[11] 3,568,202

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[54] EXTENDIBLE ANTENNA FOR BATHYTHERMOGRAPH

11 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **343/709,** 343/902, 343/906
[51] **Int. Cl.** **H01g 1/34,** H01g 1/10, H01g 1/50
[50] **Field of Search** 343/709, 710, 714, 715, 719, 900, 903, 906

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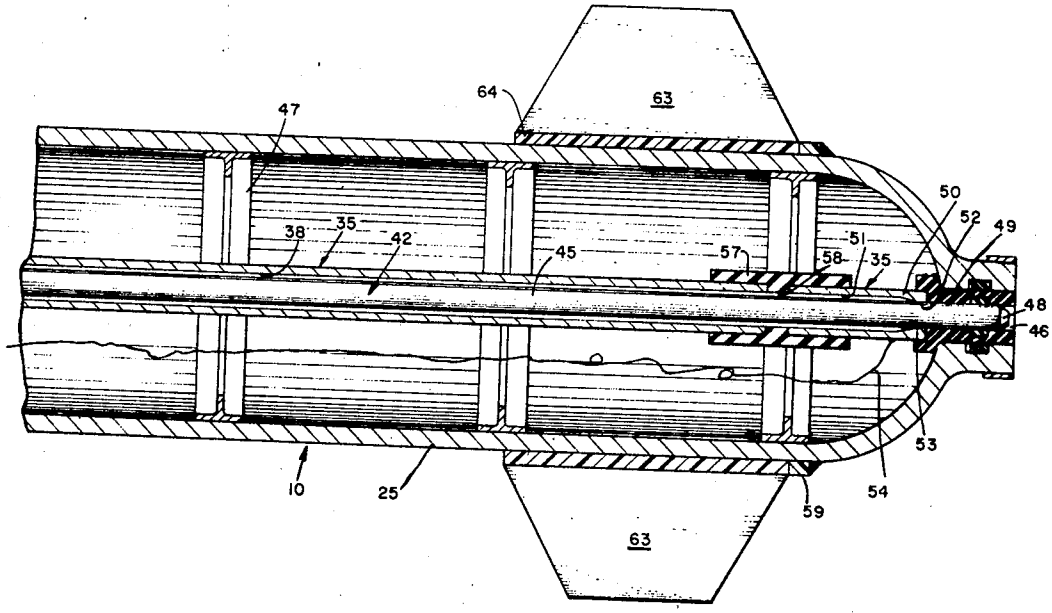
ABSTRACT: An extendible antenna for a bathythermograph and combination thereof, in which there are supporting means for the antenna in a stowed position within the bathythermograph and in an extended position outwardly of the latter, including means to move the antenna to its extended position at a predetermined time, and means to secure the antenna in the latter position as it is being fully extended and where electrical connection is made.



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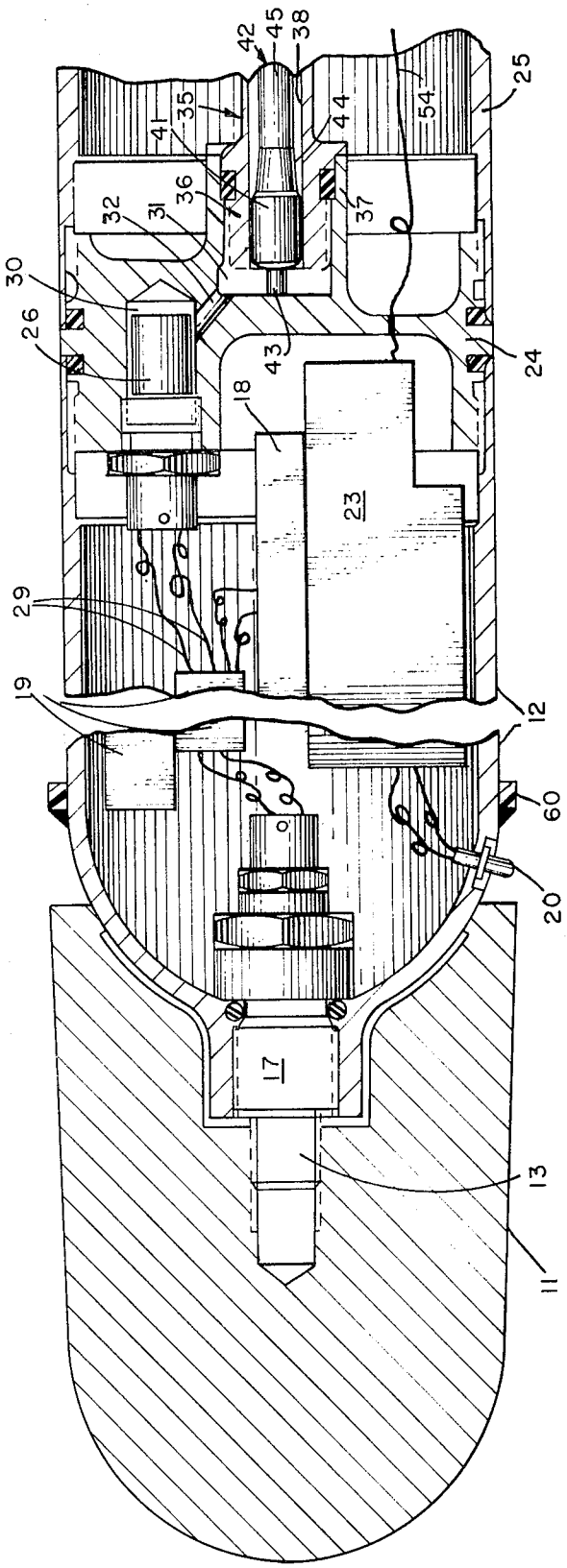

