US005443027A

United States Patent [19]

Owsley et al.

[11] **Patent Number: 5,443,027**

[45] **Date of Patent: Aug. 22, 1995**

[54] **LATERAL FORCE DEVICE FOR UNDERWATER TOWED ARRAY**

[75] Inventors: **Norman L. Owsley**, Gales Ferry; **John F. Law**, Oakdale; **Robert D. Vanasse**, Columbia, all of Conn.; **Stephen P. Ebner**, Wheaton; **Richard K. Knutson**, Germantown, both of Md.; **Roger C. Norris**, Mystic, Conn.

[73] Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, D.C.

[21] Appl. No.: **169,276**

[22] Filed: **Dec. 20, 1993**

[51] **Int. Cl.**[6] **B63B 21/00**

[52] **U.S. Cl.** **114/244**; 405/158

[58] **Field of Search** 405/158, 166, 171; 114/242, 243, 244, 245, 246

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,375,800	4/1968	Cole et al.	114/245
3,931,608	1/1976	Cole	114/245 X
4,027,616	6/1977	Guenther et al.	114/244
4,729,333	3/1988	Kirby et al.	114/244
4,798,156	1/1989	Langeland et al.	405/166 X

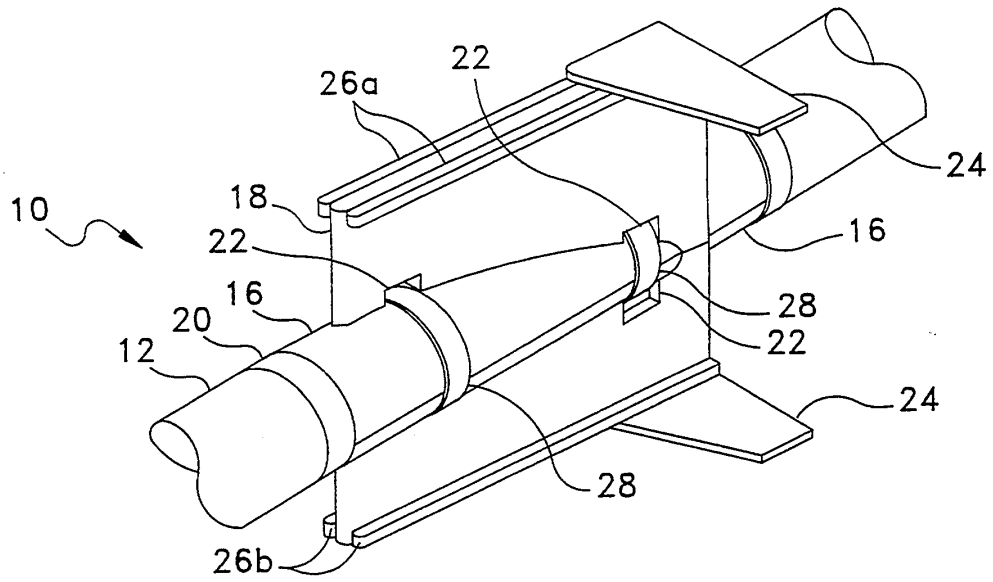
Primary Examiner—David H. Corbin

Attorney, Agent, or Firm—Michael J. McGowan; Prithvi C. Lall; James M. Kasischke

[57] **ABSTRACT**

A lateral force device for displacing a towed underwater acoustic cable providing displacement in the horizontal and vertical directions having a spool and a rotationally mounted winged fuselage. The hollow spool is mounted on a cable with cable elements passing therethrough. The winged fuselage is made with the top half relatively positively buoyant and the bottom half relatively negatively buoyant. The winged fuselage is mounted about the hollow spool with clearance to allow rotation of the fuselage. The difference in buoyancy between the upper and lower fuselage maintains the device in the correct operating position. The wings are angled to provide lift in the desired direction as the fuselage is towed through the water.

