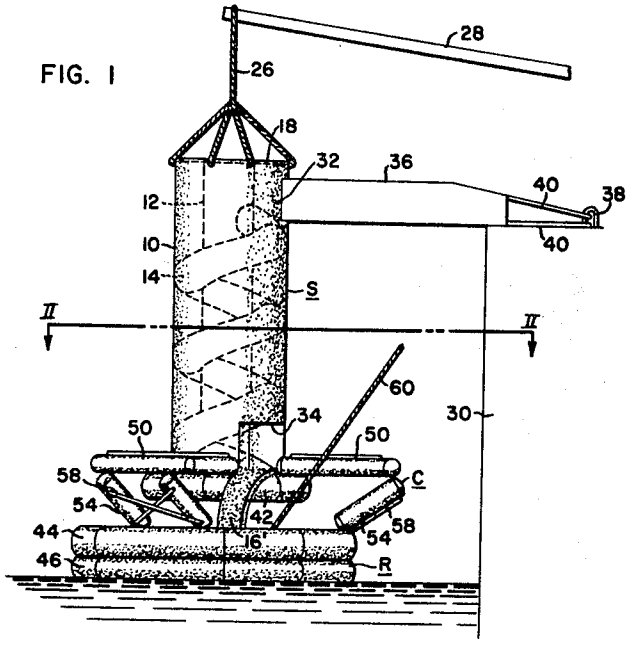
March 18, 1969 AKIRA UKAWA 3,433,323

INFLATABLE ESCAPE SLIDEWAY APPARATUS

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FIG. 1



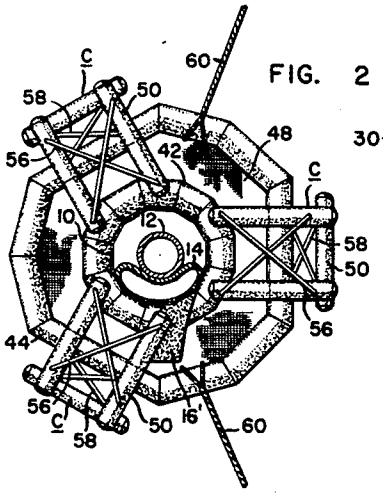
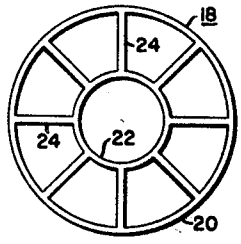




FIG. 2




FIG. 3



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FIG. 4

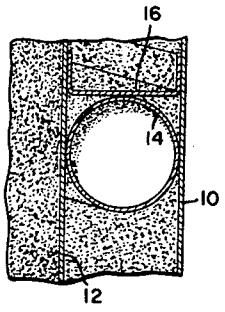



FIG. 5

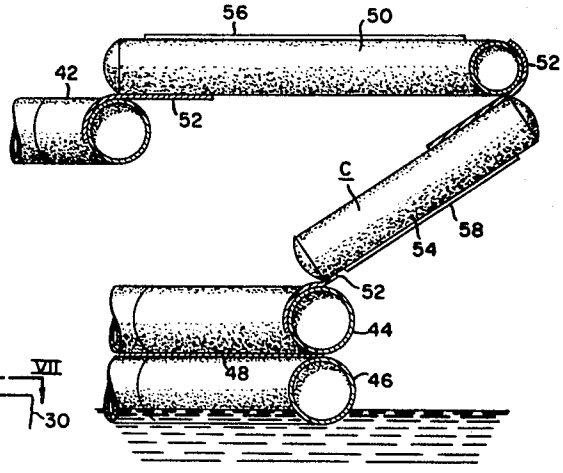
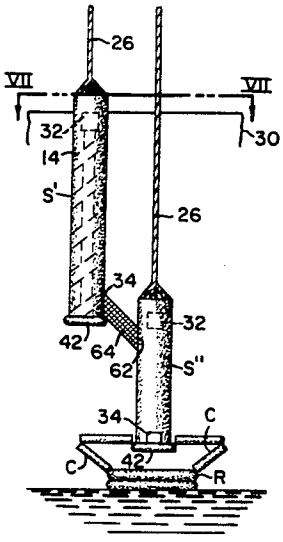



