United States Patent

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[33] **Netherlands**
[31] **68,05458**

[54] **APPARATUS FOR ANCHORING A RIVER MINE OR OTHER EXPLOSIVE CHARGE**
14 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **102/13**
[51] **Int. Cl.** **F42b 22/16**
[50] **Field of Search** 102/10, 12–14

[56] **References Cited**
UNITED STATES PATENTS

1,290,054	1/1919	Bertrand	102/13
2,775,939	1/1957	Fogal	102/13

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ABSTRACT: An anchoring apparatus, permitting the application of river mines or other explosive charges, is provided in which the charge and the anchor constitute the two base points and the ignition device contained in a floater constitutes the summit point of a triangular configuration consisting of these three elements and of the three cables interconnecting them. The reduced dimensions of the floater held in suspense beneath the water surface ensure a restricted detectability by sight thereof and a restricted surface area on which forces can be exerted by the flowing water.

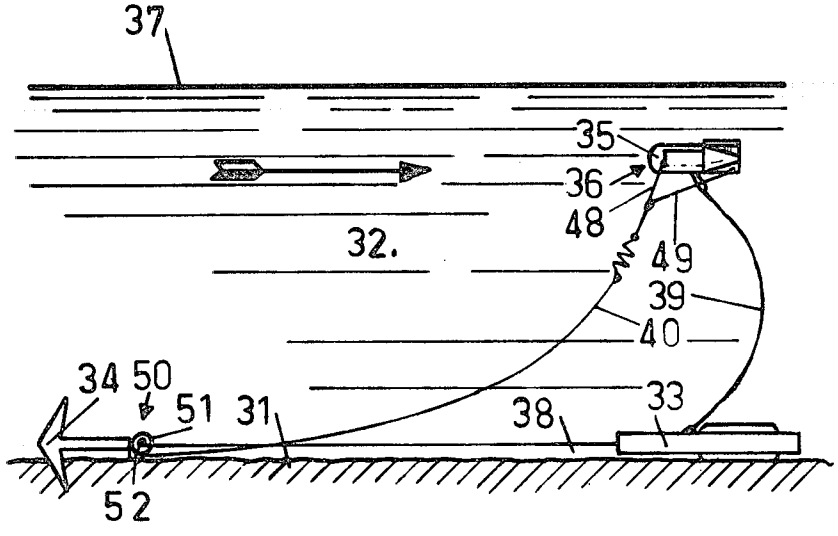


FIG.1

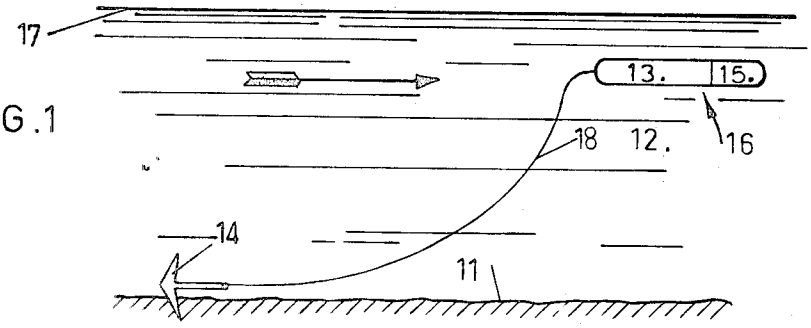


FIG.2

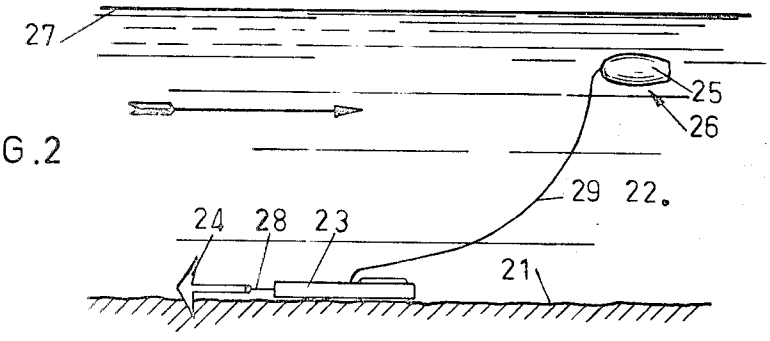


FIG 3

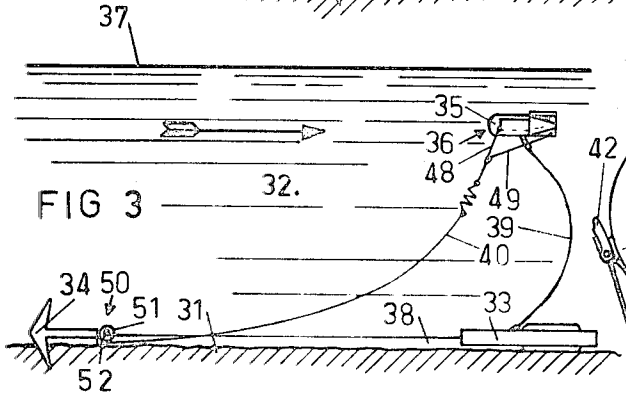


FIG.5

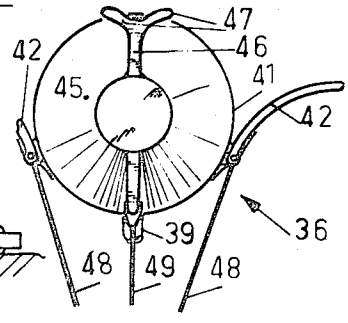
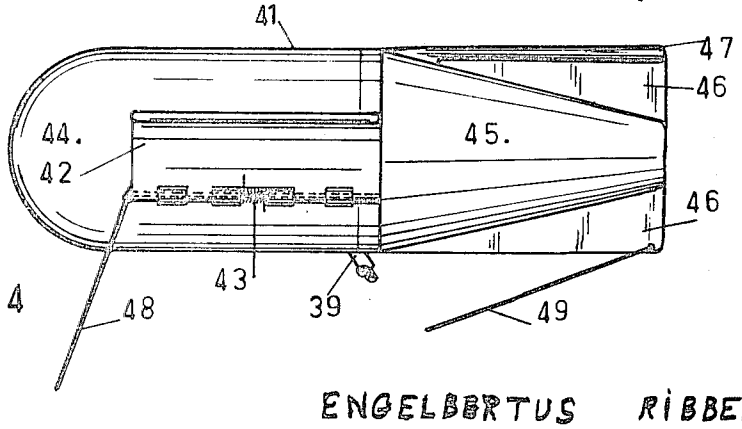


FIG.4



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APPARATUS FOR ANCHORING A RIVER MINE OR OTHER EXPLOSIVE CHARGE

The invention relates to an apparatus for anchoring a river mine or other explosive charge on the bottom of a flowing waterway, the river mine or other explosive charge being anchored against displacement relatively to the bottom in the flow direction and having an ignition device mounted in a floater and held in suspense underneath the water surface thereby, the apparatus parts which are distanced from each other and are separated from each other in space being interconnected by means of one or more cables.

An apparatus of this kind, in which the charge and the ignition device are mounted together in an anchored, floating, or suspended casing, is already known. In this known apparatus, the combination of the charge and the ignition device has relatively large dimensions. Consequently, large forces are exerted on the anchorage at flow velocities of 1 to 2 m./sec. on the one hand, and a rather conspicuous whole is obtained, on the other hand, which is contrary to the tactical object of the apparatus. Furthermore, it is impossible to use existing antitank mines as the explosive charge. Finally it is difficult to keep a floater containing the combination of the charge and the ignition device suspended at a depth of 0.5 to 1 m. underneath the water surface at varying water levels and flow velocities.

