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[54] **METHOD AND APPARATUS FOR EMPLACEMENT OF LONG BEAMS IN RUGGED SEA BOTTOM AREAS**


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[51] **Int. Cl.**..... **B63b 35/00,** E02b 17/00

[58] **Field of Search**..... 114/.05 R, .05 F, 114/.05 D; 175/5-10; 166/.5, .6; 61/46.5, 53.68



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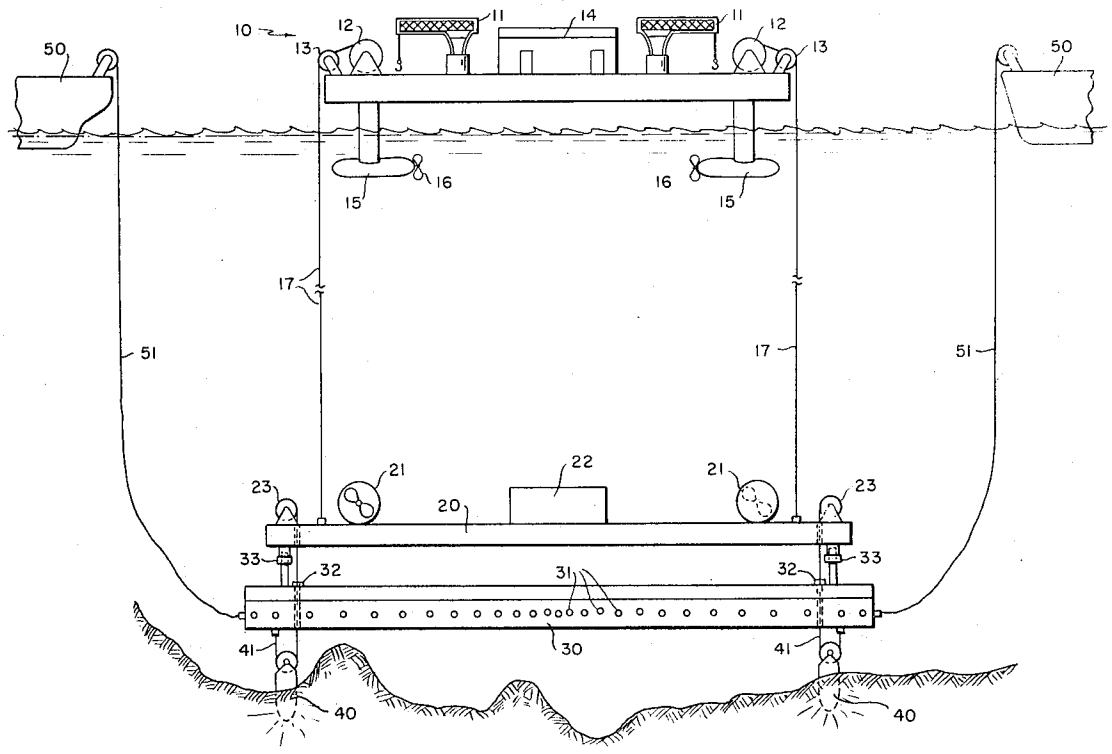
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[57] **ABSTRACT**