FIG. 6



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FIG. 7

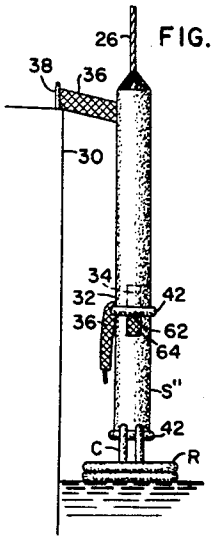
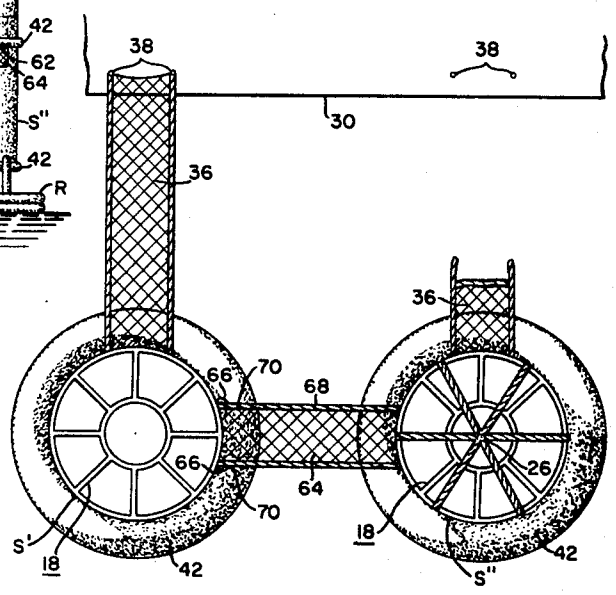



FIG. 8



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FIG. 9

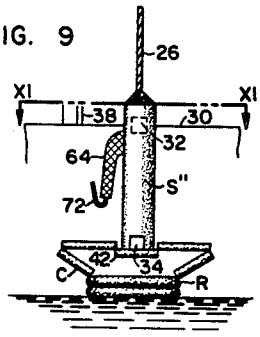



FIG. 10

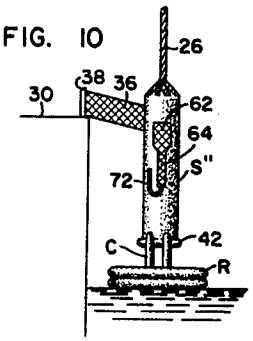
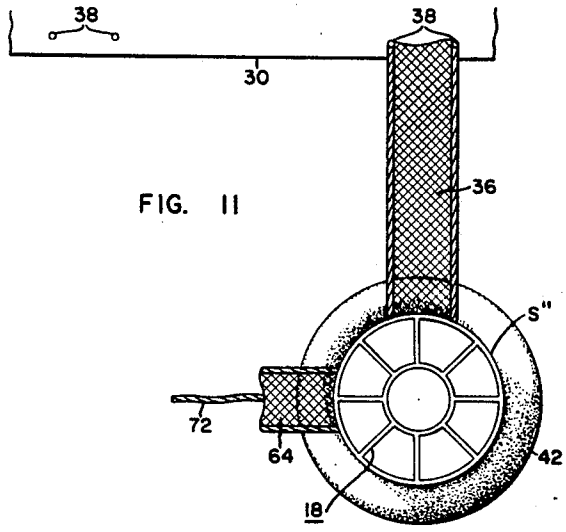



FIG. 11



United States Patent Office 3,433,323
Patented Mar. 18, 1969



3,433,323

# INFLATABLE ESCAPE SLIDEWAY APPARATUS

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Claims priority, application Japan, Feb. 15, 1966, 41/13,300
U.S. Cl. 182—48 7 Claims
Int. Cl. A62b 1/20; E04b 1/34; E04g 11/04

## ABSTRACT OF THE DISCLOSURE

The disclosed escape slideway apparatus is characterized by an enclosed inflatable spiral balloon providing, when inflated, an enclosed spiral slideway extending downwardly in the vertical direction. The slideway has its upper end adjacent to a boarding entrance and its lower end adjacent to an exit leading a landing composed of an inflated toroidal balloon attached to the lower end of the apparatus.

For use with a ship the apparatus further has an inflatable life raft of conventional construction connected to its lower end directly or through an articulated connection composed of an inflatable balloon.

This invention relates to an inflatable escape slideway apparatus for use in escape upon the occurrence of a shipwreck, skyscraper fire and the like, and more particularly to such an apparatus characterized by an inflatable spiral slideway.

The conventional type of escape pipes for use in escape upon the occurrence of a fire in a skyscraper has been generally spanned obliquely and downwardly between the skyscraper and the ground such that the lower end thereof is firmly secured to the ground at a position relatively separated away from the skyscraper. This leads to a large space occupied by the escape pipe.

Also there have been previously proposed inflatable escape slideways for use in transferring persons from a wrecked ship to life boats or rafts, lowered on the surface of the sea. Such slideways have also been spanned obliquely and downwardly in a straight line from the board side of the wrecked ship toward the sea. They are required to be made rigidly enough to withstand a high load imposed thereon due to persons sliding downwardly along the slideway thereby to be effectively prevented from being greatly deformed. Further the slideways are rather large in size and therefore required a long time before they have been inflated to be ready for use.