Fig. 1A

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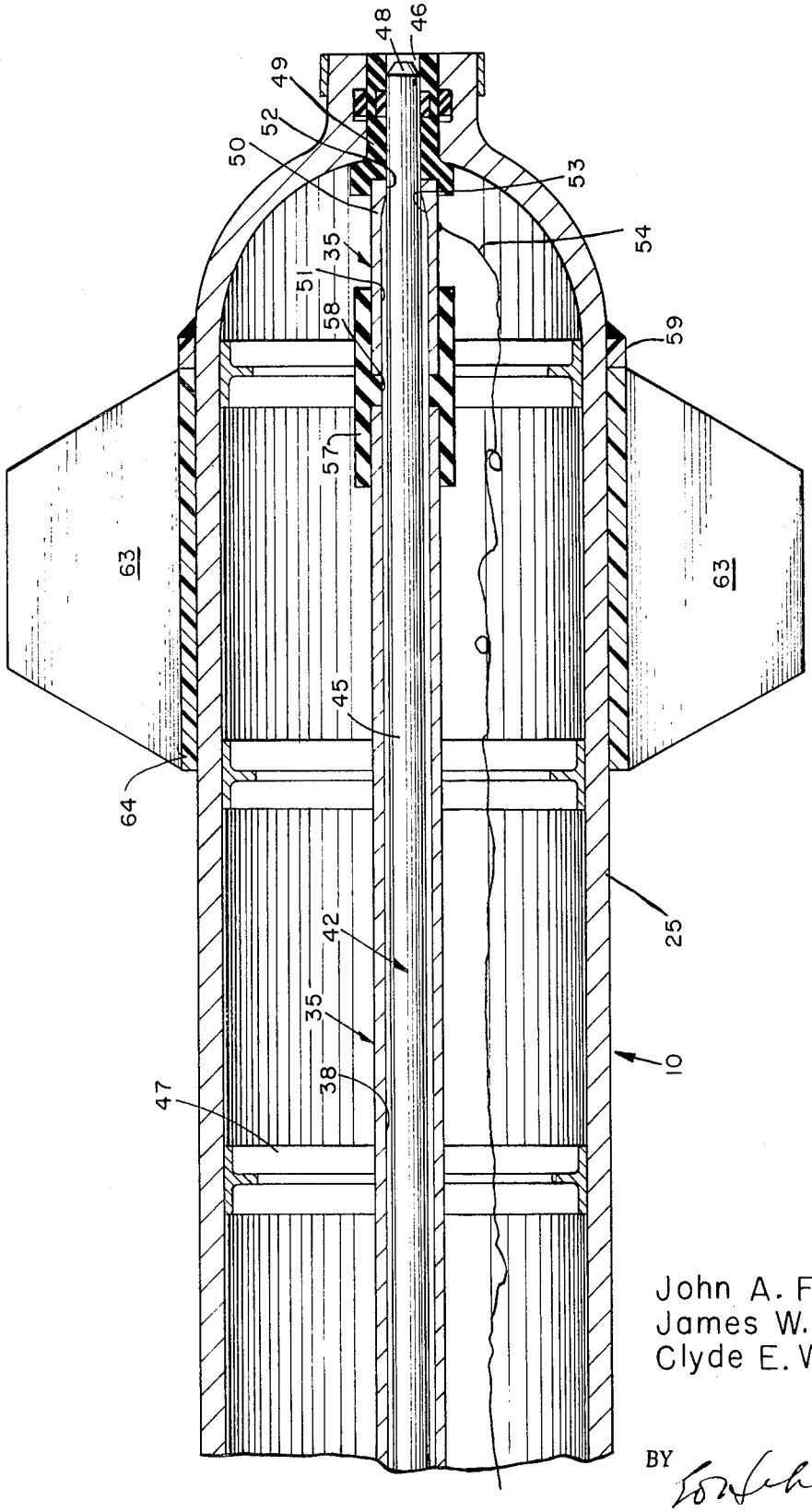

