July 30, 1963 E. P. ANDERSON 3,099,813

ELECTROLYTIC-IGNITION UNDERWATER SOUND SOURCE

Filed April 26, 1957

FIG. 1

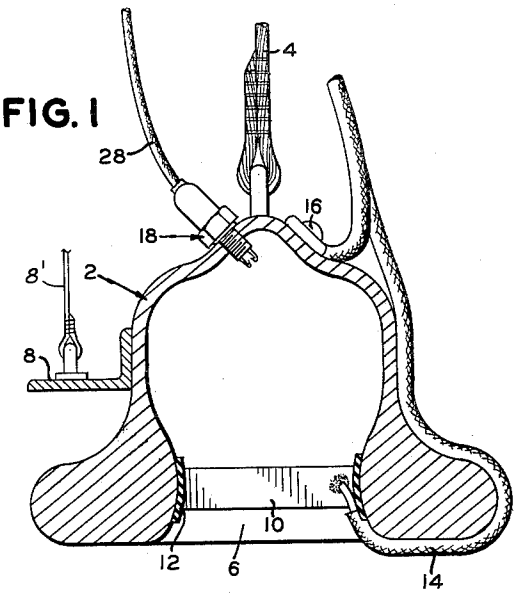


FIG. 2

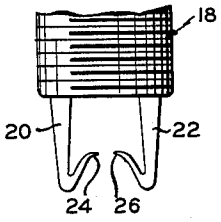


FIG. 3

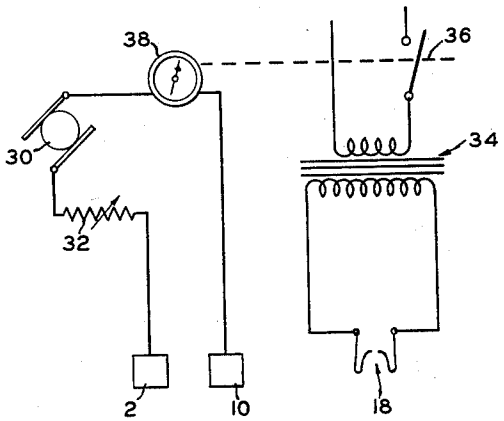
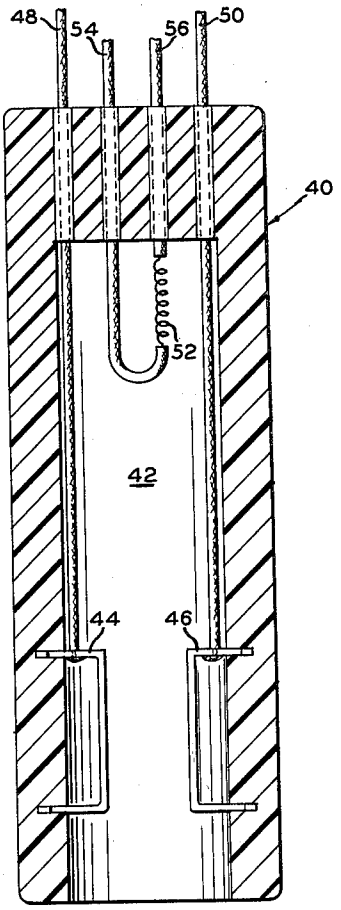


FIG. 4



INVENTOR.
EDWARD P. ANDERSON

BY Karl Huber
James E. Bryan
ATTORNEYS

United States Patent Office 3,099,813 Patented July 30, 1963

3,099,813
ELECTROLYTIC-IGNITION UNDERWATER SOUND SOURCE

Edward P. Anderson, Livingston, N.J., assignor, by mesne assignments, to Engelhard Industries, Inc., Newark, N.J., a corporation of Delaware

Filed Apr. 26, 1957, Ser. No. 655,390
1 Claim. (Cl. 340—12)

This invention relates to an underwater sound source, such sources of underwater sound being required for navigation, depth soundings, and signaling purposes.

It has been found in practice that sources heretofore utilized for these purposes are cumbersome, insufficiently intense, or of a frequency undesirable in this work.

Generally speaking, the underwater sound source of the invention comprises a container which is open at one end and which is hung submerged below the surface of a body of water with the open end of the container at the lower end thereof. The container includes an electrolysis apparatus and igniter or detonator mounted at a point adjacent the closed end of the container.