Accordingly, an object of the invention is to provide a new and improved inflatable escape slideway apparatus for use with either a skyscraper or a ship having a small space occupied by the same and permitting persons to escape safely from the skyscraper or the ship.

Another object of the invention is to provide a new and improved inflatable escape slideway apparatus having a sliding surface tiltable at any desired angle so as to permit persons to slide down along the sliding surface in safe and rapid manner.

Still another object of the invention is to provide a new and improved inflatable escape slideway apparatus having a sliding surface rigid sufficiently to permit many persons to slide down at a time along the sliding surface without any flexure.

A further object of the invention is to provide a new and improved inflatable escape slideway apparatus for use with a ship including a slide unit and a raft unit wherein evacuees or refugees can transfer from the slide unit to the raft unit without hindrance even when the raft unit is vertically moving by sea waves.



Another object of the invention is to provide a new and improved inflatable escape slideway apparatus especially suitable for use with a ship greatly variable in level of its deck above the sea-level due to a difference between the full and empty load drafts.

According to one aspect of the invention there is provided an inflatable escape slideway apparatus including a slide unit comprising an outer collapsible tubular member, an inner collapsible tubular member coextensive and disposed coaxially with the outer tubular member to form an annular tubular space therebetween. Supporting means are provided for supporting the outer and inner tubular members at the upper ends to extend them vertically. An inflatable spiral balloon is disposed in fixed relationship with respect to the outer and inner tubular members within the annular space and capable of being filled with a gap under pressure to provide a slideway spirally extending about said inner tubular member. A boarding entrance is provided on the upper end portion of the outer tubular member, an exit is provided on the lower end portion of the outer tubular member. The entrance and the exit are adjacent the ends of said slideway. A flexible escape bridge is connected to the entrance, and an inflatable toroidal balloon is secured to the lower end of the outer tubular member providing a landing consecutive to said exit, and a length of rope is connected to the supporting means to hang the slide unit at a predetermined level in a predetermined escape place.

The arrangement just described is especially suitable for use in escape from a fire in a building or a skyscraper.

According to another aspect of the invention there is provided an inflatable escape slideway apparatus for use with a ship including, in addition to the slide unit just described, an inflatable raft unit comprising a pair of inflatable toroidal balloons disposed one above the other and a piece of water-proof sailcloth sandwiched in tensioned state between said toroidal balloons; and an inflatable articulated connection for operatively connecting the raft unit to the slide unit directly below the latter so as to absorb vertical movement of the raft unit due to sea waves.

For use with a very large-sized ship such as a super tanker whose deck is at a high level above the surface of the sea, an inflatable escape slideway apparatus may advantageously comprise an upper slide unit comprising an outer collapsible tubular member, an inner collapsible tubular member coextensive and disposed coaxially with said outer tubular member to form an annular tubular space therebetween. Supporting means for supporting the outer and inner tubular members at the upper ends are provided to extend them vertically, an inflatable spiral balloon is disposed in fixed relationship with respect to said outer and inner tubular members within said annular space and capable of being filled with a gap under pressure to provide a slideway spirally extending about said inner tubular member. A boarding entrance is provided on the upper end portion of the outer tubular member. An exit is provided on the lower end portion of the outer tubular member, said entrance and said exit being consecutive to the adjacent ends of said slideway. A flexible escape bridge is connected to the entrance, and an inflatable toroidal balloon is secured to the lower end of the outer tubular member providing a landing consecutive to said exit. A lower slide unit substantially identical in construction to the upper slide unit except for both a transfer entrance is provided on the upper end portion and a flexible transfer bridge is connected to said transfer entrance. A pair of lengths of rope are connected respectively to supporting means of the upper and lower slide units to hang them along the broad side of the ship at such

levels that the transfer entrance of the lower slide unit is approximately aligned with the exit of the upper slide unit. The transfer bridge is connected to the exit of the upper slide unit. An inflatable raft unit comprising a pair of inflatable torodial ballons are superposed one above the other and a piece of water-proof sailcloth is sandwiched in a tensioned state between said toroidal balloons; and an inflatable articulated connection is provided for operatively connecting said raft unit to said lower slide unit directly below the latter so as to absorb vertical movement of the raft unit due to the action of sea waves.

If the tanker is in its full load condition under which its deck is at a relatively low level above the surface of the sea, only the lower slide unit along with the associated equipment may be conveniently used with the upper slide unit maintained in its collapsed state on the deck.

The invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevational view of an inflatable escape slideway apparatus for use with a ship according to the invention illustrated in its operative position with a slide unit thereof illustrated by dotted lines.

