

[54] ACOUSTIC MINESWEEPING GENERATOR

[75] Inventor: Paul F. Gould, Panama City, Fla.
[73] Assignee: The United States of America as represented by the Secretary of the Navy, Washington, D.C.
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[58] Field of Search 181/110, 121, 114; 340/17; 114/235 R, 235 B

[56] **References Cited**

UNITED STATES PATENTS

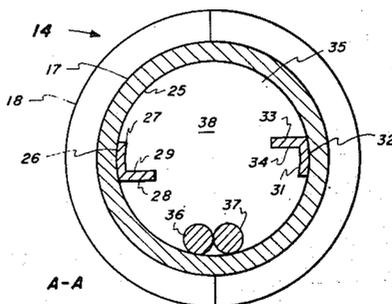
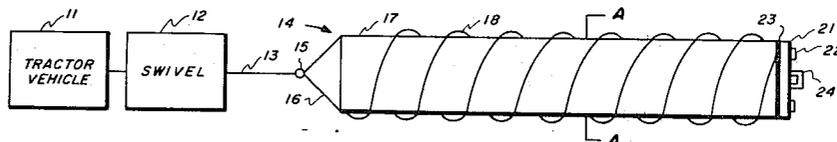
2,397,209	3/1946	Schaelchlin	114/235 B
2,524,863	10/1950	White	114/235 B
3,012,534	12/1961	Thomas	114/235 R
3,583,521	7/1971	Anstey	181/121
3,720,908	3/1973	McCoy et al.	340/8 R

