Feb. 13, 1968 C. C. PAYNE ETAL 3,368,480

FOLDING CONE SONOBUOY DELIVERY SYSTEM

Filed April 15, 1966 3 Sheets-Sheet 1

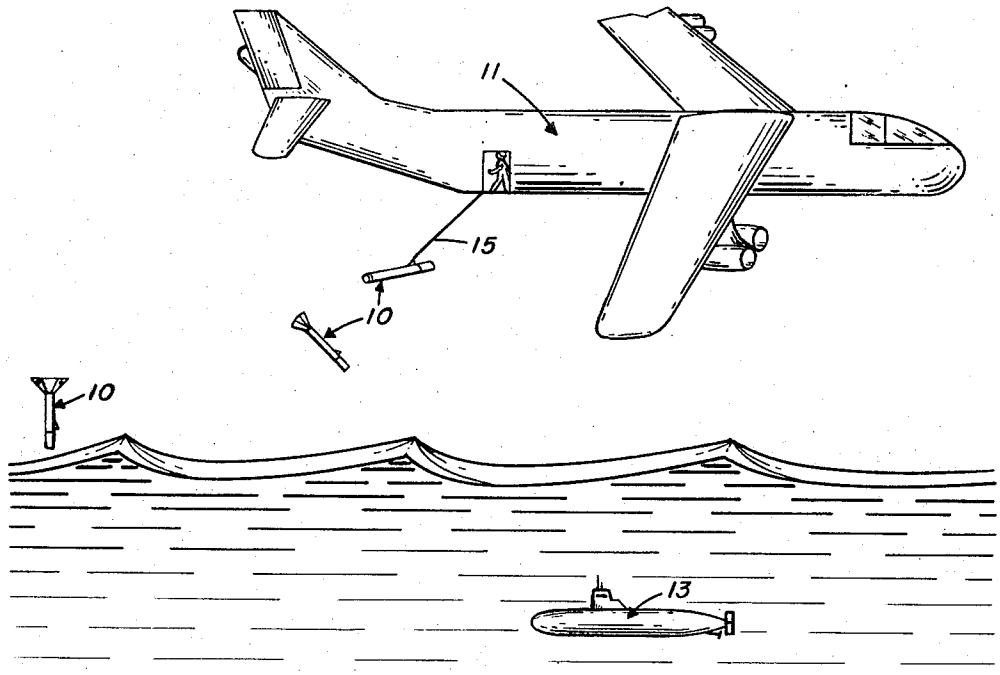

FIG. 1

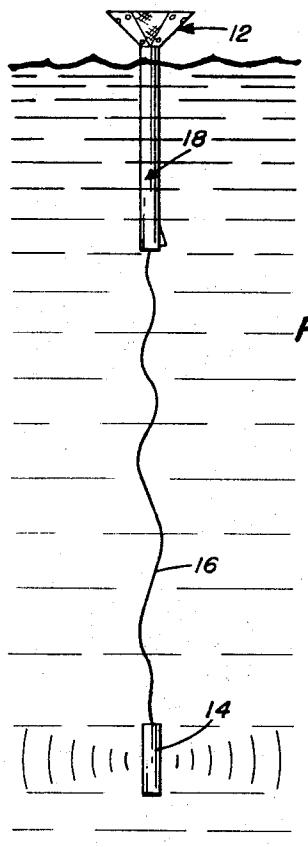

FIG. 3

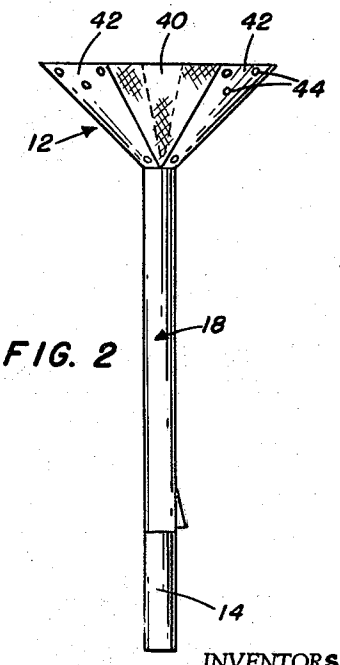

FIG. 2

INVENTORS
CHARLES C. PAYNE
WILLIAM R. EDWARDS