FIG. 2 is a plan view, partly in cross section, of the apparatus as viewed in the direction of the arrows on the line II—II of FIG. 1;

FIG. 3 is a plan view of a supporting frame for the slide unit;

FIG. 4 is a fragmental longitudinal sectional view of the slide unit;

FIG. 5 is a fragmental longitudinal view of an articulated connection to the slide unit of a raft unit according to the invention;

FIG. 6 is a front elevational view of a modification of the invention using two slide units in its operative position with the internal construction of the upper slide unit schematically illustrated by dotted lines;

FIG. 7 is a side elevational view of the apparatus illustrated in FIG. 6;

FIG. 8 is a plan view of the apparatus as viewed in the direction of arrows on the line VIII—VIII of FIG. 6;

FIG. 9 is a view similar to FIG. 6 but illustrating the manner to use one of the slide units shown in FIG. 6;

FIG. 10 is a side elevational view of the apparatus illustrated in FIG. 9; and

FIG. 11 is a plan view of the apparatus as viewed in the direction of the arrows on the line XI—XI of FIG. 9.

While the invention will now be described with reference to ships it is to be understood that it is equally used with skycrapers.

Referring now to FIGS. 1 to 5 inclusive, there is illustrated an inflatable escape slideway apparatus constructed in accordance with the principles of the invention and in its inflated state or in its operative position. An arrangement illustrated comprises essentially a vertically extending slide unit generally designated by the reference character S, a raft unit generally designated by the reference character R and an articulated connection generally designated by the reference numeral C for operatively connecting the raft unit R to the lower end of the slide unit S directly below the latter.

It is to be noted that if the slideway apparatus of the invention is intended to be used only with a building or a skyscraper that the slide unit is required only to be hung down from the building or skyscraper through any suitable supporting means in such a manner that the lower end of the slide unit is positioned close to the ground thereby to permit evacuees to at least jump down from the lower slide end upon the ground with both the raft unit and the connection omitted.

As best shown in FIG. 1, the slide unit S comprises an outer collapsible cylindrical envelope **10** of circular cross section extending vertically, an inner collapsible hollow cylindrical column **12** of circular cross section coextensive and disposed coaxially with the outer envelope **10** to form an annular cylindrical space therebetween, and a balloon **14** shown as being in the form of a helicoid of circular cross section disposed within that space. The outer envelope **10** and the inner column **12** are preferably composed of any suitable flexible material such as cloth and the balloon **14** are composed of any suitable flexible material such as rubber-coated cloth impermeable to a gas such as air. The balloon **14** is fixed to the outer envelope **10** and the inner column **12** and can be filled with any suitable pressurized gas such as air under pressure to be inflated into a helical or spiral shape. The inflated spiral balloon **14** has an upper spiral slide surface providing a slideway along which persons may slide down. The slide surface, in this instance, has a sliding layer **16** applied thereon (see FIG. 4) for the purpose of improving the sliding effect of the slide unit. The sliding layer **16** may be preferably made of a vinyl resin-coated cloth.

In order to hang the slide unit A from one board side of the associated ship toward the surface of the sea, a supporting frame generally designated by the reference numeral **18** is attached at the upper ends of the outer and inner members **10** and **12**. As best shown in FIG. 3, the supporting frame **18** includes a pair of concentric circular rings **20** and **22** secured to the inner and outer members **12** and **10** respectively and a plurality of radial arms **24** disposed at substantially equal angular intervals to connect the outer and inner rings together. The frame **18** is composed of any suitable rigid material such as a metal. As shown in FIG. 1, the outer ring **20** has a plurality of rope branches rigidly secured thereto at a plurality of equally spaced points and jointed into a single rope **26** which, in turn, is connected at the other end to a supporting rod **28** of crane type projecting from a ship hull **30** and beyond the associated side. In operation, the slide unit A is arranged to be hung down by the supporting rod **28** through the rope **26**.

The outer envelope **10** is provided on the upper and lower end portions of the peripheral wall, with a pair of openings **32** and **34** serving as a boarding entrance and an exit consecutive to the adjacent ends of the spiral slideway **14** respectively. In order to permit the evacuees to reach the entrance **32** a flexible escape bridge **36** composed of either any suitable thick cloth or a plurality of lengths of ropes is arranged to be spanned between the slide unit S and the ship hull **30**. To this end, the bridge **36** has one end connected to the boarding entrance **32** and the other end adapted to be connected to an eye plate **38** disposed on the deck of the ship hull **30** through a pair of lengths of strings **40**.