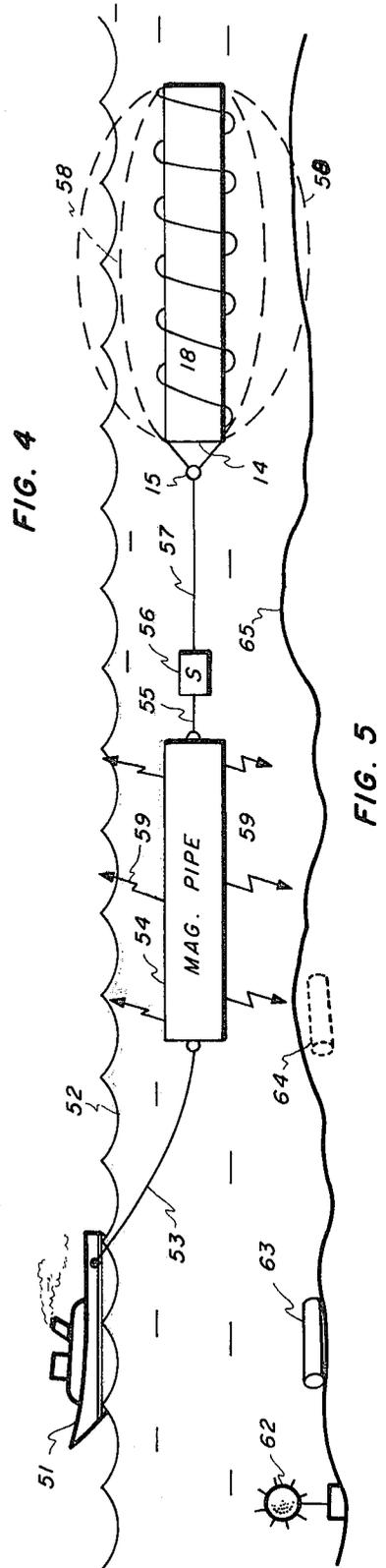
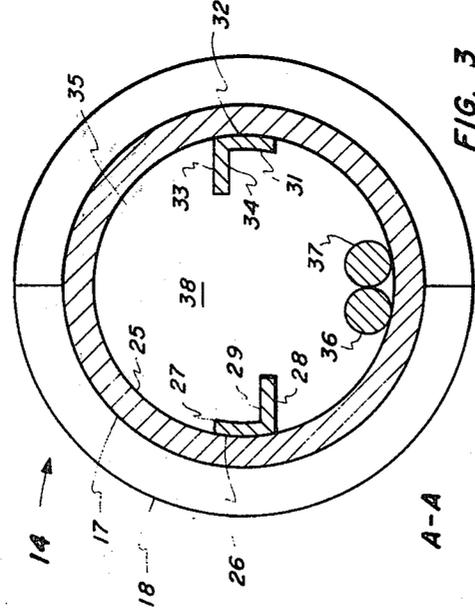
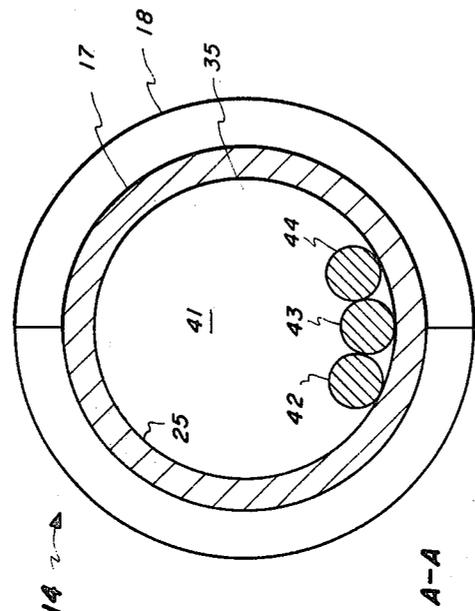
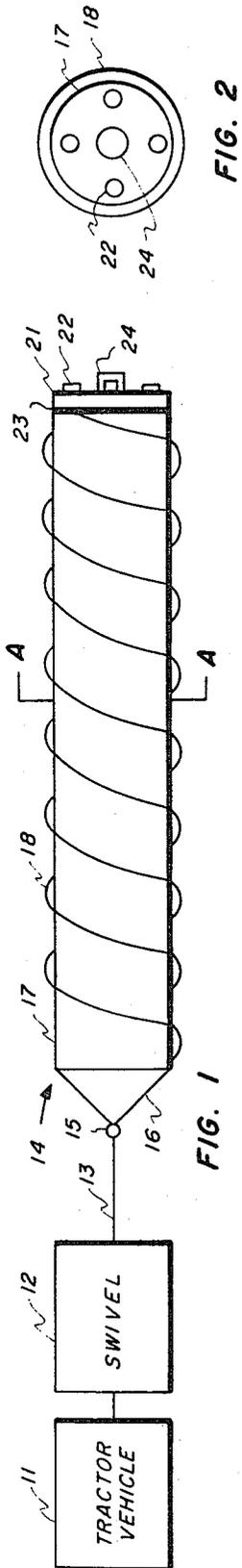
Primary Examiner—Maynard R. Wilbur
Assistant Examiner—H. A. Birmiel
Attorney, Agent, or Firm—Richard S. Sciascia; Don D. Doty; Harvey A. David

[57] **ABSTRACT**

A noisemaker is disclosed which includes an elongated metal pipe with screwthread-like fins that are connected to the outside surface thereof and that extend along substantially the length thereof. One or more clangor rods are disposed within said pipe, and one or more various and sundry shelf-like protrusions are optionally connected to the inside surface of said pipe. The ends of said pipe are effectively closed in such manner as to form a pressure tight chamber there-within which may be filled with a predetermined pressurized fluid for effecting the resonance frequency tuning thereof. A tractor vehicle tows, by means of suitable cables and swivels, the aforesaid pipe assembly through water or any other environmental medium compatible therewith for the purpose of making it rotate about its longitudinal axis, thereby causing said clangor rods to bang against the inside surface of said pipe, said shelf-like protrusion, and each other, so as to make a noise which, in turn, is broadcast by said pipe throughout the environmental medium ambient thereto.

11 Claims, 5 Drawing Figures





A further object of this invention is to provide a mechanical-acoustical transducer requiring very little motive power and which is adaptable for being motivated by numerous conventional types of motors or other motive powers.

Another object of this invention is to provide an improved sound source that is easily and economically manufactured, transported, operated, and maintained.

Another object of this invention is to provide an improved pressure responsive mine sweeping system that is easily and economically manufactured, transported, deployed, operated, maintained, and retrieved.

