Nov. 4, 1952 G. B. BROWN 2,616,369

PARACHUTE RELEASE MECHANISM

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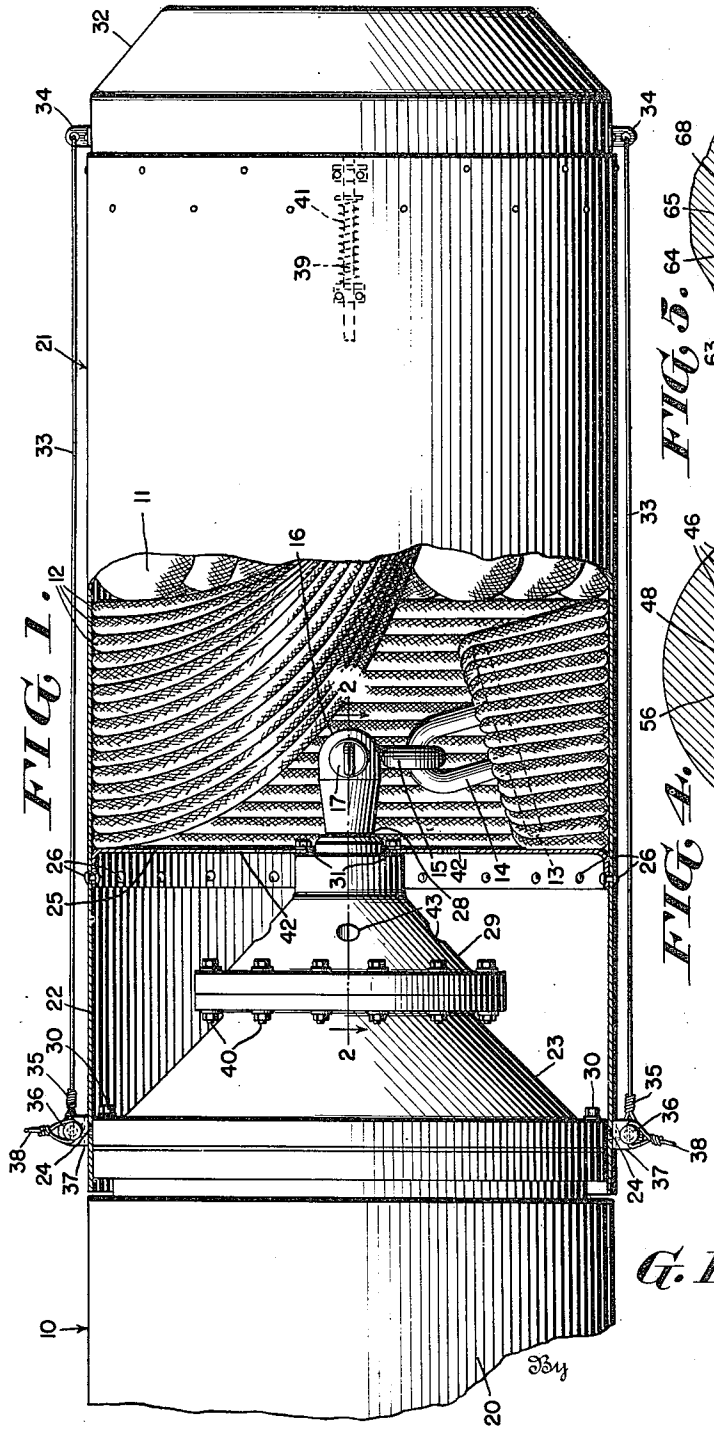


FIG. 1.

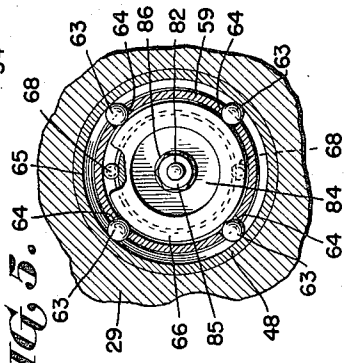


FIG. 5.