The envelope and column **10** and **12** have attached at the lower ends an inflatable common balloon **42** shown as being in the form of a toroid of circular cross section. The inflated balloon **42** has an outer diameter greater than that of the outer envelope **10** by a radial length sufficient to provide a landing where the evacuees may temporarily stop. The balloon **42** is composed of the same material as the spiral balloon **14** and adapted to be fitted with any suitable gas such as air under pressure. This is true in the case of balloons forming the raft unit R and the connection C as will be described hereinafter.

The sliding layer or surface **16** has an extension **16'** extending through the exit **34** of the envelope **10** and over the adjacent portion of the toroidal balloon **44** into the raft unit R where it is freely pendant down.

The raft unit R disposed directly below the slide unit S is of the conventional structure including a pair of inflatable toroidal balloons **44** and **46** of circular cross section superposing one above the other and a piece of any suitable water-proof sailcloth **48** sandwiched in a tensioned state therebetween. After the completion of the escape operation the raft unit R may be separated from the slide unit S for the purpose of using it as a life boat or raft. However, the raft unit R in the illustrated em-

bodiment is normally utilized as a waiting space where the evacuees rendezvous before they transfer to separate life boats or rafts.

It is recalled that the slide unit S has the raft unit R operatively connected to and directly below the same by the articulated connection C. As best shown in FIG. 2 the connection C comprises three articulated connection sections of identical structure generally also designated by the same reference character C and disposed at substantially equal angular intervals or in a Y shape. These connection sections C serve to maintain the raft unit R in its position assumed directly below the slide unit S as well as absorbing any difference in distance between the slide and raft units due to vertical movement of the raft units effected by the sea waves thereby to prevent the slide unit S from vertically moving.

More specifically, each of the connection sections C comprises an inflatable pi($\pi$)-shaped balloon **50** having a pair of parallel legs articulated at the free ends to the lowermost toroidal balloon **44** on the slide unit S by a piece of any suitable flexible cloth **52** and a pair of inflatable straight balloons **54**, **54** articulated at both ends to the cross member of the $\pi$-shaped balloon **50** and to the upper raft balloon **44** by pieces of any suitable flexible cloth **52**. In order to prevent the balloons **50** and **54** from being deformed, a pair of lengths of reinforcing ropes **56** are tensioned in X-shape between the two legs of the balloon **50** while at the same time another pair of lengths of ropes **58** are similarly tensioned between the straight balloons **54** (see FIG. 2).

Thus it will be appreciated that the three point connection provided by the three articulated connection sections C maintains always the raft unit R disposed directly below the slide unit S and that vertical movement of the raft unit R due to sea waves is mainly converted into a change in angle between the longitudinal axes of the balloon **50** leg and straight balloon **54**. Of course this change in angle is accompanied by variations in angles at which the balloons **54** and **52** are articulated to the adjacent ends of the connection section C.

It will be appreciated that if the pieces of flexible cloth **52** removably connect the straight balloons **54**, **54** to the raft unit R that the raft unit R can be separated from each connection section C after all the evacuees have transferred to the raft unit R for the purpose of utilizing singly the latter as a life raft.

In order to prevent the raft unit R from moving along the associated board side of the ship hull **30** and also from being greatly separated from the latter, a length of rope **60** may be preferably provided having one end connected to the raft unit R and the other end connected to an appropriate portion of the ship hull **30**. If desired, another length of rope such as the rope **60** may be advantageously spanned between the lower portion of the slide unit S and a suitable portion of the ship hull **30** to aid in positioning the raft unit R in place.

Any suitable source of gas under pressure may be utilized to inflate the ballons **14**, **42**, **44**, **46**, **50** and **54**. For example, the balloons **14** and **42** may be filled by an inboard source of gas under pressure through any suitable conduit means and the respective filling openings on the balloons while the balloons of the connection C and raft unit R may be filled by a source of gas under pressure carried on the raft unit through any suitable conduit means and the respective filling openings on the balloons. Those source, conduit means, filling openings and the manner in which the respective balloons are filled with gas under pressure are well known in the art and accordingly need not be illustrated nor described.

Upon the occurrence of any emergency such as a shipwreck, the slideway apparatus as above described can be thrown down from the wrecked ship toward the surface of the sea. At the same time, all the balloons are filled with a gas under pressure in the manner as above outlined to be inflated into the respective operative shapes. Then the escape bridge **36** is laid to bridge between the slide units S and the ship hull **30** and the length of rope **60** is spanned between the raft unit R and the ship hull **30** after which the inflated slideway apparatus is put in its position illustrated in FIG. 1. Under these circumstances, the supporting rod **28** can be adjusted in angle of elevation to compensate for any variation in level of the associated deck above the sea-level involving a lateral inclination of the ship hull. Also any vertical movement of the raft unit R due to the sea waves can be effectively absorbed by the articulated connection C in the manner as previously described.