By electrochemical decomposition of the water in which the sound source is submerged, such as the salt water in the ocean, hydrogen and oxygen are produced in their decomposition ratios of 2:1 respectively, and these decomposition products are collected in the container, which may be of any suitable shape such as a bell or cylinder and the like, having a structural design capable of resisting the physical forces produced and being provided with suitable electrodes capable of functioning under the operational requirements of the device.

An igniter mounted in the upper closed portion of the sound source is used to detonate the explosive mixture of hydrogen and oxygen, and a suitable source of electric current, either direct or alternating, is provided to supply the electrical energy necessary to decompose the water by electrolysis.

Ordinarily, such underwater sound sources are required to sound at a predetermined interval, such as thirty seconds, for example. For this purpose a control device is provided which, when set to some predetermined frequency, automatically adjusts the power delivered to the anodes, such that the igniter will fire at a predetermined interval into a full charge of explosive gas mixture. In order to maintain a full charge of explosive mixture at various intervals, it is desirable that the electrical power utilized for electrolysis be modified in accordance with the interval to control the rate of gas generation for efficient power usage.

The invention will be further illustrated by reference to the accompanying drawing in which:

FIGURE 1 is a sectional view of one embodiment of the novel underwater sound source of the invention,

FIGURE 2 is a detail view of the spark gap used in the igniter or detonator of the invention,

FIGURE 3 is a schematic drawing showing the electrical circuit involved in the present invention, and

FIGURE 4 is a sectional view of a preferred embodiment of the novel underwater sound source of the invention.

Referring to FIGURE 1, the explosive chamber **2** may be bell-shaped, as shown, or of any other desired shape such as cylindrical, so that when the chamber is suspended below the surface of a body of water by the cable **4**, it hangs in a position such that the open end thereof is at the bottom. The geometry of this chamber is such that the average specific gravity thereof, when filled with gas, exceeds the specific gravity of water, with the result that the chamber will submerge. The chamber is also designed so that the center of gravity thereof is located

close to the bell mouth **6**, to eliminate tipping or rolling of the chamber when it is filled with gas. The bell geometry can control the predominant frequency.

A lever or arm **8** on one side of the chamber or bell may have a line **8'** attached thereto so that the bell can be tipped after detonation, thus refilling the enclosed volume thereof and washing out any non-combustible decombustible decomposition products which may tend to collect in the upper portion of the bell or chamber. Theoretically, the hydrogen and oxygen will again form water upon detonation and leave no unburned gases remaining. In practice, however, this may not be the case since dissolved gases, such as carbon dioxide and oxygen, exist in the water and will not necessarily be removed except by physical tipping and flushing of the enclosure. Tipping and flushing of the bell are not essential to the operation thereof, but it is a desirable practice in order to obtain a signal of uniform intensity.

An electrode **10** is mounted in the lower portion of the bell in a position such that it maintains electrical contact, with the water in which the bell is submerged, until the bell is filled with gas, and being so located, this electrode will automatically serve to stop the flow of power to the electrode when the bell is filled with gas. The surface of this electrode should be made of some material such as platinum or palladium which will insure long life of the electrode in the corrosive environment to which it is subjected in use. This electrode may be a single electrode extending across the diameter of the chamber or bell, or it may be two or more electrodes mounted in concentric rings or 170° arcs, for example, the design being dependent upon the length of service required and other economic considerations.

The electrode **10** is insulated from the bell or chamber body **2** by means of the insulation **12** and the circuit is completed by the bell body itself which serves as the other electrode. Current is supplied to the electrode **10** by means of the insulated cable **14**, and to the bell body or chamber **2**, by means of another cable which is secured to the bell body by any suitable means such as the bolt **16**.