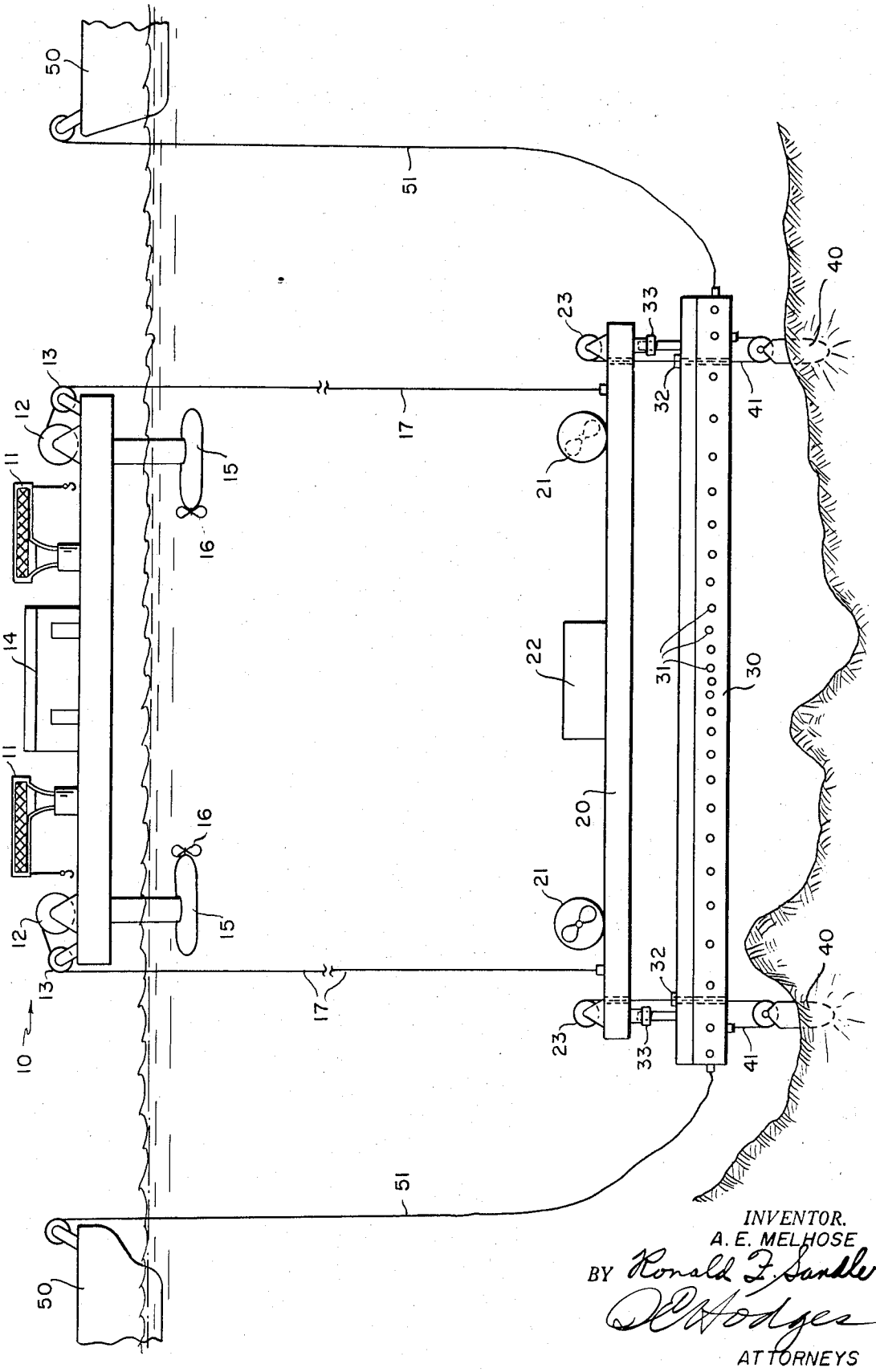
A method and apparatus for accurate emplacement of mechanical long beams, such as those incorporating acoustic transducers, in rugged sea bottom areas.


**5 Claims, 1 Drawing Figure**



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# METHOD AND APPARATUS FOR EMPLACEMENT OF LONG BEAMS IN RUGGED SEA BOTTOM AREAS

## BACKGROUND OF THE INVENTION

The invention relates to a method and apparatus for carrying out that method for the emplacement of long beams and more particularly to a new method and apparatus for accurate emplacement of long and heavy mechanical beams carrying such components as arrays of acoustic transducers which require very accurate alignment. The invention finds its greatest use and advantages over the prior art where the beams are to be placed in areas where the sea bottom is extremely rugged.