The evacuees pass successively from the ship hull **30** through the escape bridge **36** to the boarding entrance **32** of the slide unit S and then slide down along the spiral sliding surface **16** of the slideway **14** until they reach the exit **34**. After having reached the exit **34**, the evacuees stop at a time on the landing balloon **40** to correct their postures and then they can jump down into the raft unit R.

It is to be noted that the slope of the spiral sliding surface **16** may be preselected at will. For example, the slideway **14** and hence the sliding surface **16** may progressively decrease in slope toward the lower end.

Referring now to FIGS. 6 to 11 inclusive wherein like reference characters and numerals designate the components corresponding to those shown in FIGS. 1 to 5 inclusive, there is illustrated a modification of the invention especially suitable for use with a very large-sized ship such as a super tanker. It is well known that in such a super tanker its deck is not only at a high level above the surface of the sea but also greatly varies its level above the surface of the sea between its full load condition and its empty load condition. For example, the deck of a certain super tanker has its level of approximately 9 meters above the surface of the sea in its full load condition while the level of the deck above the surface of the sea is as high as approximately 20 meters in its empty load condition.

FIGS. 6 to 8 inclusive illustrate the manner in which a plurality of slideways according to invention are used in functionally tandem relationship for the empty load condition of a super tanker.

In FIGS. 6, 7 and 8, an upper slide unit generally designated by the reference character S′ is substantially identical in construction and operation to the slide unit S as previously described in conjunction with FIGS. 1 to 5 inclusive and has operatively coupled at the lower end to a second or lower slide unit generally designated by the reference character S″. The second or lower slide unit S″ also is substantially identical in construction and operation to the slide unit S and has a raft unit B as previously described, operatively connected thereto through the abovementioned articulated connection C in the same manner as previously described.

The upper and lower slide units S′ and S″ are hung down from the associated ship hull **30** in the same manner as above described through the respective lengths of rope **26**. In order to operatively connect the upper slide unit S′ to the lower slide unit S″, the lower slide unit S″ is provided, in addition to a boarding entrance **52** with another entrance **62** disposed at a position below the entrance **32** by a distance corresponding to a quarter the pitch of a spiral slideway **14** in the lower slide unit S″. The entrance **62** serves to cause the evacuees to transfer from the upper to the lower slide unit. A transfer bridge **64** made preferably of any suitable flexible material such as cloth can connect the transfer entrance **62** of the lower slide unit S″ to the exit **34** of the upper slide unit S′.

As shown in FIG. 8, the transfer exit **32** of the upper slide unit S′ is provided on each of the upper and lower edges with a pair of opposed eye bolts **66** and **66**. The transfer bridge **64** is permanently connected at one end to the transfer entrance **62** of the lower slide unit S″ and

has a pair of lengths of rope **68** attached on both longitudinal edges. Each length of rope **66** has mounted at the free end a hook **70**. Engagement of the hooks **70** with the eye bolts **66** causes the transfer bridge **64** to connect the exit **34** of the upper slide unit S'' to the transfer entrance **62** of the lower slide units S''. The transfer bridge **64** is provided at the free end with a length of rope **68** sufficiently long and having the other end connected to an appropriate portion of the upper slide unit S' for the purpose as will be apparent hereinafter.

In FIG. 7 it is to be noted that the lower slide unit S'' has a member **36'** pendant from the upper portion. That member **36'** corresponds to the escape bridge **36** as previously described in the first embodiment. With the upper slide unit S' connected to the lower slide unit S'', the member **36'** is pendant from the upper portion of the unit as shown in FIG. 7 thereby to close the entrance **32** of the lower slide unit S' with the result that the evacuees are prevented from accidentally falling down from entrance **32** on the surface of the sea.

Upon the occurrence of a shipwreck, the upper and lower slide units S' and S'' are hung down in their suitable positions from the associated ship hull **30** and then the various balloons such as already described in conjunction with FIGS. 1 to 5 inclusive are filled with any suitable gas under pressure in the same manner as previously described. Thereafter, the escape bridge **36** on the upper slide unit S' is drawn up to the deck as by a hooked pole (not shown) and rigidly secured to an eye plate **38** on the deck. Under these circumstances, the evacuees successively pass through that bridge **36** to the entrance **32** of the upper slide unit S' and then slide down along the spiral sliding **14** until they successively reach the transfer exit **34**. Then they stop one at a time on the landing balloon **42** and one of them hauls the transfer bridge **64** by the abovementioned rope **68** hand over hand and engages the hook **70** with the eye bolts **66** to connect the exit **34** to the transfer entrance **62** by the bridge **64**. Therefore the evacuees successively pass through the bridge **64** to the lower sliding surface **16** along which they fall down into the raft unit R.