CLIFFORD L. FREEMAN

BY

ATTORNEY

FOLDING CONE SONOBUOY DELIVERY SYSTEM

Filed April 15, 1966 3 Sheets-Sheet 2

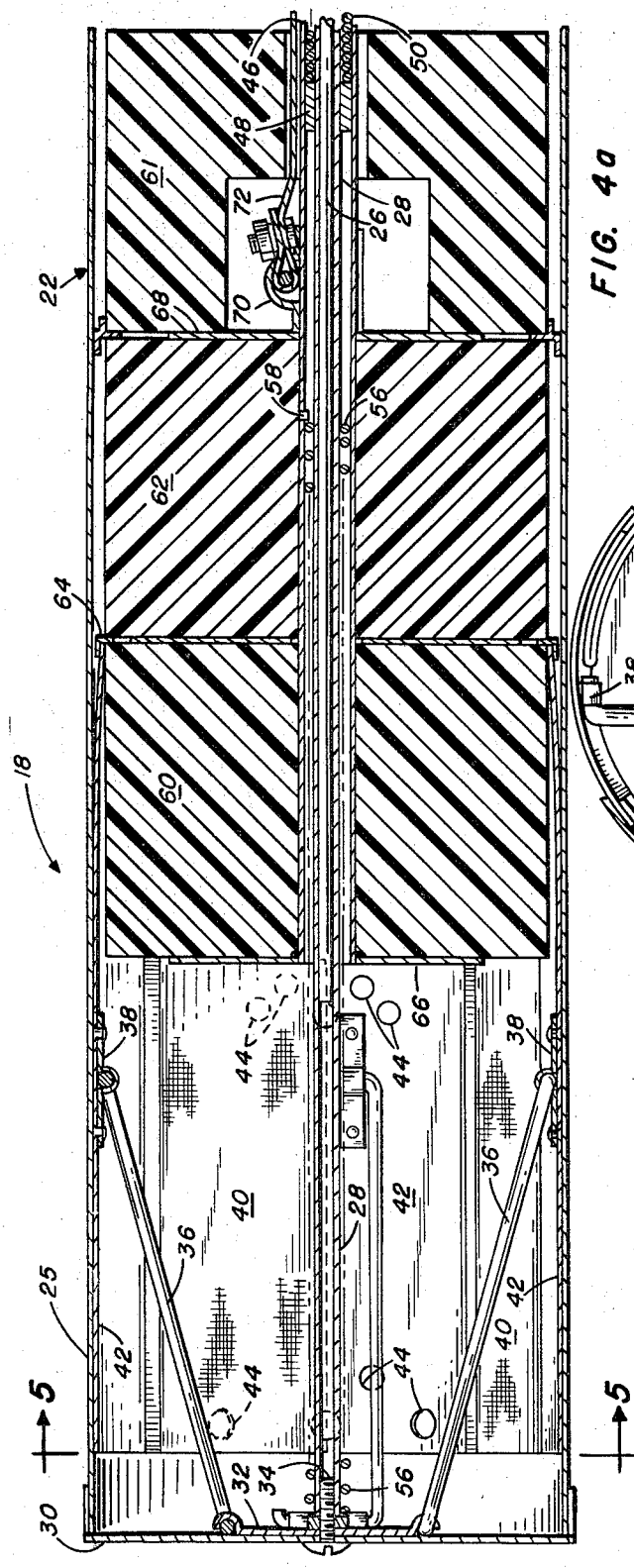

FIG. 4a

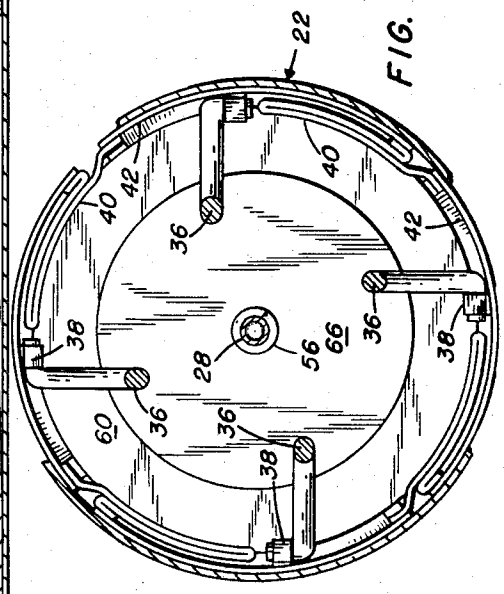

FIG. 5

FOLDING CONE SONOBUOY DELIVERY SYSTEM

Filed April 15, 1966 3 Sheets-Sheet 3

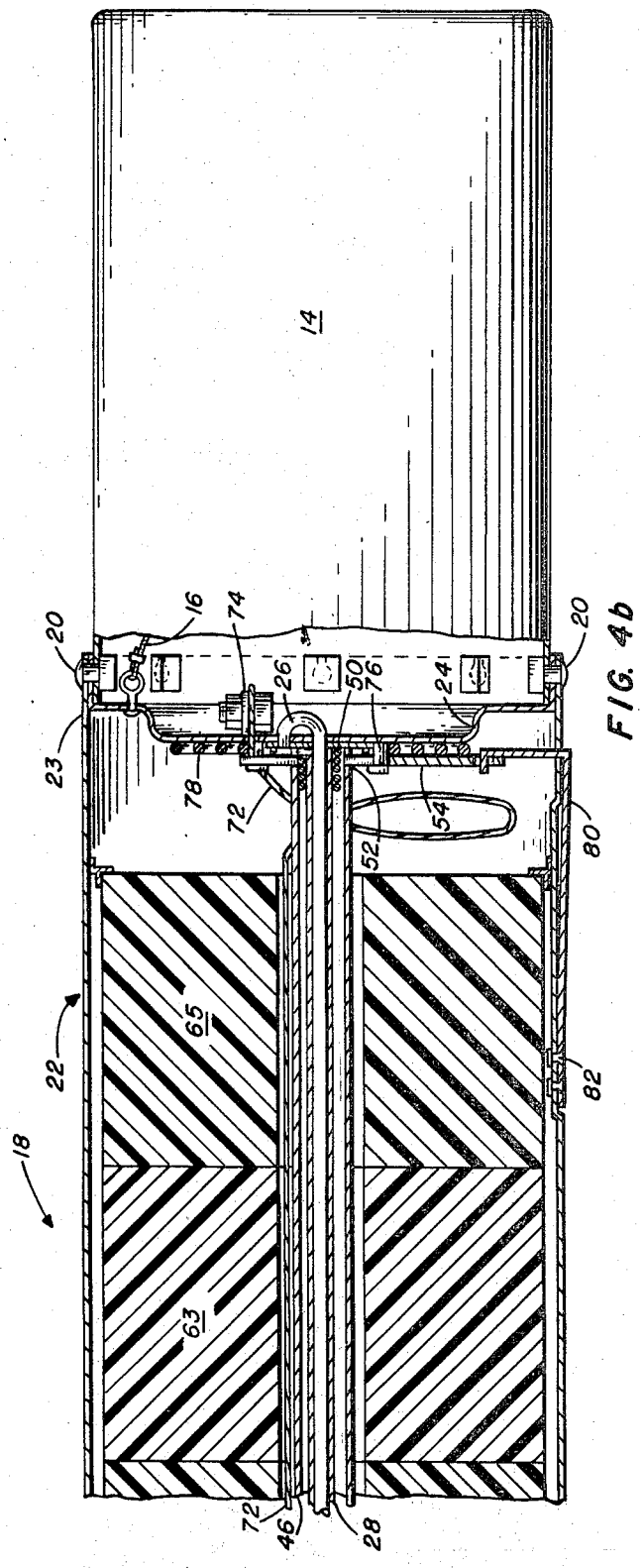

FIG. 4b

United States Patent Office 3,368,480
Patented Feb. 13, 1968

3,368,480

FOLDING CONE SONOBUOY DELIVERY SYSTEM

Charles C. Payne, Hollywood, William R. Edwards, California, and Clifford L. Freeman, Valley Lee, Md., assignors to the United States of America as represented by the Secretary of the Navy

