, the gas from the storage container 6 enters the tube 3 and inflates it to a high pressure of the order of 100 pounds per square inch and simultaneously unrolls the dinghy if the dinghy is in a folded condition. When the pressure of gas in the tube 3 has risen to a predetermined value it is effective to move shrouds 10 of water-operated release devices 11. This is the position shown in FIGURE 2.

The lifting of the shrouds 10 exposes soluble plugs in the devices 11 to water and these plugs are timed to collapse after about ten seconds to permit the devices to release gas from storage containers 12, as indicated in FIGURE 3. The gas from the containers 12 enters the buoyancy tube 2 through non-return valves 14 of conventional design. The containers 12 are charged with a sufficient quantity of gas to fully inflate the buoyancy tube at all ambient temperatures likely to be encountered in service. It follows that the buoyancy tube 2 is provided with a relief valve to blow off excess gas to avoid any possibility of the tube being ruptured in the event of high ambient temperatures. Relief valves of various designs are however a standard fitting in the buoyancy tube of inflatable dinghies and it has not been considered necessary to show such a valve in the present drawings.

It will be appreciated that the water-operated release devices 11 act to impose a time delay between the admission of gas to the high pressure tube 3 from the storage 6 and the admission of gas to the buoyancy tube 2 from the containers 12 so that there is a sufficient time interval to allow the dinghy to unfold before inflation of the buoyancy tube commences.

In FIGURE 4 there is shown in detail a water-operated device for release of gas from a storage container 6. This device comprises a body 20, having an internal screw threaded socket 21 for engagement with complementary thread on the container 6. The body 20 has a gas outlet passage 22, through which the gas passes when a sealing diaphragm on the container has been ruptured, to pass into an outlet banjo 23 from which it passes through a flexible hose to the pack clasp release device 9.

The rupture of the sealing diaphragm of the container 6 is effected by a hollow plunger 24, which is urged in the diaphragm rupturing-direction by a heavy spring 25, which is arranged between an abutment in a body part 26, into which the body 20 is screw threaded, and an abutment on the plunger 24.

The plunger 24 is ordinarily held in the retracted position shown in FIGURE 4 by means of the engagement of a locking ball 27 with a chamfered face 28 of a guide bush 29.

The ball 27 lies in a hole 30 in the wall of the hollow plunger 24 and acts as a lock only so long as it projects beyond the periphery of the plunger 24. It is held in such projecting position by the tip end 31 of a release

spindle 32 and so soon as the release spindle 32 is withdrawn from contact with the ball 27, the plunger 24 is released to make a seal rupturing stroke. The spindle 32 is urged in the release direction by a compression spring 33 positioned in the body part 26 and an end cup 34 secured to the spindle 32. The movement of the release spindle is blocked by an annular soluble plug 35 held between the end cup 34 and a casing member 36 screw-threaded onto the body part 26. The casing member 36 is formed with a peripheral row of apertures 37 around the soluble plug 35 and the apertures 37 are in register with apertures 38 in an outer cover 39. The apertures 37 are however masked by a slidable shroud member 40 which is urged in an unmasking direction by a compression spring 41. The shroud member 40 is held against movement by a locking ball 42 screwed to the cable 8 and trapped between the side of an aperture 43 in the outer cover 39 and an angular abutment on the top of the member 40 defined by the top of said member and an annular member 44 carried thereon.

It will be appreciated that the soluble plug 35 is masked from accidental exposure to water until the shroud member 40 is released by means of the cable 8, so that gas cannot be released to unfold the dinghy by reason of the plug 35 being accidentally wetted by rain.

Furthermore the shroud member 40 also acts as a positive locking means to hold the release spindle 32 against movement in the event of the soluble plug being defective and crumbling prematurely before the release of the shroud member 40. This locking function is performed by co-operation between the shroud member and a locking pin 45 which is engaged in a shallow recess 46 in the periphery of the end cup 34. Endwise movement of the shroud member by its spring 41 simultaneously releases the pin 45 for outward movement and releases the spindle 32 from this positive lock.

In the construction shown the loading on the spring 33 required to move the release spindle 32 in the unlocking direction is light in relation to the loading on the spring 25 necessary to drive the plunger 24 in the diaphragm-rupturing direction. In consequence the static load on the soluble plug 35 is much less than it would be if the load of the spring 25 were imposed on it. Soluble plugs however have a tendency to crumble under heavy static loads and it is for this reason that the relatively complicated release device is employed instead of a simpler construction in which the movement of the diaphragm-rupturing plunger is directly resisted by a soluble plug.

The unmasking of the soluble plug 35 by movement of the shroud member 40 makes the device ready so that the striker 24 is released after immersion in water for the time necessary to disintegrate the soluble plug 35. It is perfectly possible to manufacture such plugs so that they disintegrate in a more or less uniform time when immersed in water. In the present instance the plug 35 is designed to break up in about fifteen seconds. As a result gas from the storage 6 is released about fifteen seconds after a pilot carrying on his person a dinghy of the present invention alights in the water and thus initiates the release of the dinghy from its packing and the automatic unfolding of the dinghy by the inflation of the high pressure tube 3.

The gas thus released passes through a flexible hose to the inlet 50 of the pack clasp release device 9, shown in FIGURE 6. This device is a very simple device having a body 51, in which there is a two diameter bore with a gas outlet passage 52 communicating with the larger diameter portion. The outlet 52 is sealed off from the inlet 50 by a piston 53, provided with sealing rings 54.