Other objects and many of the attendant advantages will be readily appreciated as the subject invention becomes better understood by reference to the following detailed description, when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a combination block diagram and schematic elevational view of a system comprising the new and unique noisemaker of this invention and a generalized tractor means and swivel means for the towing thereof;

FIG. 2 is a rear end view of the noisemaker of FIG. 1;

FIG. 3 is a view taken at A—A of the noisemaker of FIG. 1, showing a cross-section of a preferred embodiment thereof;

FIG. 4 is a view taken at A—A of the noisemaker of FIG. 1, showing, in cross-section, another preferred embodiment thereof; and

FIG. 5 is a quasi-pictorial view of a representative operational situation in which the subject invention may be used to an advantage.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, there is shown a tractor vehicle 11 which is connected through a swivel 12 and a tow cable 13 to a noise maker 14 of the type constituting the instant invention.

At the outset, it should perhaps be stated that the aforesaid tractor vehicle 11 may be of any type which will operate and provide motive power for the moving — that is, the rotating, pushing, or pulling, as the case may be — of noisemaker 14 in whatever environmental medium or mediums are encountered in any given operational situation. Hence, for example, it may be a small boat, a ship, an underwater vehicle, a submarine boat, an aircraft, a helicopter, a space craft, a land craft, or the like. Of course, the proper selection thereof by the artisan may be made without violating the scope or spirit of the invention.

Swivel 12 is, of course, any conventional type that will allow noisemaker 14 to be rotated without causing tractor vehicle 11 to be rotated or otherwise adversely affected. It may be connected directly to the rear end of tractor vehicle 11, the front end of noisemaker 11, or anywhere inbetween which facilitates the operation thereof.

Tow cable 13 is, in fact, connected to tow eye 15 which, in turn, is attached to the nose 16 — in this case, a pointed or otherwise streamlined nose — which is integrally connected to a metal pipe 17 off said noisemaker 14. One or more screw thread-like fins 18 is connected, as by welding or the like to the outside surface of pipe 17, as will be discussed more fully subsequently.

As best seen in FIG. 1, but as also depicted, in part, in FIG. 2, an end cap 21 is connected by means of threaded bolts 22 that extend through holes therein (not shown) to the rear end of the wall of pipe 17, as a result of said bolts 22 being screwed into compatible threaded holes therein (also not shown). Optionally, a gasket 23 may be disposed between the rear end of pipe 17 and the front surface of end cap 21 for the purpose of making noisemaker 14 fluid pressure tight for reasons that will be explained in detail below.

Either a plug-like pressure fitting or a pipe plug 24 — as operational circumstances dictate — is screwed into a pipe-threaded hole (not shown) in end cap 21, for reasons which will also be discussed later.

Although the external appearance of noise maker 14 is substantially similar to that portrayed in FIGS. 1 and 5, it should be understood that the actual geometrical configuration thereof may be changed by the artisan to customize it in any manner that will optimize the operation thereof during any given operational circumstances. With that in mind, it should be readily appreciated that the size, angle of attack, and number of screw thread-like fins 18 employed should be properly designed to take into consideration the type of environmental medium or mediums within which the invention will be used, the speed at which noisemaker 14 is to be rotated, the speed it is to be moved along the course to be traveled, the materials (of which there are many) from which it is made, the internal and external forces to which it is subjected, etc. Also, of some consideration in determining the best external design configuration therefor, is whether or not the fluid flow therearound must be substantially laminar or whether there may be some or considerable cavitation within the environmental medium within which it is being towed or otherwise moved. Obviously, it would be well within the purview of the artisan to select whatever parameters, dimensions, angles, materials, and the like, that would best suit any given operational circumstances, if he had the benefit of the disclosure of the invention presented herewith.

Referring now to FIG. 3, the cross-section of noisemaker 14 taken at A—A of FIG. 1 is illustrated, with the reference numerals thereof the same as those employed in FIG. 1 for simplicity of disclosure purposes. Hence, the preferred embodiment of FIG. 3 includes metal pipe 17 and screw fins 18 connected to the outer surface thereof as previously indicated.