While the invention has been described in terms of two slide units S' and S'', it is to be understood that with the deck very high above the surface of the sea, any desired number of intermediate slide units may be disposed in functionally tandem relationship between the upper slide units S' and S''. Such intermediate slide units each are of course of the same construction as the slide unit S' or S'' excepting that the upper portions thereof are identical to the upper portion of the lower slide unit S'' and the lower portions are identical to the lower portion of the upper slide unit S'.

If as in its full load condition a large-sized ship such as a super tanker has its deck positioned at a relatively low height above the surface of the sea enough to be approximately equal to the length of a single one of the slide units then only the lower slide unit S'' as above described in conjunction with FIGS. 6 to 8 inclusive may be conveniently used along with the associated connection C and raft unit R in the manner as shown in FIGS. 9 to 11 inclusive. In this case, the slide unit S' previously used as the upper slide unit is maintained in its collapsing state on the deck while the slide unit S'' previously used as the lower slide unit, is hung down from the ship hull **30** through a length of rope **26** and inflated into its operative shape in the manner as already described (see FIGS. 9 and 10). The raft unit R connected to the slide unit S'' by the articulated connection C is, of course, floating on the surface of the sea, and the escape bridge **36** connected to the slide unit S'' bridges between the slide unit S'' and the ship hull **30** by having its free end rigidly secured to the associated eye plate **38** on the deck (see FIG. 11). Under these circumstances, the transfer bridge **64** is pendant from the transfer entrance **62** by the action of the gravitational force regardless of the collapsing slide unit S' disposed on the deck because the rope **72** connected between the transfer exit **34** of the slide unit S' and the transfer bridge **64** is made sufficiently long. The pendant bridge **64** effectively closes the transfer entrance **62** thereby to prevent the evacuees from accidently falling down from the entrance toward the surface of the sea.

From the foregoing it will be appreciated that the objects of the invention have been accomplished by the provision of an inflatable spiral slideway which can vertically extend.

While the invention has been illustrated and described with reference to several preferred embodiments thereof it is to be understood that various changes and modifications may be resorted to without departing from the spirit and scope of the invention. For example, the outer envelope **10** may have a rectangular or square cross section etc., rather than the circular cross section with the inner column **12** complemental in shape to the envelope. If desired, the raft unit may be connected directly to the slide unit. Also for use with a skyscraper, the landing balloon **42** may be omitted.

What I claim is:

**1.** An inflatable escape slideway apparatus including a slide unit comprising an outer collapsible tubular member, an inner collapsible tubular member coextensive and disposed coaxially with said outer tubular member to form an annular tubular space therebtween, supporting means for supporting said outer and inner tubular members at the upper ends to extend them vertically, an inflatable spiral balloon disposed in fixed relationship with respect to said outer and inner tubular members within said annular space and capable to be filled with a gas under pressure to provide a slideway spirally extending about said inner tubular member, a boarding entrance provided on the upper end portion of said outer tubular member, an exit provided on the lower end portion of said outer tubular member, said entrance and said exit being consecutive to the adjacent ends of said slideway, a flexible escape bridge connected to said entrance, and an inflatable toroidal balloon secured to the lower end of the outer tubular member providing a landing consecutive to said exit; and means connected to said supporting means to hang said slide unit at a predetermined level in a predetermined escape place.

**2.** An inflatable escape slideway apparatus as claimed in claim **1**, wherein for use with a ship, said slide unit has directly connected to the lower end an inflatable raft unit of conventional construction.

**3.** An inflatable escape slideway apparatus for use with a ship including a slide unit comprising an outer collapsible tubular member, an inner collapsible tubular member coextensive and disposed coaxially with said outer tubular member to form an annular tubular space therebetween, supporting means for supporting said outer and inner tubular members at the upper ends to extend them vertically, an inflatable spiral balloon disposed in fixed relationship with respect to said outer and inner tubular members within said annular space and capable to be filled with a gas under pressure to provide a slideway spirally extending about said inner tubular member, a boarding entrance provided on the upper end portion of said outer tubular member, an exit provided on the lower end portion of said outer tubular member, said entrance and said exit being consecutive to the adjacent ends of said slideway, a flexible escape bridge connected to said entrance, an inflatable toroidal balloon secured to the lower end of the outer tubular member providing a landing consecutive to said exit; a length of rope connected to said support means to suspend said slide unit at a predetermined level in a predetermined escape place, an inflatable raft unit comprising a pair of inflatable toroidal balloons superposed one above the other and a piece of water-proof sailcloth sandwiched in a tensioned state between said toroidal balloons; and an inflatable articulated connection for operatively connect-

ing said raft unit to said lower slide unit directly below the latter so as to absorb vertical movement of the raft unit due to sea waves.