The pressure of gas released from the storage container 6 has the effect of moving the piston 53 along the bore, but gas cannot pass out through the outlet 52 to commence the inflation of the high pressure tube 3 until the piston 53 clears the outlet 52. The piston 53 is however connected by a piston rod 55, passing through a gland 56, to a connector bar 57 to which is also secured

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a latch bar 58. The latch bar 58 forms part of the clasp for the dinghy pack cover, but when it is withdrawn to the right in FIGURE 6, the clasp 4 is released. In consequence the dinghy pack cover is released before the admission of gas to the high pressure tube 3 can commence.

The construction of one of the water operated release devices 11, which are used to release gas from the storage containers 12 for the inflation of the buoyancy tube 2, is shown in FIGURE 5. The device 11 is essentially the same in construction as the device 7 shown in FIGURE 4. Like reference numerals are used in FIGURE 5 to indicate parts which are common to both constructions and these parts are not separately described. The essential difference between the two forms of water-operated release device lies in the method used for unmasking the soluble plug 35. In the construction shown in FIGURE 5, a shroud piston 60 slides on the outer surface of the casing member 36. The piston 60 has aperture 61, which can be brought into register with the apertures 37 in the casing member 36 by depressing the piston 60 against the pressure of a return spring 62. The piston 60 has external grooves for O-rings 63, which form a sliding seal against the wall of an outer cover 64, which acts as a cylinder and has a gas inlet 65 to admit gas from the high pressure tube 3 of the dinghy. The depression of the piston 60 by the admission of gas under pressure through the inlet 65 actuates the release device 11, by bringing the apertures 37 and 61 into register to permit water to enter through apertures 66 in the outer cover 64 and thus attack the soluble plug 35 so that the striker pin is released at a predetermined interval after the unmasking movement of the piston. It will be appreciated that since the release device 7 for the inflation of the high pressure tube 3 only operates when immersed, the piston 60 of a release device 11 only moves to the non-masking position in relation to the soluble plug when the release device is immersed.

It will be seen that the construction above described not only provides a fully automatic system for unfolding and inflating an inflatable dinghy, but also each device for release of inflating gas is locked against accidental movement to prevent premature inflation of either the buoyancy tube 2 or the high pressure tube 3. Such premature inflation could be disastrous in the extremely limited cockpit space of a single seat aircraft, for example.

I claim:

1. A self-unfolding inflatable floatable rescue device adapted to be stored in folded condition comprising floatable structure including a buoyancy tube of relatively large cross-section, expandable structure secured to said buoyancy tube and including an unfolding tube of much smaller cross-section and capable of withstanding a much higher gaseous pressure than said buoyancy tube for unfolding said buoyancy tube, a first source of gaseous medium under pressure having a valved outlet, a conduit connecting said outlet to the interior of said unfolding tube for conducting gaseous medium under pressure from said first source to said unfolding tube to effect unfolding of the rescue device upon opening of said valved outlet and to establish a predetermined pressure in said unfolding tube, means for effecting opening of said valved outlet, a second source of gaseous medium under pressure having a valved outlet, a conduit connecting said last mentioned outlet to the interior of said buoyancy tube to effect inflation of said buoyancy tube upon opening of said last mentioned outlet, a control head for effecting opening of said last mentioned valved outlet in re-

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sponse to a predetermined gaseous pressure, and a conduit establishing fluid flow communication between the interior of said unfolding tube and said control head for effecting operation of said control head in response of attainment of the predetermined pressure within said unfolding tube.

2. A device according to claim 1, wherein said means for effecting opening of said first mentioned valved outlet includes a water-sensitive element for initiating actuation after contact with water for a predetermined period, means for masking said element from contact with water, and manually operable means for moving said masking means to a non-masking position.

3. A device according to claim 1, wherein said control head for effecting opening of said last mentioned valved outlet includes a water-sensitive element for initiating actuation after contact with water for a predetermined period, means for masking said element from contact with water, and pressure operable means for moving said masking means to a non-masking position in response to pressure in said last mentioned conduit.

4. A device according to claim 1, wherein a pack-release device is arranged in said conduit connecting said unfolding tube and said first source, said pack-release device including a piston member movable under pressure from a conduit closing position to a conduit opening position and a latch member operable by said piston to be released.

5. A self-unfolding inflatable floatable rescue device adapted to be stored in folded condition comprising floatable structure including a buoyancy tube of relatively large cross-section, expandable structure secured to said buoyancy tube and including an unfolding tube of much smaller cross-section and capable of withstanding a much higher gaseous pressure than said buoyancy tube for unfolding said buoyancy tube, a first source of gaseous medium under pressure having a valved outlet, a conduit connecting said outlet to the interior of said unfolding tube for conducting gaseous medium under pressure from said first source to said unfolding tube to effect unfolding of the rescue device upon opening of said valved outlet and to establish a predetermined pressure in said unfolding tube, means for effecting opening to said valved outlet, sources of gaseous medium under pressure each having a valved outlet, a conduit connecting each of said last mentioned outlets to the interior of said buoyancy tube to effect inflation of said buoyancy tube upon opening of said last mentioned outlets, a control head for effecting opening of each of last mentioned valved outlets in response to a predetermined gaseous pressure, and conduits establishing fluid flow communication between the interior of said unfolding tube and each of said control heads for effecting operation of said control heads in response of attainment of the predetermined pressure within said unfolding tube.

6. A device according to claim 5, wherein the conduit of said last mentioned outlets are connected to said buoyancy tube at opposite sides thereof.

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