A spark igniter **18** is mounted in the upper portion of the bell or chamber so that the gas mixture may be electrically ignited or detonated, thereby causing the detonation signal. The design of this igniter is such that any residual water remaining on the spark gap electrodes does not tend to short out the signal and, referring to FIGURE 2, one means for the prevention of the shorting of this igniter is shown. The igniter body **18** is mounted so that the spark gap electrodes **20** and **22** respectively, extend in a generally downward direction, and the electrodes are formed at the lower ends thereof with hook-like projections, terminating at the points **24** and **26** respectively. Thus it will be seen that by virtue of this design, the igniter assembly will drain water from an area other than the ignition points or spark gap, thereby preventing the igniter from being shorted out by water dripping from the points of the electrodes. The igniter is fired by current carried by a high voltage conduit **28**, shown in FIGURE 1, which is connected to a high voltage source, not shown.

Referring to FIGURE 3, one embodiment of the electrical system used is shown in which an electric power supply **30**, either alternating or direct, is used to support the electrolysis of the water, and suitable means for power adjustment such as the variable resistance **32** may be connected in series with the power supply. A suitable high voltage supply **34** may be used to ignite the combustible mixture and the ignition may be so arranged that the frequency of the discharge thereof may be manually or automatically controlled by the controller **36**,

according to the ratio of gas generation which may be monitored through an appropriate ammeter **38**.

Referring to FIGURE 4 of the drawings, a preferred embodiment of the invention is shown which includes a cylindrical body **40** which may be fabricated from any suitable non-corrosive material such as a suitable plastic or other non-conducting material, the cylindrical body member having a cylindrical well or cavity **42** therein. Mounted adjacent the lower end of the body member **40** are a pair of electrodes **44** and **46**, these electrodes being supplied with current through the cables **48** and **50** respectively, these cables passing through the upper end of the body member **40** and being sealed therein against the passage of fluids through the channels occupied by the cables.

An igniter **52** is mounted in the upper end of the cavity **42**, and consists of a filament wire of iridium or an alloy of iridium. The filament is connected to a pair of cables **54** and **56** for the purpose of supplying electric current thereto, these cables passing through the upper end of the body member **40** and being sealed therein against the passage of fluids through the channels occupied by the cables.

In the operation of this embodiment of the invention, the mixture of hydrogen and oxygen formed in the upper end of the cavity **42**, by electrolysis of water, is ignited or detonated by passing sufficient current through the iridium filament **52** to cause the gas mixture to ignite. Sufficient current is passed through the filament to raise the temperature thereof to the vicinity of about 3300° F. The diameter of the filament wire is not critical as long as the desired high temperature is attained, but a wire diameter of 0.003 inch has been found to give excellent results.

It will be obvious to those skilled in the art that many modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

What is claimed is:

In an underwater sound source, an open-ended chamber, means for supporting said chamber below water with the open end facing downwardly when said chamber is filled with gas, means for electrolytically decomposing water into hydrogen and oxygen to automatically fill a portion but not all of said chamber with hydrogen and oxygen, said last mentioned means including exposed metal electrodes, at least one of which terminates within said chamber and adjacent the open end of said chamber, whereby the electrolytic decomposition action ceases when said one electrode is exposed to the gases in said chamber and is out of contact with water, an igniter assembly including at least one active ignition zone and a water draining area contiguous with said active ignition zone but below said zone, means for supplying current to said electrodes, means for selectively supplying power to said igniter assembly, and means for tilting said chamber to wash out the chamber and completely refill it with water.

References Cited in the file of this patent

UNITED STATES PATENTS

248,565	Edison	Oct. 18, 1881
1,152,697	Bodde	Sept. 7, 1915
1,500,243	Hammond	July 8, 1924
1,738,595	McBride	Dec. 10, 1929
1,992,216	Kirst	Feb. 26, 1935
2,164,858	West	July 4, 1939
2,167,536	Suits	July 25, 1939
2,240,941	Ohl	May 6, 1941
2,679,205	Piety	May 25, 1954
2,797,399	Camp	June 25, 1957
2,820,214	O'Neill	Jan. 14, 1958

FOREIGN PATENTS

30,253	Great Britain	Dec. 21, 1898
18,025	Great Britain	June 10, 1909
400,085	Great Britain	Oct. 19, 1933

OTHER REFERENCES

Handbook of Engineering Material; D. F. Miner and J. B. Seastone; first ed.; 1955; John Wiley and Sons, New York, page 2–411 relied on.

Spreadbury, E. G.: "Electrical Ignition Equipment"; 1954; Constable and Company, Ltd., London; pp. 62 and 63 relied on.