Connected to the inside surface 25, as by welding 26 or any other suitable means, is a metallic angle iron 27 which extends along all or some substantial portion of the length pipe 17. As depicted, angle iron 27 forms a first shelf 28 and a second shelf 29 oppositely disposed therefrom which act as roller shelves, respectively, depending on which direction pipe 17 is rotated by fins 18 as noisemaker 14 is towed through the water.

Diametrically opposed to angle iron 27, is another angle iron 31 which is attached to the inside surface 25 of pipe 17 by welding 32 or some other suitable means. Of course, angle iron 31 likewise forms oppositely disposed shelves 33 and 34, depending on the rotation of pipe 17.

At this time, it would perhaps be noteworthy that, although only two angle irons 27 and 31 are illustrated in FIG. 3, any number thereof may be used (including just one) if so desired.

ACOUSTIC MINESWEEPING GENERATOR

STATEMENT OF GOVERNMENT INTEREST

The invention described herein 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.

FIELD OF THE INVENTION

The present invention relates, in general, to sound sources, and is, in particular, a mechanical-acoustical transducer. In even greater particularity, the subject invention is a noise maker which may be used to an advantage in sweeping marine or other mines that are responsive to sonic or other pressure type energies.

DESCRIPTION OF THE PRIOR ART

Heretofore, numerous methods and means have been employed to generate sound at a given source location and for neutralizing and detonating acoustic energy responsive marine mines. As a matter of fact, said sound generators and such minesweeping apparatus have been so copious in quantity that many thereof would undoubtedly come to the mind of the artisan having the benefit of the information presented herewith. Nevertheless, it would perhaps be noteworthy, for example, that electroacoustical transducers in combination with sonar or other signal generators have been used to broadcast acoustical and/or pressure energies throughout various and sundry suitable environmental mediums, and especially throughout water, sea water, estuary water, bay water, river water, and the like. Of course, the speaker of a radio or television is a comparable sound source that is ordinarily disposed and used in an atmospheric environment.

In addition, there are mechanical and pneumatic sound sources which are well known and conventional in the art.

Most of the prior art sound generators are quite satisfactory for some operational purposes, but for the purpose of pressure sweeping marine mines in shallow water, they leave a great deal to be desired.

With respect to mine sweeping in general, the aforementioned mechanical apparatus in the form of towed cables, cutters, and the like, have been employed with some degree of success; however, with respect to marine mines deployed in shallow water of, say, less than 5 feet depths, they are usually quite unsatisfactory because they are complex, cumbersome, unwieldy, and require extensive motive powers to tow or otherwise emplace them where they would be effective for their intended purpose.

SUMMARY OF THE INVENTION

The invention is a very simple but profound noise maker which can be towed through water and make sufficient sounds as a result thereof to satisfy the acoustic neutralization requirements of numerous marine mines. Although simplicity of structural combination is one of the assets of the subject invention, it is also very effective in sweeping pressure responsive marine mines in shallow water, especially as suggested above, in water less than five feet deep. Moreover, the maneuverability thereof in cramped physical locations is facilitated, inasmuch as it is or may be designed to be a self-contained unit which may, without great difficulty, be sized, moved around, and particularly positioned in

such manner as to optimize the effectiveness thereof, regardless of the environment ambient thereto, and regardless of its ultimate intended purpose.

Speaking of the intended purpose of the invention, it will herewith — but without limitation — be considered to be a sound source that is intended to be used to acoustically excite the pressure responsive mechanism off acoustic marine mines, in order to effect the detonation thereof at a safe, remote distance therefrom. However, it should also be understood that it may be designed and used in any manner for any other purpose, whether mentioned herein or not. Obviously, it would be well within the purview of one skilled in the art having the benefit of the teachings presented herewith to make such design choices with respect thereto as would make it suitable for use as a noise maker for any other predetermined operational purpose or purposes, in any other environmental medium or mediums, or for any other reason or reasons.