4. An inflatable escape slideway apparatus for use with a ship including an upper slide unit comprising an outer collapsible tubular member, an inner collapsible tubular member coextensive and disposed coaxially with said outer tubular member to form an annular tubular space therebetween, supporting means for supporting said outer and inner tubular members at the upper ends to extend them vertically, an inflatable spiral balloon disposed in fixed relationship with respect to said outer and inner tubular members within said annular space and capable to be filled with a gas under pressure to provide a slideway spirally extending about said inner tubular member, a boarding entrance provided on the upper end portion of said outer tubular member, an exit provided on the lower end portion of said outer tubular member, said entrance and said exit being consecutive to the adjacent ends of said slideway, a flexible escape bridge connected to said entrance, an inflatable toroidal balloon secured to the lower end of said outer tubular member providing a landing consecutive to said exit; a lower slide unit substantially identical in construction to said upper slide unit except for both a transfer entrance provided on the upper end portion and a flexible transfer bridge connected to said transfer entrance; a pair of lengths of rope connected respectively to supporting means of said upper and lower slide units to hang them along the board side of the ship at such levels that said transfer entrance of said lower slide unit is approximately aligned with said exit of said upper slide unit, said transfer bridge being connected to said exit of said upper slide unit; an inflatable raft unit connected directly to said lower slide unit immediately below the latter, said raft unit comprising a pair of inflatable toroidal balloons superposed one above the other and a piece of water-proof sailcloth sandwiched in a tensioned state between said toroidal balloons.

5. An inflatable escape slideway apparatus for use with a ship including an upper slide unit comprising an outer collapsible tubular member, an inner collapsible tubular member coextensive and disposed coaxially with said outer tubular member to form an annular tubular space therebetween, supporting means for supporting said outer and inner tubular memebrs at the upper ends to extend them vertically, an inflatable spiral balloon disposed in fixed relationship with respect to said outer and inner tubular members within said annular space and capable to be filled with a gas under pressure to provide a slideway spirally extending above said inner tubular member, a boarding entrance provided on the upper end portion said outer tubular member, an exit provided on the lower end portion of said outer tubular member, said entrance and said exit being consecutive to the adjacent ends of said slideway, a flexible escape bridge connected to said entrance, an inflatable toroidal balloon secured to the lower end of said outer tubular member providing a landing consecutive to said exit; a lower slide unit substantially identical in construction to said upper slide unit except for both a transfer entrance provided on the upper end portion and a flexible transfer bridge connected to said transfer entrance, a pair of lengths of rope connected respectively to supporting means of said upper and lower slide units to hang them along the board side of the ship at such levels that said transfer entrance of said lower slide unit is approximately aligned with said exit of said upper slide unit, said transfer bridge being connected to said exit of said upper slide unit; an inflatable raft unit comprising a pair of inflatable toroidal balloons superposing one above the other and a piece of water-proof sailcloth sandwiched in tensioned state between said toroidal balloons; and an inflatable articulated connection for operatively connecting said raft unit to said lower slide unit directly below the latter so as to absorb vertical movement of the raft unit due to sea waves.

6. An inflatable escape slideway apparatus according to claim 1, comprising a plurality of slide units including the first-mentioned slide unit connected vertically in tandem relationship but somewhat offset from each other in the horizontal direction, the uppermost slide unit comprising said first-mentioned slide unit the remaining slide units being substantially identical to said first-mentioned slide unit, the remaining slide units each comprising both a transfer entrance provided on the upper end portion and a flexible transfer bridge connected to said transfer entrance, and a plurality of lengths of rope connected to support means associated with the respective slide units to hang them at such levels that the exit of the upper slide unit is substantially aligned with the transfer entrance of the next lower slide unit; and means connecting each transfer bridge to the exit of the next upper slide unit.

7. An inflatable escape slideway apparatus as claimed in claim 3, wherein said inflatable articulated connection comprises an inflatable pi($\pi$)-shaped balloon having a pair of parallel legs articulated to said landing balloon of the slide unit and a pair of inflatable straight balloon articulated at both ends to said TT-shaped balloon and the raft unit.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,270,437 | 1/1942 | Herendeen | 9—14 |
| 2,955,299 | 10/1960 | Ingraham | 9—14 |
| 3,070,203 | 12/1962 | Hailstone | 182—48 |
| 3,102,623 | 9/1963 | Schacht et al. | 182—48 |
| 2,936,056 | 5/1960 | Heyniger | 182—48 |


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9—14; 52—2; 193—25