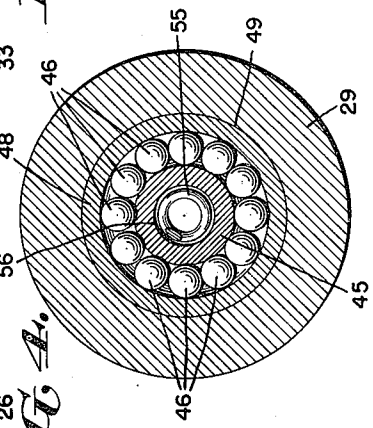


FIG. 4.

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FIG. 6.

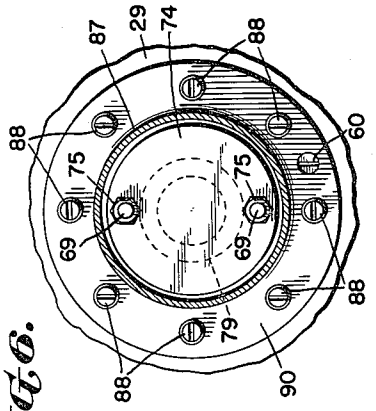


FIG. 2.

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PARACHUTE RELEASE MECHANISM

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FIG. 7.

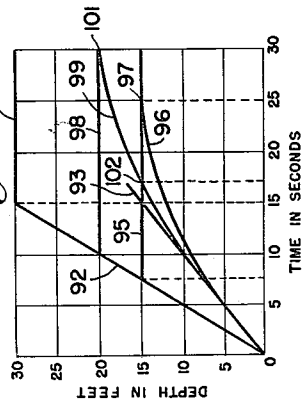


FIG. 8.

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PARACHUTE RELEASE MECHANISM

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Application April 1, 1947, Serial No. 738,597

1 Claim. (Cl. 102—13)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates generally to hydrostatically controlled means for releasing a parachute from a marine mine adapted to be planted on the bed of a body of water from an aircraft in flight and more particularly to a control device of this character adapted to release the parachute from the mine at the termination of a predetermined interval of time when the mine comes to rest at a minimum operating depth of submergence and to delay release of the parachute until the mine comes to rest at a greater depth of submergence when the mine descends beyond the minimum operating depth.

In the use of hydrostatically controlled parachute release devices heretofore devised for the purpose, it has been the usual practice to release the parachute from the mine either at a predetermined depth of submergence or at the termination of an appreciable interval of time after the mine has entered the water, and, in either case, to utilize the parachute as a drogue to limit the average velocity of the descending mine to a relatively low value such, for example, as two feet per second. This retarding effect on the movement of the mine through the water is particularly desirable in the case of mines having sensitive firing mechanisms which otherwise might be damaged or prematurely actuated as a result of shocks received by the mine upon impact thereof with the bed of the body of water.

Release means adapted to be actuated at a predetermined depth of submergence have not been found to be entirely satisfactory in service for the reason that the mine may be free to accelerate when the parachute is released at the predetermined depth of submergence and may reach a relatively high velocity as the mine strikes bottom when the depth of the water is considerably greater than the predetermined depth of submergence. In such case, the shock upon impact might be sufficient to damage or prematurely actuate the firing mechanism of the mine.

Hydrostatic control means adapted to be actuated to release the parachute at the termination of an appreciable interval of time controlled, for example, by the dissolving of a soluble washer in from 20 to 40 minutes have not been found to be entirely satisfactory in service for the reason that a mine employing such control means may be dragged away from the target area of the mine by channel or tidal currents acting on the parachute before the mine is released from the parachute. Mines employing this release means have the additional disadvantage in that a demolition crew, acting quickly, may recover the mines by

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fouling the parachutes with a sweep wire before the mines are released therefrom.

The foregoing disadvantages of the prior art devices are obviated in the arrangement of the hydrostatically controlled release device of the present invention by the provision of an expansible bellows which is air-filled at atmospheric pressure and adapted to be collapsed against the opposing force of a calibrating spring by the pressure of water acting externally on the bellows, the water being admitted into a housing surrounding the bellows through a restricted orifice in the housing. The bellows and housing are carried within a chambered structure for supporting the mine from the parachute, this structure being apertured to receive the surrounding water thereinto and disposed in a region of reduced pressure at the downstream or trailing end of the mine as it descends through the water whereby a period of time controlled by the rate of flow of the water through the aforesaid orifice is caused to elapse before sufficient pressure is developed within the bellows housing to actuate the bellows to a predetermined releasing position.