Fig. 1B

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EXTENDIBLE ANTENNA FOR BATHYTHERMOGRAPH

BACKGROUND OF THE INVENTION

Depth-temperature profiles are basic data in the great bulk of oceanographic work and are particularly important in physical oceanography, fishery research and antisubmarine warfare operations. In the prior art, a mechanical bathythermograph has been used, but the limitations of this instrument have long been recognized. Further, extendible antenna that have been used in other equipment and spacecraft utilized spring-actuated arms released by latches. These have been usually characterized by complexity of moving joints, latches, moving wires, sliding electrical contacts or slip rings. The present invention provides an extendible antenna for a bathythermograph that eliminates the foregoing complexity.

SUMMARY OF THE INVENTION

The present invention utilizes a pyrotechnic squib of high proven reliability in missile systems having a small propellant charge to extend the antenna. No wires are attached to the antenna, either in the stowed position or while extending, thereby eliminating any moving wires and electrical connections. The connection of the antenna to its wiring is made mechanically and automatically at the extreme limit of the antenna extension. The antenna is secured in its extended position as it is being arrested during the extension moving; that is, it is secured just as it is fully extended by a conical section on the antenna being forced into a mating conical section adjacent an outer end of a supporting guide tube. The guide tube conical section is insulated from the remainder of the tube and bathythermograph shell and has the necessary wiring attached to it for connecting the antenna to a transmitter in the bathythermograph.

An object of the invention is to provide an improved extendible antenna.

Another object of the invention is to provide an improved bathythermograph.

A further object of this invention is to provide an antenna, as described in the preceding paragraphs, for which connection to its wiring in its extended position is made mechanically and automatically, the connection being made without the use of moving wires or moving electrical connections.

It is a still further object of the invention to provide an antenna, as described in the preceding paragraphs, which when moved into its extended position is secured in place without the use of any moving parts.

Further objects and advantages of the invention may be brought out in the following part of the specification, wherein small details have been described for the competence of disclosure, without intending to limit the scope of the invention which is set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the accompanying drawings, which are for illustrative purposes:

FIG. 1A is a cross-sectional view of a portion of an air-droppable, expendible thermograph, with parts omitted, and illustrating the portions of the present invention; and

FIG. 1B is a cross-sectional continuation of the bathythermograph shown in FIG. 1A, the two views illustrating the entire invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring again to the drawings, there is shown in FIGS. 1A and 1B an air-droppable bathythermograph, generally designated as **10**, and having at one end a jettisonable ballast **11** secured to a shell or housing portion **12** by means of a conventional shear pin **13**. The shear pin is adapted to be broken to release the ballast from the shell portion **12** by means of a gas pressure operated release **17**. The release **17** is in turn actuated by a timer **18**, the release and timer being electrically

connected to batteries **19**. A thermistor **20** is sealingly fitted to extend through the wall of the shell **12** to pick up temperatures at different water levels which are received by tape recorder **23** electrically connected to the thermistor. The shell portion **12** terminates at a transverse wall **24** so as to separate the former from a shell portion **25**. The wall **24** is sealingly secured to the shell portion **12** and also sealingly secured to the shell portion **25**. In the transverse wall **24** there is fitted a gas pressure generator **26** electrically connected to the batteries **19** and the timer **18** by leads **29**. The timer **18** also actuates the batteries **19** to operate the generator **26** at a predetermined time. The generator **26** is positioned in a wall **30** and is comprised of a pyrotechnic squib. The well **30** is on communication with a well **31**, the two being connected by means of a gas passage **32**.