20 Claims, 3 Drawing Sheets



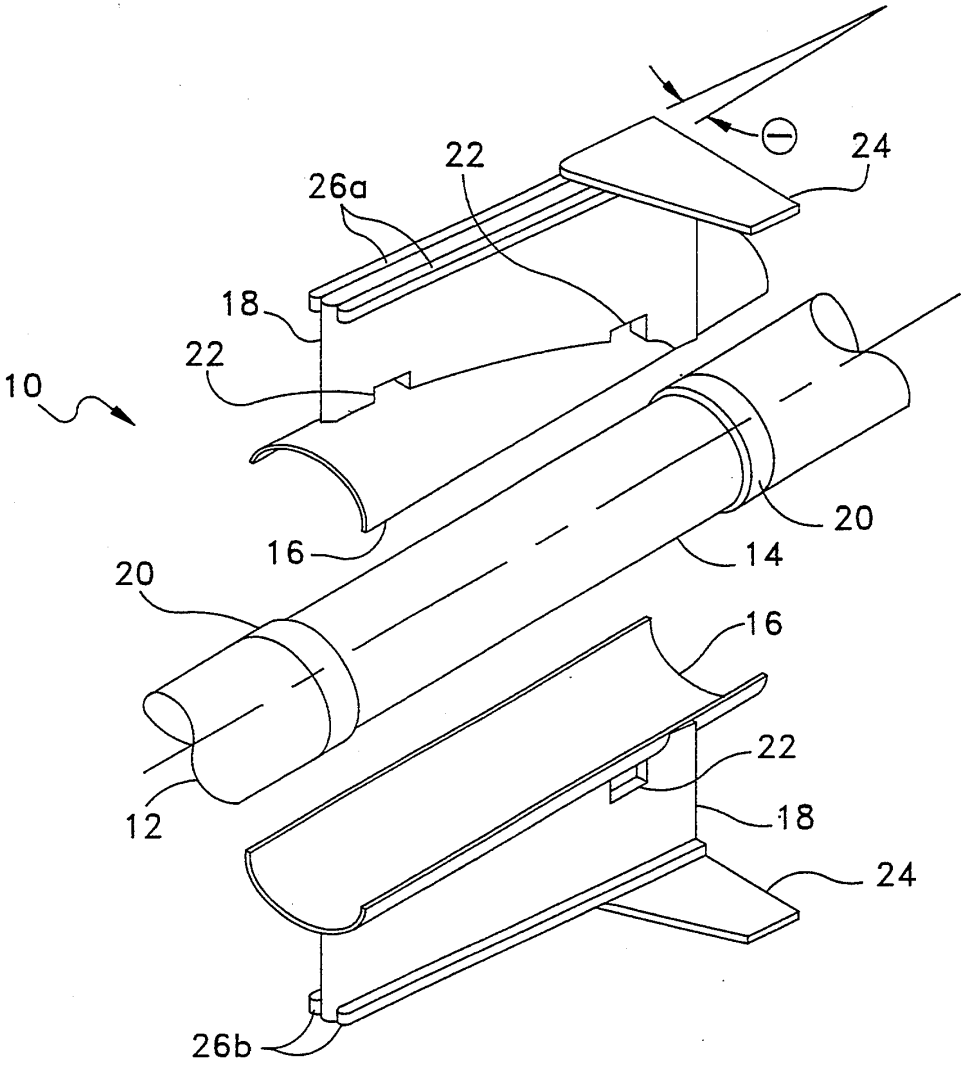


FIG. 1

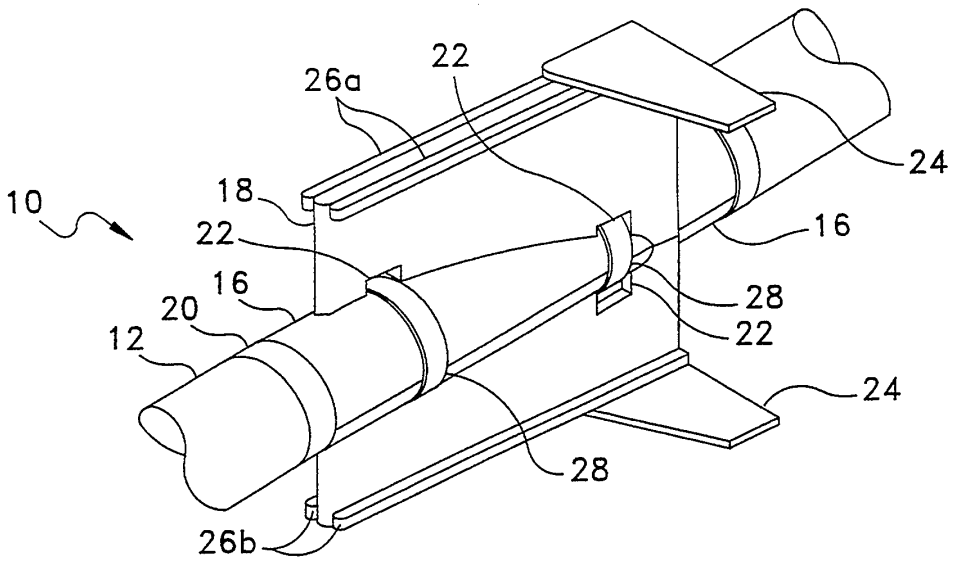


FIG. 2

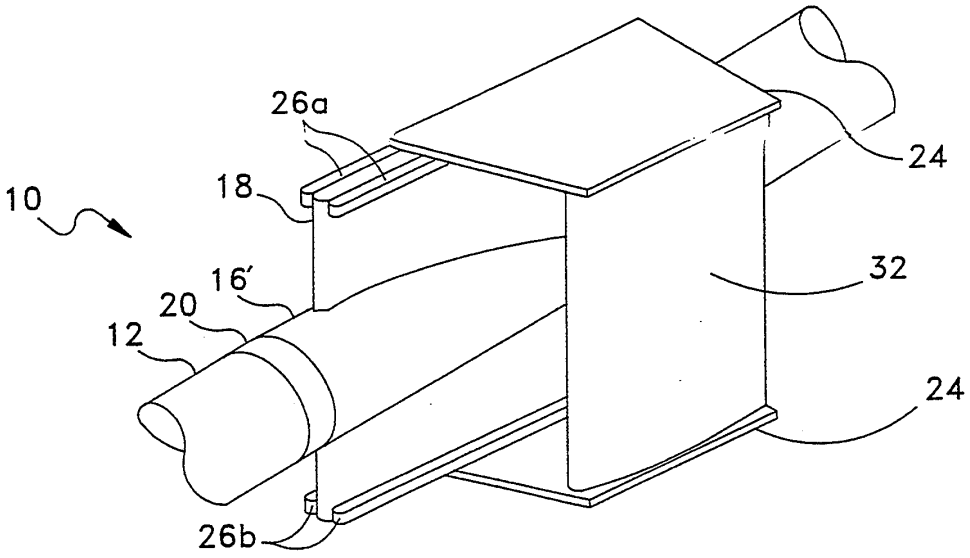


FIG. 4