Briefly, the invention comprises a sealed cylinder-like pipe which contains a plurality of rods, balls, rocks, or any other appropriate objects which will batter, bang, or knock against the inside wall of said pipe and make a desired noise or sound when said pipe is rotated by any given motive power. Of course, in the preferred embodiment disclosed herein, one or more screw-like fins or threads attached to the outside surface of the wall of the pipe and along the length thereof provide such rotational motive power when the invention is towed through water by a boat, submarine vehicle, helicopter, or other appropriate tractor vehicle. Also, for example, any motor connected thereto could be used to cause said pipe to properly rotate (and travel along a course, if so desired) within its aqueous environmental medium. For instance, when towed through water, the aforesaid rods or other objects bang together, bang against the inside surface of the wall of the pipe, and bang against other obstacles disposed within the hollow of said pipe thereby producing a sound, which is broadcast throughout the ambient water or other environmental medium or mediums ambient thereto, as the case may be.

It is, therefore, an object of this invention to produce a new and unique method and means for generating a sound.

Another object of this invention is to provide an improved noise maker.

Another object of this invention is to provide an improved mechanical-acoustical transducer.

A further object of this invention is to provide a tunable sound source.

A further object of this invention is to provide an improved pressure-responsive mine neutralizing system.

Still another object of this invention is to provide a pressure mine sweeping system that may be effectively operated at any water depths but especially in shallow water depths, such as, for example, in water depths of one-half foot or thereabouts.

Still another object of this invention is to provide a noise maker that may be moved — and, thus, is operable — in numerous different environmental mediums, such as in water, earth, the atmosphere, space and various combinations thereof.

A further object of this invention is to provide a mine sweeping means that may be deployed and maneuvered within a relatively small space or confining territory.

Disposed within a chamber 35 defined by the wall of pipe 17 is a pair of metal beater objects, such as, for example, elongated metal rods 36 and 37 which are free to roll, drop, or otherwise move or bump against each other, the respective shelves of angle irons 27 and 31, and the inner surface of said pipe 17.

It would ostensibly be noteworthy at this time that metal balls or clangor type objects of other predetermined or random configurations or materials may be substituted for rods 36 and 37, if so desired, without violating the spirit and scope of the invention. Hence, reference numerals 36 and 37 may be considered as being balls 36 and 37, etc., respectively, as well as rods 36 and 37, respectively.

Inasmuch as the wall of pipe 17 defines chamber 35, it is inherently adapted for being filled with some predetermined fluid; therefore, in this preferred embodiment, it will be filled with a gas, viz., air 38. However, it should be understood that any other gas (or liquid) may be substituted therefor, and said air (or other gas) may be pressurized for pipe tuning purposes, in the event so doing would optimize the frequency, fidelity, or other characteristics of the acoustical energy generated by the invention during the operation thereof.

FIG. 4 illustrates, in cross-section, another possible embodiment of the subject invention that is even simpler than that portrayed in FIG. 3. Externally, of course, it is similar to that shown in FIGS. 1 and 3, and, thus, it may also be considered as being a cut at A—A of FIG. 1. Consequently, as appropriate, like reference numerals for like parts are used in both FIGS. 1 and 4, as was done in FIGS. 1 and 3.

As seen in FIG. 4, pipe 17 and screw fins 18 are connected and configured as described above. Inside wall 25 of pipe 17, like in the embodiment of FIG. 3, defines a chamber 35 which is filled with a predetermined fluid 41, such as, for example, nitrogen gas under whatever pressure as would effect the proper tuning the frequency frequency of pipe 17 in a favorable manner for any given operational circumstances. Of course, like fluid 38 of FIG. 3, fluid 41 of FIG. 4 may be air or some other gas, liquid, or combination thereof at atmospheric pressure or at some other suitable pressure.

In this particular embodiment, a trio of rollers 42, 43, and 44 are disposed for free action within the hollow chamber 35 of pipe 17, so that they may bang against each other and the inside surface 25 of pipe 17. Of course, any number of such rollers may be employed, or, if desired, balls or other suitable beating or clanging objects may be substituted therefor.