The bellows is adapted, upon movement into the releasing position thereof, to initiate actuation of ball locking means employed to releasably secure the parachute pack to the aforesaid mine supporting structure, and the compression and spring rate of the aforesaid calibrating spring are predetermined whereby the release mechanism is caused to operate to release the parachute from the mine at a minimum operating depth and at the termination of a predetermined period of time when the mine comes to rest at such depth. If the depth of the water is greater than the minimum operating depth, however, the parachute is not released until the mine either comes to rest at, or descends to, a greater depth of submergence. Whereas, the parachute is not immediately released upon reaching bottom except in the case of a relatively great operating depth, it remains attached to the mine for only a few seconds at other depths for the reason that the entire time delay corresponding to said predetermined period of time, which begins upon entrance of the mine into the water, is of the order of approximately 25 seconds.

An object of the present invention is to provide a new and improved hydrostatically controlled device for releasing a parachute from a marine mine adapted to come to rest on the bed of a body of water.

Another object is to provide a parachute release mechanism for a marine mine adapted to release

the parachute therefrom at the termination of a predetermined interval of time when the mine comes to rest at a minimum operating depth of the mechanism within a body of water and to delay such release when the mine descends beyond the minimum operating depth.

Another object is to provide a parachute release mechanism adapted to delay release of the parachute from the mine until the mine either descends to a relatively great depth of submergence within a body of water or comes to rest on the bed thereof at a depth which exceeds a minimum operating depth of the mechanism.

Another object is to provide a parachute release mechanism adapted to release the parachute from the mine at the termination of a period of time controlled by the rate of flow of the surrounding water through an orifice in the mechanism.

A further object is to provide a parachute release mechanism employing a pressure responsive device in communication with the surrounding water through an orifice in the mechanism and adapted to initiate release of the parachute from the mine when the pressure applied to the device reaches a predetermined value.

A further object resides in the provision of a parachute release mechanism employing pressure responsive means in communication with the surrounding water through an orifice in the mechanism and adapted to initiate release of the parachute from the mine when the pressure of the water reaches a predetermined value and at the termination of a predetermined interval of time controlled by the rate of flow of the water through the orifice.

An additional object is to provide a parachute release mechanism having means adapted to initiate release of the parachute from the mine in response to predetermined operating conditions and to effect complete release of the parachute therefrom immediately and positively when such release has been initiated.

The foregoing and still other objects, features and advantages of the present invention will become more clearly apparent from the following detailed description of a preferred embodiment thereof, reference being had to the accompanying drawings wherein:

Fig. 1 is a view in elevation showing the release mechanism of the present invention interconnecting a parachute pack to a marine mine;

Fig. 2 is a somewhat enlarged sectional view of the device taken along the line 2—2 of Fig. 1 and showing the device in its locked position;

Fig. 3 is a view similar to Fig. 2 and showing the device in the releasing position thereof;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken along the line 5—5 of Fig. 2;

Fig. 6 is a sectional view taken along the line 6—6 of Fig. 2; and

Fig. 7 illustrates graphically the operating characteristics of the release mechanism and the variation in lapsed time before the parachute is released from the mine upon striking bottom at different depths.

Referring now to the drawings for a more complete understanding of the invention and more particularly to Fig. 1 thereof, there is shown thereon a marine mine 10 of a type adapted to be planted from an aircraft in flight and having a sensitive firing mechanism such, for example, as the magnetic needle type mechanism disclosed and claimed in the copending application of James B. Glennon et al. for Firing Mechanism for a Submarine Mine, Serial No. 395,230, filed May 26, 1941.

A parachute 11 is employed to decrease the descending velocity of the mine as it falls from the aircraft and to act as a drogue on the mine as it descends through the water. For this purpose, the parachute may be of any conventional type having a plurality of shroud lines 12 which are secured to the parachute and on the free ends thereof to the shroud ring 13. The shroud ring 13 has welded, or otherwise secured thereto, a shackle 14 which is adapted to be hooked onto a hook 15 adapted to be received in a clevis 16 and removably secured therein by means of a threaded clevis pin 17. The clevis pin is adapted to pass through registered openings in the clevis and hook, and is threadedly secured to the clevis as at 18. As will appear in greater detail hereinafter, the clevis 16 is releasably secured to the mine 10 by means of a release mechanism generally designated by the numeral 19.