Other devices relating to this invention are concerned with platform erection and leveling, buoyant coring devices, drilling rigs with positioning propellers and drilling rigs with adjustable legs extending from a buoyant platform to achieve stability when operating over an uneven ocean bottom. These systems were involved with geological survey and drilling rather than the underwater placement of electronic equipments.

Recent consideration of the problems attendant the emplacement of long beams in a sea bottom environment have led to proposals that have assumed that the beam weight would be supported by a stabilized surface craft while part of the load would be supported by tripod feet resting on the bottom. While such a system is apparently feasible where the ocean floor is mostly mud, sand, or, at worst, only moderately rocky, such a system would not be feasible where the floor was extremely jagged and precipitous because it would be expected to be beyond the ability of tripod legs to preserve the balance and support of the beam structure. Additionally, since the tolerances for tilt of the very long beams have become tighter, tripod legs perched on a jagged bottom cannot be relied upon.

There are, therefore, outstanding requirements for a reasonable system capable of laying long beams on a jagged ocean floor where the beam emplacement is characterized by rigid tolerances on beam tilt. While such requirements have proved difficult to achieve in the past, the present invention does teach how to meet these requirements.

Accordingly, it is an object of the present invention to provide an improved apparatus for the emplacement of long beams on an ocean floor.

A further object is to provide an improved method for the emplacement of long beams on an ocean floor.

Still another object is to provide an improved apparatus for the emplacement of beams within rigid tolerances for tilt on an ocean floor.

A still further object is to provide an improved method for the emplacement of beams within rigid tolerances for tilt on an ocean floor.

Other objects and advantages, as well as the exact nature of the invention, will be readily apparent to those skilled in the art from the consideration of the following disclosure of the invention.

## SUMMARY OF THE INVENTION

The present invention accomplishes the above-cited objects by use of a stable platform, cable laying vessels, a spreader, and explosive anchors. The system employed makes both the horizontal and the azimuthal placement of the beam independent of the ocean floor topography and morphology.



At the sea surface is the stable platform from which the beam lowering operation is conducted. The platform carries two cables to which the spreader is attached, spreader being a heavy piece of apparatus to which the beam, while being lowered, is attached. The beam is constructed so that it will exhibit substantial positive buoyancy; it is the weight of the spreader that allows lowering. The beam itself carries a plurality of explosive anchors.

The cables from the platform are extended until the bottom is sensed as being close. The downward motion of the beam is then halted and the beam position is corrected. The explosive anchors are individually lowered to the bottom and exploded, the beam position again corrected, and then the beam is detached from the spreader, leaving the buoyant beam free of the emplacement equipment except for the communications cable attached to the cable laying vessels which thereafter go into operation laying cable to the next selected beam site.

## BRIEF DESCRIPTION OF THE DRAWING

The sole FIGURE illustrates an emplacement of a beam in a craggy area using apparatus constituting an embodiment of the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the figure, there is shown the stable platform **10,** spreader **20,** beam **30,** explosive anchors **40** and cable laying vessels **50.**

The entire beam lowering operation is conducted from stable platform **10** which carries cranes **11** for lifting the spreader **20** and beam **30,** cable storage reels **12,** winches **13,** plus the control room **14.** Under the platform are mounted a plurality of floatation tanks **15** and position correcting propellers **16.** Also at the surface is shown two cable laying vessels **50** which pay out the communications cable **51** and which proceed with the cable lay after emplacement of the beam **30,** shown carrying a hydrophone array **31.** One of the two cable laying vessels may be replaced by a cable support buoy which would be pulled under to release the cable as beam **30** nears its prescribed position near the ocean bottom.