Sealingly secured in the well **31** is an open-ended antenna support and guide tube, generally designated as **35**. Within the well **31**, the tube **35** has an enlarged diameter portion **36**, threadedly engaged with an axially directed cylindrical wall portion **37** of the wall **24**. The guide tube **35** has a cylindrical interior surface **38** adapted to permit snug and slidable travel of a piston **41** on an inner end of a rod-shaped antenna, generally designated as **42**. The piston **41** is limited in its movement inwardly in the well **31** by means of a stop **43**. Between the piston **41** and a generally cylindrical rod portion **45** of the antenna is a conical section or portion **44**, smaller in diameter than the piston and for the most part having diameters larger than the rod portion **45**.

Within the shell portion **25** of the bathythermograph there are a plurality of longitudinally spaced rings **47** having their outer circumferential surfaces in contact with a generally cylindrical surface of the shell **25** so as to act as strength members to support the wall of the shell. Adjacent to the outer end **48** of the antenna, there is an electrical insulator **49** sealingly engaged in the end of the bathythermograph and around the antenna rod. The insulator **49** has an outer open end **46**, permitting extension of the antenna. Axially inwardly of the insulator **49** is an electrical connection sleeve **50** forming a part of the guide tube **35**. A substantial portion of the conductive sleeve **50** has an inner cylindrical surface **51** in alignment with the surface **38**, and the insulator **49**. Adjacent the outer end of the opening **52** of the sleeve **51** is a smaller diameter portion slidably engaged with the antenna rod. Inwardly of the opening **52** is a conical surface **53** adapted to mate tightly in a press-fit with the conical surface **44** of the antenna, thereby to form an electrical path from the antenna via the antenna conical portion **44** to the connection sleeve conical surface **53**. Electrical lead **54** extends outwardly from the sleeve **50** longitudinally in the annulus between the guide tube **35** and the shell portion **25** and further extending through sealed openings in the transverse wall **24** to be connected to the recorder **23**. Axially inwardly of the conductive sleeve **50** is a second sleeve-shaped insulator **57** having an inner cylindrical surface **58**, flush with the cylindrical surfaces **38** and **51**, so as to separate the two.

Adjacent opposite ends of the respective shell portions are rings **59** and **60** which provide stops for four stabilizing fins **63** circumferentially spaced at right angles to each other and supported on a ring **64**, slidably engaged with the exterior surfaces of the two shell portions **12** and **25**. The ring and fins are made of polyethylene.

In the embodiment shown, the housing comprised of the shell portions **12**, **25** is formed of two deep drawn, hard anodized aluminum canisters with a parting line formed at the transverse wall **24**, seven inches from the ballasted end. The recorder **23** is connected to a digital encoder (not shown) and has a playback module. The thermistor temperature sensor has responsive characteristics matched to the speed of the bathythermograph through the water.

The bathythermograph, in operation, may be dropped adjacent the water's surface or from an aircraft and descends to a depth as determined by calculated sink rate and the setting of the timer **18**. When the maximum depth is reached, the

timer 18 closes a circuit to the batteries to fire the gas generator 26 so as to shear the ballast retaining pin 13, thus jettisoning the ballast. At this time, the timer turns on the thermistor recorder circuit. The bathythermograph, after jettisoning the ballast, has positive buoyancy and ascends. Temperature data is recorded in digital form during the ascent on a belt of magnetic tape.

The ascent data is taken at half-second or one-second intervals. Sampling rate is accurately controlled by the timer. When the unit reaches the surface, the timer closes a circuit to a gas pressure generator 26 so as to create a relatively high pressure gas in the wells 30 and 31 and their connecting conduit 32, which pressure is applied to the piston 41 to drive the antenna from its stowed position as shown to an extended position outwardly of the bathythermograph. When the conical portion 44 adjacent the antenna piston moves into the conical surface 53 in the the electrical connection sleeve 50, the force on the antenna locks it into the electrical connector and the data playback commences. Tape rewind, after recording and before transmission, is unnecessary because the tape is a continuous belt. The recorded data is transmitted to an aircraft, for example. During the playback, when the bathythermograph is at the surface, the heavy end having the electronic equipment holds that end down in the water so that the antenna extends outwardly from the water in a generally vertical position, aided by the stabilizing fins.

It is clear that the omission of all moving parts relative to the extension of the antenna, except for the antenna itself, provides a substantial advantage, particularly in that the antenna is automatically locked into fixed extended position as well as into a position where it is electrically connected to the transmission means without the requirement of movable wires or movable electrical connections.