The parachute 11 and the shroud lines thereof are contained within a parachute pack generally designated 21 and comprising a cylindrical housing 22 which is secured to the end housing 23 of the mine by suitable screws 24. The end housing, in turn, is secured to the mine casing 20 by suitable bolts 30. The pack also comprises a partition 25 which is riveted to the housing 22 as at 26. The partition has a central opening 27 for receiving therethrough the hub portion 28 of a bell-shaped member 29 for supporting the release mechanism contained therein. Member 29 is secured to the end housing 23 by a plurality of circumferentially disposed bolts 40, and the partition preferably is secured, in turn, to the supporting member as by a plurality of screws 31.

The parachute and shroud lines are packed against the partition 25 within the cylindrical housing 22 and releasably retained therein prior to launching from the aircraft by means of a cover 32 which is secured in place by a pair of flexible cables 33. The cables are secured respectively to a pair of ears 34, in turn, secured in any suitable manner to the cover 32. The other ends of the cables are doubled back and substantially bound with a serving cord as at 35 to form eyes adapted to be received respectively by a pair of pins 36. The pins 36, in turn, are adapted to be received respectively in a pair of apertured ears or lugs 37 which are secured to the pack by the aforesaid screws 24. Pins 36 have respectively secured thereto a pair of arming wires 38, the other ends of which are adapted to be secured to the aircraft.

As the cover 32 is secured in place on the pack 21, a pair of spring loaded plungers 39 slideably carried by housing 22 in diametrically opposed relation thereon are moved inwardly by the cover 32 against the opposing force of the loading springs 41 individual thereto.

In the operation of the apparatus thus far described, pins 36 are withdrawn from ears 37 individual thereto by arming wires 38 as the mine falls away from the aircraft. This releases cables 33 and permits the cover 32 to be forcibly ejected from the pack by plunger 39 under power of the loading springs 41. As the cover leaves the pack, it is caught in the air stream and removed sufficiently from the pack to cause the parachute to be removed therefrom by means of a static line, not shown, which interconnects the cover to the parachute.

Thereafter, the parachute opens to break the free flight of the mine through the air whereby the mine is caused to approach the surface of the body of water at a reduced velocity. As the mine enters the water, water enters the cylindrical housing 22 from the open end thereof and passes through suitable apertures 42 in the pack partition 25 to fill the chamber formed by a cylindrical housing 22 of the pack and surrounding the release mechanism 19 and end housing 23. Water in this chamber flows into the release mechanism 19 by way of apertures 43 in the supporting member 29.

Referring now to Figures 2 through 6 wherein the parachute release mechanism is disclosed in detail, it will be seen that the supporting member 29 has a central bore 44 adapted to receive slideably therewithin the cylindrical portion 45 of clevis 16. The clevis is releasably locked to the supporting member 29 by means of a plurality of balls 46 which are initially carried within an annular groove 47 formed in the cylindrical portion 45 of the clevis by means of a retainer sleeve 48. The sleeve is slideably carried within a central bore 49 provided within the supporting member 29 whereby the sleeve may be moved to the right in Fig. 2 sufficiently to prevent the balls from moving out of groove 47 and to cause them to seat against the ring 51. This ring preferably is pressed within a reduced bore 52 against a shoulder 53 formed between bores 52 and 44 and is formed of a relatively hard material so as to provide a wear resistant surface for the balls 46, thereby to prevent premature wearing of the coacting surfaces which otherwise might be sufficient to prematurely release the parachute from the mine.

Sleeve 48 has an integrally formed partition 54 which forms a seat for a spring 55 which is also seated within a counterbore 56 in the cylindrical clevis 16. The spring is inserted under compression between the sleeve partition and the clevis whereby the sleeve is urged yieldably to the left, as viewed in Fig. 2. Partition 54 also serves to restrict leakage of water into the release mechanism by limiting leakage thereinto by way of the space between the retainer sleeve 48 and bore 44 whereby leakage of water into the control mechanism may be held to a minimum, the entrance of water into the release mechanism preferably being entirely by way of an orifice of predetermined size, as will appear more fully as the description proceeds.