The cranes **11,** cable storages reels **12** and winches **13** comprise the system for lowering the spreader **20** and beam **30** via lowering cables **17.** The spreader and beam are initially stored and attached on platform **10.** The beam is made with a positive buoyance characteristic by use of imbedded flotation material **34** in the beam. The weight of the attached spreader **20** is such that the positive buoyancy of the beam **30** is overcome, thereby permitting gravity lowering of the beam and spreader assembly.

Cranes **11** are used to carry the beam and spreader assembly over the side of platform **10** after the platform is positioned by means of position correcting propellers **16.** Lowering cables **17** are payed out by use of the cable storage reels **12** and winches **13.** The lowering cables **17** not only serve the mechanical lowering function but also carry electrical power to the spreader **20** for powering its controls and azimuthal correction propellers **21** and signal carrying conductors for carrying

sensor and control information. The sensor and control section **22** is located on spreader **20.**

When at a prescribed position achieved by use of positioning propellers **16, 21** and as determined from the general topography of the ocean bottom as reported by the sensors, the downward motion of the beam and spreader assembly is halted and the assembly position is then corrected for tilt, and azimuth again by means of the above mentioned propellers **16, 21.** After adjustment, the explosive anchors **40** are lowered by means of the beam anchoring cable reels **23.** While only two anchors are shown, additional anchors could be similarly attached for use in areas where the ocean floor is extremely precipitous. Each anchor employed would be individually lowered to penetrate the bottom layers until in substantial bottom and they are then exploded. Final correction of tilt then takes place by adjusting lengths of the anchor lines. Trial pulls from the surface would determine the holding capability of the anchors.

The seizure clamp devices **32** which grip the anchor cables **41** at beam **30** are fired in order to sever the anchor cable between the beam and spreader **20.** The release plugs **33** which also act as compression spacers between the spreader and the beam are now able to pull apart allowing the spreader to be pulled to the surface platform for future use. The lowering cables would not entangle as azimuth is again controlled in ascent, as in descent, by the azimuth correction propellers **21.**

The beam is thus emplaced. Water currents will control the sway of the beam as permitted and determined by the lengths of the anchor cables **41.** If the sway of the beam is unequal throughout its length due to bottom depth variatiion, the beam will take an azimuthal set which will remain constant in continuously flowing bottom currents which would have been previously measured and compensated for in the azimuthal emplacement of the beam.

What has been disclosed is an improved apparatus and method for emplacement of mechanical long beams carrying electronic components in rugged accuracy. It should be understood, of course, that the foregoing disclosure relates only to a preferred embodiment of the invention and that numerous modifications may be made therein.

What I claim is:

**1.** The method of beam emplacement in sea bottom areas comprising the steps of:

providing a beam to be positioned near the sea bottom;

providing a spreader with propulsion means to aid in the emplacement of said beam;

providing explosive anchors and line;

mechanically coupling said beam, spreader and explosive anchors together thereby forming a beam-anchor-spreader assembly;

lowering said assembly towards said sea bottom;

lowering said explosive anchor;

firing said explosive anchors; and

detaching said explosive anchors and said beam from said spreader.

**2.** The method of beam emplacement as set forth in claim **1** wherein the assembly position is sensed and corrected after said assembly is lowered toward the sea bottom.

**3.** The method of beam emplacement as set forth in claim **2** wherein assembly position is again sensed and corrected after said explosive anchors are fired.

**4.** The method of beam emplacement as set forth in claim **1** wherein assembly tilt position is corrected after said explosive anchors are fired by adjusting the length of line between said beam and said anchors.

**5.** A system for beam emplacement in sea bottom areas comprising:

a mechanical beam including underwater acoustic centers;

spreader means for aiding the lowering of said beam toward the ocean floor and including sensors to sensing beam position;

anchor means for tying said beam to the ocean floor;

mechanical coupling means between said beam, spreader means, and anchor means forming a beam-anchor-spreader assembly; and

control means for decoupling said spreader means from said beam and anchor means and for implanting said anchor means in the sea bottom when said sensors indicate said beam in a predetermined, desired position.

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