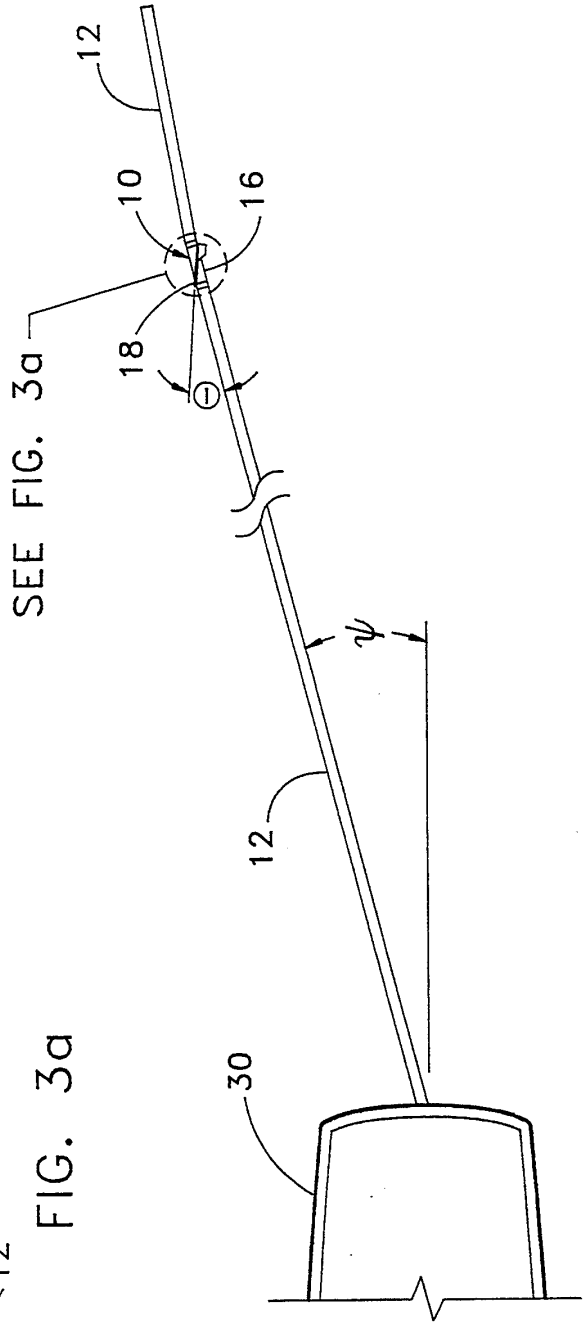


FIG. 3

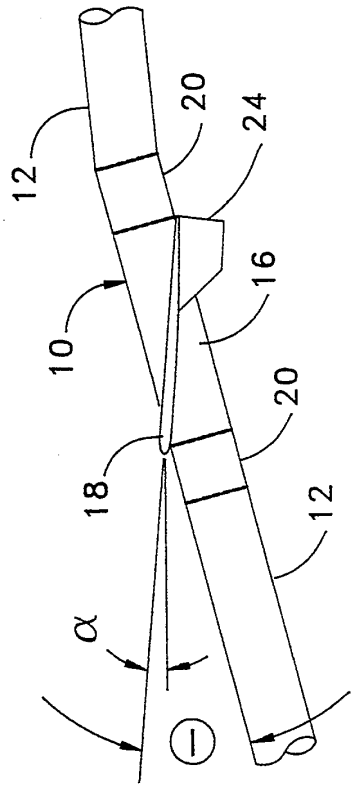


FIG. 3a

LATERAL FORCE DEVICE FOR UNDERWATER TOWED ARRAY

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.