Filed Apr. 15, 1966, Ser. No. 543,777
10 Claims. (Cl. 102—7)

ABSTRACT OF THE DISCLOSURE

This disclosure is directed to a sonobuoy which is dropped from an airplane. The sonobuoy utilizes a folded delay mechanism which is contained in the housing of the sonobuoy and is released when the sonobuoy is ejected from the airplane. Upon water impact, a sonar transducer is released from the sonobuoy and sinks to a predetermined level. The sonobuoy is maintained on the surface of the water by a flotation chamber contained in its housing.

The present invention relates generally to a delivery system for air-dropping stores and, more particularly, to a sonobuoy delivery system which is designed to be dropped from an aircraft into the sea.

In locating underwater objects, such as submarines or the like, sonar devices are frequently deployed in the water over a wide area for either transmitting or receiving signals. In deploying such sonar devices, it is common to air-drop the device at the location desired. The problem has thus arisen of compactly packaging the sonar device, the descent retarding device and flotation means into a sonobuoy delivery system.

Accordingly, it is an object of the present invention to provide a compact package for stores that are to be air-dropped which will have a self-contained descent retarding device, a flotation device and associated mechanism for actuating the devices when the package is released from an aircraft.

Another object of the present invention is to provide a delivery system for stores that are to be air-dropped which has a folding ballistic delay cone and a mechanism for actuating the ballistic delay cone from a folded to an opened position.

Still another object of the present invention is to provide a package for air-dropping sonar devices which package has a self-contained descent retarding device and a release mechanism for automatically deploying the retarding device.

A further object of the present invention is the provision of a compact package for air-dropping sonar devices which has a self-contained descent retarding device, a flotation device and a mechanism for automatically deploying the devices into operable position.

Still another object of the present invention is to provide a delivery system for air-dropping sonar devices which system has a folding ballistic delay cone which can be held within the package and which can be released by suitable mechanisms into an opened position.

Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings wherein:

FIG. 1 is a view illustrating the manner of deploying the sonobuoy from an aircraft;

FIG. 2 is a side view of the sonobuoy showing the folding ballistic delay cone in an opened position as, for example, when the sonobuoy is descending:

FIG. 3 is a side view of the floating delivery system with the sonar device being deployed;

FIG. 4*a* is a side elevation view in cross-section of the aft portion of the sonobuoy;

FIG. 4*b* is a side elevation view in cross-section of the forward portion of the sonobuoy; and

FIG. 5 is an end view taken along line 5—5 of FIG. 4*a*.

Referring to FIGS. 1 through 3, it will be seen that the sonobuoy **10** is designed to be dropped from an aircraft **11** when searching for an underwater object such as submarine **13**. A folding ballistic delay cone **12**, or similar descent retarding means, is automatically deployed from the delivery system when released from an aircraft and thereby retards the rate of descent of the sonobuoy. Upon impact with the water, the sonar device **14** is released from the delivery system and allowed to sink to a predetermined depth as determined by the length of the line **16** attached to the floating delivery system **18**.

Referring to FIGS. 4 and 5, it will be seen that the sonobuoy is specifically made up of a delivery system **18** containing the flotation means, ballistic delay cone and the associated mechanism and a sonar device **14** attached to the delivery system. The sonar device is attached to the forward end of the system by shear pins **20**. The particular sonar device forms no part of the present invention and could be replaced by any electronic device or store which is required to be air-dropped.

The delivery system is packaged in a housing having a cylindrical casing **22**, end wall **24** and a cap **30**. The cylindrical casing **22** has a forward end **23** and an aft end **25**. The circular end wall is attached at the forward end and a cap **30** is adapted to snugly fit over the aft end of casing **22**. A pilot rod **26** is mounted at the center of end wall **24** and extends longitudinally through the center of the cylindrical casing. Slidably mounted on the pilot rod is a guide tube **28**. Attached at the aft end of guide tube **28** is the cap **30** and a clamp **32**. Both cap **30** and clamp **32** are held in position by screw **34** which is screwed into the aft end of the guide tube **28**. Clamp **32** holds four C-shaped spring arms **36** which are attached to the folding ballistic delay cone by means of clamps **38** and which arms are designed to bias the delay cone into an open position. Arms **36** are further adapted to be rotated in order to fold the ballistic delay cone for insertion into the housing.