At this time, it would perhaps be of some significance to disclose that noisemaker 14 may be made of any appropriate conventional materials, either in part or entirely. Hence, although the preferred embodiments have, to date, been made of iron or steel, they may be made of some other metal, plastics, rubber, wood, or anything else that would cause sound of a useful type or character to be generated for some useful purpose by the instant invention, with the selection thereof being left up to the artisan for any given operational situation.

Moreover, with the exception of noisemaker 14, all of the components incorporated in the subject invention are well known and conventional per se; accordingly, it is their new and unique interconnections and interactions which constitute the new combination of

elements that effect the invention and produce the new and improved results generated thereby.

Referring now to FIG. 5, a typical minesweeping system is shown as being operated for the purpose of neutralizing, detonating, and sweeping marine mines. A boat 51, in this particular case, acts as the tractor vehicle and travels along a minesweeping course on water 52. Boat 51 tows by means of a tow line or cable 53 a magnetic pipe 54 of, for instance, the type that is comparable to that disclosed in patent application Ser. No. 395,331, entitled Magnetic Mine Detector System, filed in the U.S. Patent Office on Sept. 9, 1973, by Richard C. Dyjak.

The trailing end of magnetic pipe 54 is connected through another cable 55 to a swivel 56, the trailing end of which is likewise connected to another tow cable 57, with the tail end thereof connected to a nose connector 15 of acoustic energy source 14 having screw fins 18 attached to body 17 thereof, in a manner similar to that depicted in FIG. 1 and discussed in detail above in conjunction therewith.

Of course, the aforesaid swivel 56 may be directly connected to either magnetic pipe 54 or sound source 14 or both, if so desired. It would be obvious to the artisan to select whatever component interconnection arrangement would provide optimum operation for any given situation; hence, so doing thereby would not violate the spirit or scope of the claimed invention.

In the minesweeping system of FIG. 5, sound source 14 is portrayed as broadcasting acoustical energy 58 throughout a portion of water 52 and the air above the surface thereof, as well as throughout a portion of sea floor 65, within the influence range thereof.

Moreover, magnetic energy 59 is schematically shown as emanating from the aforesaid magnetic pipe 54 in such manner as to effectively travel to some useful minesweeping location.

As may readily be seen, pressure and/or magnetic responsive marine mines 62 and 63 or other pressure and/or magnetic responsive devices 64, suspended from, laying on, or buried in sea floor 65, respectively, would be subjected to the respective energies emanating from magnetic pipe 54 and sound source 14 and be influenced accordingly thereby.

In addition to the above mentioned components incorporated in combination in the system of FIG. 5, minesweeping cables, cutters, and the like, as well as any other utilization apparatus (not shown), may be connected to trail from ship 51, pipe 54, or sound source 14, if so desired, thereby making the system illustrated therein as integrated and comprehensive as necessary for any given operational purpose.

MODE OF OPERATION

The operation of the instant invention will be discussed briefly now in conjunction with all of the Figures of the drawing, but especially in conjunction with the preferred operational embodiment shown in FIG. 5 and the preferred structural embodiments shown in FIGS. 1, 3, and 4.

Actually, the operation of the invention is so simple that it is practically self-evident; nevertheless, the simplicity thereof does not distract in any respect from the significance thereof, especially in the minesweeping art.

Again, for purpose of emphasis, it should be understood that noisemaker 14 per se, although primarily in-

tended to be deployed and towed in an aqueous environmental medium such as water (as illustrated in FIG. 5) is also useful within numerous other environmental mediums (such as that intended to be very generally depicted in FIG. 1). However, for the purpose of keeping this disclosure as simple as possible, only the pressure responsive marine mine destruction situation will be discussed, without detailed mention of magnetic pipe 54 or other towed utilization apparatus.

As best seen in FIG. 5, ship 51 effectively tows sound source 14 through water 52. As it does so, screw fins 18 react to the surrounding mass forces of the water moving relative thereto, to thereby cause sound source 14 to rotate within said water with a speed that is proportional to the angle of attack of said fins and the forward velocity of the sound source per se.