BACKGROUND OF THE INVENTION

(1). Field of the Invention

The present invention relates to a device to provide lateral and vertical displacement of a towed underwater cable and more particularly to a durable lightweight device for displacing an underwater cable which will not create excessive noise as the cable is towed through the water.

(2). Description of the Prior Art

The inventive device has characteristics in common with two other classes of devices, paravanes and depth control systems. Paravanes displace towed cables in a lateral direction away from the path of the towing craft. Depth control systems provide displacement in a vertical direction above or below the towing craft.

It is well known in the art that paravanes are used to provide displacement for towed cables lateral to the motion of the towing craft. Paravanes are towed bodies affixed at the end or along the length of a towed cable to position the cable away from the path of the towing craft. A fin or vane on the paravane causes a lateral displacement of the cable by producing lift in a lateral direction. Prior art paravane systems depend on components other than the vane itself to set and stabilize the direction of the hydrodynamic force. The stabilizing components used in prior art devices include attachment bridles, surface floats on tethers, net floats and trawl chains. These components increase size, weight, drag and noise thereby limiting use of these paravanes to low speeds in sonic operations.

Because many prior art paravanes are large or mechanically complicated devices, they must be removed from the water separately as the tow cable is retracted. Larger paravanes require the use of a hoist to remove them from the water. More complicated paravanes are less sturdy and must be treated with care to avoid damaging their inner workings.

Depth control devices are also well known in the art. Many mechanisms exist for controlling the depth of a towed underwater cable. These methods include diving planes, retractable vanes, air diaphragms, and movable horizontal plates. Adjustable diving planes are often used in the prior art to control the depth of the cable. Vertical displacement is achieved in some prior art devices by changing the buoyancy of the depth control device to maintain the desired depth.

Two prior art patents, Cole U.S. Pat. No. 3,375,800 and Cole U.S. Pat. No. 3,931,608, disclose depth control device that are rotatably mounted on towed acoustic cables. Cole '800 discloses a device mounted around the towed cable that utilizes ballast to maintain the depth control device in its preferred orientation and to prevent spinning. Cole '608 discloses a device mounted to the cable by rotatable brackets in such a way that the device hangs below the cable thus allowing the weight of the device to act as ballast. Both of these devices use pressure sensing means and adjustable diving planes to control depth. Neither of these devices provides for lateral displacement of a towed acoustic cable.

These prior art devices suffer the same durability problems as the more complicated paravanes. Furthermore, none of the known prior art devices are lightweight or simple enough to be wound onto a storage winch or reel with a towed acoustic cable.

SUMMARY OF THE INVENTION

Accordingly, it is a general purpose and object of the present invention to provide an apparatus for controlling the lateral displacement of towed acoustic cables.

It is a further object that such device displace the cable while creating a minimum of turbulence and noise.

Another object is that such device be durable and small enough to be deployed and retrieved with the cable, without requiring attachment or removal during either deployment or retrieval.

These objects are accomplished with the present invention by providing a lateral force device having a spool and a rotationally mounted winged fuselage. The hollow spool is mounted on a cable with cable elements passing therethrough. The winged fuselage is made in two halves with the top half relatively positively buoyant and the bottom half relatively negatively buoyant. The two halves are mounted about the hollow spool with clearance to allow rotation of the winged fuselage. The wings are angled to provide lift as the fuselage is towed through the water. The device can be manufactured with a given buoyancy to allow it to maintain the desired depth. The wings have winglets at their tips. The difference in buoyancy between the upper and lower winged fuselage halves and the winglets maintain the device in the correct operating position.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention and many of the attendant advantages thereto will be readily appreciated as the invention becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein:

FIG. **1** shows an exploded perspective view of a lateral force device mounted on a towed cable;

FIG. **2** shows a perspective view of a lateral force device as assembled on a towed cable;

FIG. **3** shows a vessel towing a cable with a lateral force device disposed thereon;

FIG. **3***a* shows a detail view of the towed lateral force device of FIG. **3**; and

FIG. **4** shows an alternate embodiment of the inventive device having a bi-wing configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following text, all references to lateral mean in the direction orthogonal to the direction of tow. Referring now to FIG. **1**, there is shown an exploded perspective view of the inventive device. A lateral force device **10** is shown mounted on a towed underwater cable **12**. Lateral force device **10** comprises a spool **14**, two cylindrical fuselage halves **16**, and two wings **18**.

Spool **14** is a hollow cylinder with a shoulder portion **20** at each end thereof. Spool **14** is disposed integral with towed underwater cable **12** to allow cable elements and wiring to pass through the hollow in spool **14**. Shoulder portions **20** are even with the outer surface

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.