The ballistic delay cone is made up of a plurality of alternate flexible sections **40** and non-flexible sections **42** which are designed to be folded into a cylindrical shape, as shown in FIGS. 4*a* and 5. In the opened position the delay cone is formed into the shape of a truncated cone. Each of the non-flexible sections are provided with a plurality of holes **44**.

An actuator tube **46** is slidably mounted on guide tube **28** by means of a small bushing **48** mounted inside tube **46** approximately midway along the length of the tube. Compression spring **50** is located between the outside of guide tube **28** and the inside of tube **46**. Spring **50** acts against bushing **48** and is connected to the forward end of guide tube **28**. Two diametrically opposed slots **52** are provided in the forward end of tube **46**. A release bar **54** is slidably mounted on end wall **24** and is adapted to engage the slots **52** to thereby lock the tube **46** in the forward position. Thus, tube **46** can be moved forward to compress spring **50** and then locked in this position by having the release bar **54** engage slots **52**. A second spring **56** is located between the outside of guide tube **28** and the inside of tube **46** and extends to the aft end of tube **28** where it is connected. The forward end **58** of spring **56** is attached to tube **46**.

Around the aft portion of tube 46 there is positioned cylindrically-shaped flotation material 60, 62 separated by a retaining cup 64 which is designed to hold the ballistic delay cone in the folded position. The flotation material is held in position by circular flanges 66 and 68 attached to tubing 46. Additional flotation materials 61, 63, 65 are mounted within cylindrical casing 22. A clamp 70 is attached to tube 46 and holds lead wire 72. The other end of wire 72 is attached to clamp 74 mounted on end wall 24. The wire is of a length which permits tube 46 and associated flotation material 60, 62 to move to the aft end of the housing as will hereinafter be described.

The entire delivery system is held in a closed position by release bar 54 which is slidably mounted on guide studs 76 projecting from the end wall of the housing. The release bar has a portion which is shaped to enter slots 52 of tube 46 and which holds the tube against the force of spring 50. A helical spring 78 acts to maintain the release bar in the engaged position with tube 46. A trigger arm 80 is attached by rivets 82 to the outside of casing 22 and is connected to the release bar 54. By pulling trigger arm 80 away from casing 22, the release bar 54 disengages tube 46 to thereby actuate the ballistic delay cone into the opened position. The trigger arm can be actuated by either a delay line 15 as shown in FIG. 1 or by an equivalent mechanism on a bomb rack.

In operation, the delivery system will normally be held in a ready position where the entire system is within the housing. The ballistic delay cone is folded into a generally cylindrical shape and held in this position by retaining cup 64. Attached to the delivery system, as heretofore described, is the sonar device. The sonobuoy would be readied for air-dropping by attaching means, such as delay line, to the trigger arm for actuating the delivery system. When the sonobuoy is air-dropped, the trigger arm will be actuated which will unlock release bar 54 and allow tube 46 and associated flotation material to be pushed aft by the compression spring 50. As tube 46 continues to be forced aft, spring 56 is compressed and the cap is pushed off by the force of spring 56. The cap, guide tube 28 and ballistic delay cone are then forced aft out of the cylindrical casing by the force of spring 50 acting upon tube 46. Tube 46 and associated flotation material 60, 62 proceed aft until halted by wire 72. The guide tube and associated ballistic delay cone continues aft a short distance to thus release the folded ballistics cone from the retaining cup 64 and allowing spring arms 36 to fully open the delay cone. With the ballistic delay cone open the descent of the sonobuoy is retarded and upon impact with the water, the shear pins are ruptured to thus allow the sonar device to sink to a depth determined by the length of the line attached to the floating delivery system.