The invention and its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing its material advantages, the arrangement hereinbefore described being merely by way of example. We do not wish to be restricted to the specific forms shown or uses mentioned, except as defined by the accompanying claims, wherein various portions have been separated for clarity of reading and not for emphasis.

We claim:

1. An extendible antenna for a device comprising:
   a. means associated with and for supporting said antenna within the device in a stowed position and for providing a guide for the antenna as it is extended;
   b. means associated with said antenna and said supporting means to move said antenna outwardly from said supporting means and said device to an extended position at a predetermined time;
   c. said antenna being characterized by a substantially rod-shaped outer end portion, and having an engaging portion adjacent its innner end;
   d. electrical connection means for said antenna in said supporting means to make electrical connection with the antenna when it is secured in its extended position; and
   e. a mating engaging member associated with said connection means and adapted for being retainably engaged with the engaging antenna portion when said antenna is in an extended position whereby the antenna may be arrested and secured in the extended position and whereby good electrical contact to said mating engaging member is provided.

2. The invention according to claim 1 including; sealing means between said supporting means and said rod portion of the antenna axially outwardly of said electrical connection means providing a seal around said rod in its extended position.

3. The invention according to claim 1, including:
   a. a pair of electrical insulators forming inner, generally cylindrical surfaces in said supporting means and around said rod, portion of the antenna and
   b. said electrical connection means being spaced between insulators.

4. The invention according to claim 1 in which:
   a. the antenna has a cylindrical piston on its inner end snugly fitted on a cylindrical surface of said supporting means and adapted to slidably travel on said cylindrical surface a sufficient distance to permit the antenna to move to its extended position; and
   b. said means to move the antenna includes a gas pressure generator adapted to discharge a gas to contact the inner end of said piston and to move it to force the antenna to its extended position at said predetermined time.

5. The invention according to claim 1 wherein:
   a. said engaging antenna portion is conically shaped; and
   b. said mating engaging member has a conical portion adapted for receiving said antenna conical portion in a substantially press-fit thereby to provide the good electrical coupling and to retainably secure the antenna.

6. The invention according to claim 5 including:
   a. an electrical lead extending outwardly of said supporting means from said electrical connection member and adapted to extend within said device and to be connected to transmission means therein; and
   b. said lead and connection means being unaffected by the movement of said rod.

7. A bathythermograph formed of an exterior shell having a jettisonable ballast thereon, means to jettison the ballast within said shell at a predetermined time, temperature information recording and transmission means wherein said shell, said transmission means including an extendible antenna, the improvement comprising:
   a. means associated with and for supporting the antenna within the shell in a stowed position and for providing a guide for the antenna as it is extended; b. means associated with the antenna and said supporting means to move the antenna outwardly from said supporting means and the shell to an extended position at a predetermined time;
   c. said antenna being characterized by a substantially rod-shaped outer end portion, and having an engaging portion adjacent its inner end;
   d. electrical connection means for said antenna in said supporting means to make electrical connection with the antenna when it is secured in its extended position; and
   e. a mating engaging member associated with said connection means and adapted for being retainably engaged with the engaging antenna portion when said antenna is in an extended position whereby the antenna may be arrested and secured in the extended position and whereby good electrical contact to said mating engaging member is provided.

8. The invention according to claim 7 in which: sealing means between said supporting means and said rod portion of the antenna axially outwardly of said electrical connection means, providing a seal around said rod in its extended position.

9. The invention according to claim 7 including:
   a. a pair of electrical insulators forming inner, generally cylindrical surfaces in said supporting means and around said rod portion;
   b. said electrical connection means being spaced between insulators;
   c. electrical leads extending outwardly of said supporting means from said electrical connection means and connected to said transmission means; and
   d. said leads and connection means being unaffected by the movement of said rod.

10. The invention according to claim 7 wherein:
   a. the antenna has a cylindrical piston on its inner end snugly fitted on a cylindrical surface of said supporting

means and adapted to slidably travel on said cylindrical surface a sufficient distance to permit the antenna to move to its extended position; and

b. said means to move the antenna includes a gas pressure generator adapted to discharge a gas to contact the inner end of said piston and to move it to force the antenna to its extended position at said predetermined time.

11. The invention according to claim 7 wherein:

a. said engaging antenna portion is conically shaped; and

b. said mating engaging member has a conical portion adapted for receiving said antenna conical portion in a substantially press-fit thereby to provide the good electrical coupling and to retainably secure the antenna.