The design of fins 18 may, in fact, be one continuously circulating fin or several continuous or intermittently circulating fins. The angle of attack thereof should preferably be such that little or no cavitation is effected within the water contiguous therewith for whatever speed sound source is pulled through the water. Obviously, the tractor vehicle employed would or could affect the towing speeds required, and the degree of hazard encountered or anticipated during minesweeping tactics could be an important consideration in the selection of the tow vehicle. In any event, if the acoustic energy emanating from sound source 14 is to be broadcast throughout the water ambient thereto in as efficient a manner possible, screw fins 18 should be sized and otherwise designed and configured so as to cause sound source 14 to rotate at its desired speed while permitting laminar water flow adjacent thereto.

Referring now to the embodiment of FIG. 3, if it is assumed that screw threads 18 cause body 17 to rotate counterclockwise about the longitudinal axis thereof, rods 36 and 37 roll around the inside surface 25 thereof, bang against shelves 28 and 33, and are carried thereby until they fall off thereof, due to natural gravitational forces. Of course, the rolling, banging, and impact of rods 36 and 37 against surface 25, shelves 28 and 33, and each other generates a noise in body 18 which, in turn, transmits it to the water ambient to the external surface thereof. Again, the design selection of the number of shelves and rods or rollers used are factors which help determine the type of sound or noise produced.

The embodiment of FIG. 3 operate somewhat similarly to that of FIG. 4, except that the shelves have been omitted and three rods are shown as being clangers or bangers, instead of two. Thus, as rods 42, 43, and 44 roll against or bang against inside surface 25 and each other, sounds are generated which are communicated to the water ambient to the external surface of body 17, as said body 17 is rotated by fins 18, due to its being pulled through said water.

In view of the foregoing, it may readily be seen that water 52 is both an actuating element and a receiving element (for both embodiments), in that its relative force against fins 18 effect the rotation of sound source 14 as a unit about its longitudinal axis and it receives the acoustical energy produced thereby during such rotation. Accordingly, it may also be seen that the subject sound source and its ambient water environment interact as a unique combination and in a unique manner to produce an exceedingly useful result.

As previously suggested, sound source 14 may be "tuned" by pressurizing, if so desired. As a general rule the inside chamber of pipe 17 contains air at atmospheric pressure; however, it may be filled with compressed air at some predetermined pressure (or some other suitable gas under pressure), in the event so doing tends to optimize the resonance characteristics of pipe 17 and, thus, the frequencies of the sound produced thereby for some particular operational circumstance. Of course, it may also be filled or partially filled with water or any other useful liquid or fluid, depending on operational requirements. For such purpose, the entire pipe should be made water or pressure proof and the proper selection of fluid filler fitting 24 made by the artisan.

Furthermore, as also previously indicated, for tuning purposes, pipe 17 may be sized and made of whatever material — metal, plastic, wood, or the like — that would provide the desired resonance characteristics therefor.

Referring again to FIG. 5, as sound source 14 is rotated, acoustical energy 58 is generated and broadcast toward the aforementioned mines and other objects 62, 63, and 64, in order to effect the detonation and influencing thereof, respectively, as the case may be.

Obviously, other embodiments and modifications of the subject invention will readily come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing description and the drawings. It is, therefore, to be understood that this invention is not to be limited thereto and that said modifications and embodiments are intended to be included within the scope of the appended claims.

What is claimed is:

1. An underwater minesweeping system, comprising in combination:
 - an open-ended elongated pipe having a longitudinal axis;
 - a nose cap of predetermined geometrical configuration connected to one of the open ends of said elongated pipe in such manner as to effect the closure thereof;
 - another cap of predetermined geometrical configuration connected to the other of the open ends of said pipe in such manner as to effect the enclosure thereof;
 - a fin having edges along the length thereof and a predetermined width therebetween, with one of said edges thereof connected to the outer surface of the aforesaid elongated pipe in such manner as to make said fin form a substantially helical configuration around and along the length of said elongated pipe and extend outwardly therefrom, whereby said fin has such angle of attack with respect to water ambient thereto and to said elongated pipe as to effect the rotation of said elongated pipe about its longitudinal axis whenever it is propelled along an underwater course;
 - means effectively connected to one of the aforesaid end closure caps of said elongated pipe for effecting the propelling thereof along said underwater course with the longitudinal axis thereof substantially parallel thereto; and
 - means disposed within said end-capped elongated pipe for banging against the internal surface thereof in response to the rotation thereof about the longitudinal axis thereof as a result of the pro-

PELLING THEREOF ALONG SAID UNDERWATER COURSE BY THE AFORESAID PROPPELLING MEANS.