Sleeve 48 extends in overlapping relation with the sleeve portion 59 of base member 61 which is secured to supporting member 29 by threaded engagement therewith as at 62. Base member 61 preferably is held against rotation with respect to the supporting member 29 by means of a set screw 69. Sleeve 48 is releasably locked in the position shown in Fig. 2 by means of a plurality of balls 63 which are disposed respectively within a plurality of diametrical openings 64 formed within the sleeve portion 59. The balls are normally forced into an annular groove 65 formed internally of sleeve 48 by means of a locking ring 66 adapted to be moved slideably within the sleeve portion 59.

The locking ring is formed with an external groove 67 adapted to receive the end portions 68 of a pair of spacer rods 69, the end portions of the spacer rods being defined by grooves 71 respectively formed therein. Grooves 71 are adapted to receive the flange portion 72 of the locking ring which is formed as a result of the

shape of the groove 67 therein, whereby the locking ring is secured to the rods for axial movement therewith. The spacer rods are formed with close diametrical tolerances as may be obtained, for example, in the use of drill rods whereby the rods may be caused to fit closely and slideably with apertures 73 respectively provided therefor within the base member 61.

A plate 74 is provided with a pair of apertures adapted to receive the opposite ends of the spacer rods, these ends of the rods being shouldered and threaded whereby the plate may be secured thereto, as by nuts, 75, in predetermined spaced relation with respect to the locking ring 66. Plate 74 is formed with a reduced diametrical portion 76 adapted to form a seat for a calibrating spring 77 which is interposed under compression between the plate and the flange portion 78 of the base member 61, whereby the plate member 74 and the locking ring 66 are maintained yieldably in the positions shown in Fig. 2.

An expansible bellows 79 is brazed, or otherwise suitably secured, to the plate member 74 as at 81. The other end of the bellows carries a stud bolt 82 which extends through a central aperture 83 formed in the partition portion 84 of the base member 61. The stud bolt carries a nut 85 and lock washer 86 whereby the bellows may be tightly secured in position on the partition portion 84.

A pressure chamber 80 is formed about the expansible bellows by means of a cup-shaped casing 87 having a flange 90 which is secured to the base member by a plurality of cap screws 88, a suitable gasket 89 being interposed between the flange and the base member to provide a watertight seal therebetween.

The cup-shaped casing is provided with a restrictive orifice 91 of predetermined size whereby the time rate of flow of water into pressure chamber 80 is controlled so as to cause a predetermined time interval to elapse before sufficient pressure is developed on the bellows to move locking ring 66 into the releasing position thereof, as shown in Fig. 3. The spring rate of the calibrating spring 77 and the initial compression thereof are such as to require a predetermined pressure on the bellows to move the ring member into the releasing position thereof against the opposing force of the calibrating spring. By reason of the aforedescribed construction of the several moving parts of the release mechanism, leakage of water into the pressure chamber by way of the aforementioned leakage paths is held to a minimum and the flow of water into the pressure chamber is controlled substantially entirely by the orifice 91. The aforementioned predetermined time interval, therefore, may be held to a value such, for example, as 25 seconds with close tolerances.

In the operation of the parachute release mechanism as the mine enters the water, water passing into the supporting member 29 by way of apertures 43 therein passes into pressure chamber 80 by way of orifice 91, and the water entering the chamber causes increasing pressure to be developed on the bellows to cause a gradual collapse thereof as the mine descends through the water. When the pressure on the bellows reaches a predetermined value such, for example, as a pressure corresponding to 15 feet of water, the bellows has collapsed sufficiently to cause the locking ring 66 to be moved into the releasing position thereof, as shown in Fig. 3.