It should be realized that the delivery system was described in conjunction with a sonar device merely for illustrative purposes and that any electronic equipment or store could be employed with such a package assembly.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A delivery system for air-dropping equipment from an aircraft comprising:

a housing having a cylindrical section with a forward end and aft end, an end wall located at the forward end of said section and a cap snugly fitting over the aft end of said section;

a frusto-conical-shaped ballistic delay device for retarding the descent of the air-dropped equipment, said ballistic delay device normally being retained in a folded position within said housing; and

a spring actuated release means for releasing said caps and deploying said ballistic delay device from said aft end of said housing into an open position.

2. A delivery system of the character described in claim 1 wherein said ballistic frusto-conical-shaped delay device includes a plurality of alternate flexible and non-flexible sections which assume the shape of a truncated cone when opened and which are substantially cylindrical in shape when folded.

3. A delivery system of the character described in claim 2 wherein said release means includes a plurality of spring arms attached to said cap and said frusto-conical-shaped ballistic delay device, said spring arms biasing said device into an open position, said spring arms being rotatable into a closed position, whereby said frusto-conical-shaped ballistic delay device and said arms are retained within said housing when said cap is fitted over the aft end of the housing.

4. A delivery system of the character described in claim 3 wherein said release means includes tubular means slidable coaxially with said cylindrical section, spring means biasing said tubular means in the aft direction and locking means normally holding said tubular means against the biasing force of said spring means, whereby the actuation of said locking means when the equipment is released from the aircraft permits said tubular means to be moved in the aft direction to thus remove said cap and deploy said ballistic delay device.

5. A delivery system of the character set forth in claim 1 in combination with a sonar device attached to said housing.

6. A delivery system of the character described in claim 1 further characterized by flotation means normally mounted centrally within said housing, said release mechanism moving said flotation means to the aft end of said housing simultaneously with the deployment of said frusto-conical-shaped ballistic delay device, whereby said housing is converted into a buoy device which upon, entering a body of water, floats with the aft end of the housing facing upwardly.

7. A delivery system of the character described in claim 6 wherein said release means includes a first tubular member coupled to said frusto-conical-shaped ballistic delay device, a second tubular member coupled to said flotation means, said first and second members being slidably mounted within said housing, spring means coupling said tubular members for biasing said tubular members in the aft direction and locking means for normally holding said tubular members against the biasing force of said spring means, whereby the actuation of said locking means when the equipment is released from an aircraft allows said tubular members to be moved in the aft direction to thereby deploy said ballistic delay device and move said flotation means to the aft end of the housing.

8. A delivery system of the character described in claim 7 further characterized by line means attached to both said second tubular member and said end wall of said housing, the length of said line means being selected so as to limit the distance of movement of said second tubular member in the aft direction so as to position said flotation means at the aft end of said section.

9. A delivery system of the character described in claim 8 wherein a retaining cup is attached to said second tubular means which is adapted to retain said ballistic delay cone in a folded position within said housing, said ballistic delay device being released from said cup when said second tubular member is brought to an abrupt halt and said first tubular member with the ballistic delay device coupled thereto proceeds in the aft direction.

10. A delivery system of the character set forth in claim 1 in combination with a sonar device attached to the forward end of said section by a length of cable and by a plurality of shear pins, whereby upon impact with a body of water the shear pins rupture and allow the sonar device to sink to a depth determined by the length of

the cable connecting said sonar device and said housing which floats on the surface of a body of water.

References Cited

UNITED STATES PATENTS

2,942,545	6/1960	Fogal et al.	102—4
3,047,259	7/1962	Tatnall et al.	244—138
3,061,249	10/1962	Chipperfield	244—138
3,081,703	3/1963	Kamp et al.	102—50

3,212,110	10/1965	Lombardo	102—7 X
3,228,634	1/1966	Chakoian et al.	102—4 X

FOREIGN PATENTS

120,476	11/1918	Great Britain.

BENJAMIN A. BORCHELT, *Primary Examiner.*

SAMUEL W. ENGLE, *Examiner.*

T. H. WEBB, *Assistant Examiner.*