2. The underwater minesweeping system of claim 1, wherein said means effectively connected to one of the aforesaid end caps of said elongated pipe for effecting the propelling thereof along said underwater course with the longitudinal axis thereof substantially parallel thereto comprises:

- a boat adapted for traveling along a predetermined course within a body of water; and
- a swivel effectively connected between said boat and said one of the aforesaid end closure caps.

3. The underwater minesweeping system of claim 1, wherein said means effectively connected to one of the aforesaid end caps of said elongated pipe for effecting the propelling thereof along said underwater course with the longitudinal axis thereof substantially parallel thereto comprises a tractor vehicle.

4. The underwater minesweeping system of claim 1, wherein said means disposed within said end-capped elongated pipe for banging against the internal surface thereof in response to the rotation thereof about the longitudinal axis thereof as a result of the propelling thereof along said underwater course by the aforesaid propelling means comprises at least one rod, the length of which is such as to cause it to extend substantially along the entire length of said elongated pipe.

5. The underwater minesweeping system of claim 1, wherein said means disposed within said end-capped elongated pipe for banging against the internal surface thereof in response to the rotation thereof about the longitudinal axis thereof as a result of the propelling thereof along said underwater course by the aforesaid propelling means comprises at least one metallic ball.

6. The underwater minesweeping system of claim 1, wherein said means disposed within said end-capped elongated pipe for banging against the internal surface thereof in response to the rotation thereof about the longitudinal axis thereof as a result of the propelling thereof along said underwater course by the aforesaid propelling means comprises a plurality of freely moving clangors.

7. The invention of claim 1, further characterized by at least one means protruding from the inside surface of said end-capped elongated pipe for timely deflecting the aforesaid banging means during the rotation of said pipe.

8. The invention of claim 1, further characterized by an angle iron connected to and extending along the length of the inside surface of said end-capped elongated

PIPE IN SUBSTANTIAL PARALLEL WITH THE LONGITUDINAL AXIS THEREOF.

9. The invention of claim 1, further characterized by fluid means, pressurized in a predetermined manner, disposed within said end-capped elongated pipe for effecting the tuning of the resonant frequency thereof to a predetermined acoustical frequency.

10. A system for sweeping acoustic marine mines that have been deployed within a body of water, comprising in combination:

- an open-ended elongated pipe having a longitudinal axis;
- a nose cap of predetermined geometrical configuration connected to one of the open ends of said elongated pipe in such manner as to effect the closure thereof;
- a tail cap of predetermined geometrical configuration connected to the other of the open ends of said pipe in such manner as to effect the closure thereof;
- a fin connected to the outer surface of said elongated pipe in such manner as to make said fin form a substantially helical configuration around and along the length of said elongated pipe and extend outwardly therefrom, so as to make said fin have such angle of attack with respect to the water of said body of water that is ambient thereto and to said elongated pipe as to effect the rotation of said elongated pipe about its longitudinal axis whenever it is propelled along an underwater course within said body of water;
- at least one freely moving clanger disposed within said end-capped elongated pipe for falling and banging against the inside surface thereof in response to the rotation thereof about the longitudinal axis thereof;
- a tractor vehicle;
- a first cable, with one end thereof connected to said tractor vehicle;
- a swivel, with one end thereof effectively connected to the other end of said cable;
- a second cable, with one end thereof connected to the other end of said swivel; and
- means connected between the other end of said second cable and the aforesaid nose cap for effecting the connection thereof thereto.

11. The system of claim 10, further characterized by a magnetic pipe connected between the other end of said first cable and said one end of said swivel.

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