As the locking ring moves into the releasing position, balls 63 are cammed inwardly of the sleeve portion 59 of the base member 61 by the retaining sleeve 48 which moves to the left to the releasing position thereof, as shown in Fig. 3, under power of spring 55. As the retainer sleeve 48 is retracted, balls 46 are cammed outwardly of the annular groove 47 in clevis 16, this also being accomplished under power of spring 55. Thereafter, upon release of the clevis, spring 55 further acts to eject the clevis from the supporting member 29, thereby to release the parachute from the mine.

Whereas the parachute is adapted to be released from the mine at the aforesaid minimum operating depth of 15 feet of water if the mine comes to rest at such depth, the parachute is not immediately released from the mine by reason of the time delay of 25 seconds controlled by orifice 91, which time delay begins upon entrance of the mine into the water. Accordingly, when the bottom is at greater depth, the mine continues to descend beyond the minimum operating depth, but, in such case, the parachute remains attached to the mine for shorter intervals of time after the mine comes to rest.

The operating characteristics of the release mechanism and the variation in the lapsed time when the mine bottoms at different depths may best be understood by reference to the graph of Fig. 7 wherein the straight line curve 92 represents the rate of increase of the pressure of the surrounding water assuming that the mine is descending at an average velocity of 2 feet per second, and the straight line curve 93 indicates the rate of increase of pressure on the expansible bellows 79 as the mine descends through the water. Thus, when the mine comes to rest at a depth of 30 feet as indicated by the horizontal line 94, the pressure on the bellows has reached a pressure corresponding to the minimum operating depth of 15 feet of water and, therefore, the mine is immediately released from the parachute upon striking bottom. When bottom is at a greater depth than 30 feet, the mine will nevertheless be released from the parachute at 30 feet. Thus, time interval of 15 seconds from the moment the mine enters the water until it reaches a depth of 30 feet elapses before the parachute is released from the mine.

When the mine comes to rest at the minimum operating depth of 15 feet indicated by the horizontal line 95, from the moment that the mine hits bottom the rate of increase of pressure on the bellows progressively decreases and follows the curve 96 until this curve levels off at the minimum operating pressure at 97. Thus, in this case the entire time delay of 25 seconds must elapse before sufficient pressure is applied to bellows 79 to release the parachute from the mine, and approximately 17½ seconds elapses between the time the mine strikes bottom at 15 feet and the parachute is released therefrom.

When the mine comes to rest at an intermediate depth such, for example, as 20 feet, as indicated by the horizontal line 98, from the moment that the mine hits bottom, the rate of increase of the pressure on the bellows begins to decrease progressively and follows the curve 99 until it levels off at 101 at a pressure corresponding to the pressure on the bottom at 20 feet. Curve 99, however, reaches point 102 thereon which is at a pressure corresponding to the minimum operating depth of 15 feet, at the termination of approximately 17 seconds after the mine enters the water. Thus, in this case, approximately 7 seconds elapse between the time the mine strikes bottom and the parachute is released therefrom. In any case, a relatively short interval of time must elapse between the time the mine bottoms and the parachute is released for the reason that the maximum time of 25 seconds required when the mine comes to rest at 15 feet is relatively short compared to the several minutes required in the case of parachute release mechanism heretofore devised.

From the foregoing it will now readily be understood that a parachute release mechanism has been provided which is well adapted to fulfill the aforestated objects of the invention, and whereas but one structural embodiment thereof, which gives satisfactory results, has been disclosed, it will be apparent to those skilled in the art that additional embodiments and modifications thereof may be made without departing from the spirit and scope of the invention as defined by the appended claim.

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

What is claimed as new and desired to be secured by Letters Patent of the United States is:

In a parachute release mechanism for a submarine mine, the combination of a first locking means including a plurality of balls for releasably locking the parachute to the mine, a sleeve member for releasably retaining said plurality of balls in the locking position thereof and adapted to be moved into a position for releasing the balls thereby to effect release of said first locking means, spring means for yieldingly urging said sleeve into the releasing position thereof, a second locking means including a second plurality of balls for releasably locking said sleeve member in the locking position thereof against the opposing force of said spring means, means including a ring member for releasably retaining the second plurality of balls in the locking position thereof and adapted to be moved into a position for releasing said second plurality of balls thereby to effect release of the sleeve member, and means effective in time delayed relation to the entrance of the mine into the water for moving the ring member into the releasing position thereof.

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