Furthermore, an apparatus of this type is known, in which the charge rests on the bottom of the flowing water and only the ignition device is mounted in the driver which is held in suspense below the water surface. With this known apparatus it is also difficult to keep the floater at a depth of 0.5 to 1 m. below the water surface at changing water levels and flow velocities. Moreover, the ignition device is not situated vertically above the charge in flowing water, which limits the destructive effect of the charge.

The invention has for its object to provide an apparatus of the type mentioned in the preamble, which offers the possibility to keep the floater with the ignition device at a level of 0.5 to 1 m. below the water surface and substantially directly above the explosive charge within reasonable limits of the changes occuring in the flow velocity and the water level, without the apparatus having such dimensions that it may be easily detected after having been placed in its desired position under water.

To that end the apparatus according to the invention has a triangular configuration in which the anchor to be anchored in or on the bottom constitutes the upstream base point, the river mine or other explosive charge to be disposed on the bottom constitutes the downstream base point and the floater held in suspense substantially above the river mine or explosive charge constitutes the summit point of a substantially plane triangle extending vertically and in parallel to the flow direction of the waterway, the sides of said triangle being formed by three cables which interconnect the anchor, the river mine or other explosive charge, and the floater, respectively. In order to ensure that such an apparatus will remain properly functioning, i.e., with the ignition device held in suspense at the desired depth below the water surface, also at an increase of the flow velocity—at which the force exerted by the flowing water on the floater, together with the force exerted thereon by the connection cable, will be effective to move the floater and the ignition device to a greater depth below the water surface—the invention furthermore prescribes that the floater is provided with two wings extending at least along part of their surfaces horizontally and protruding at both sides of the ignition device, respectively. In order to enhance also the stability of the mechanism against rocking movements of the floater around its axis, the invention prescribes that the wings have a higher specific weight than the floater together with its contents and have a common center of gravity which is situated below the center of gravity of the amount of water displaced by the floater. Furthermore, easy transportation of the floater is provided according to the invention, if the wings are pivotally mounted to the floater, an elastic member keeping the wings in their operational positions. Lateral rocking floater movements with respect to the vertical plane through the apparatus are counteracted, according to the invention, if the floater is provided with a vertical caudal fin having preferably a V-shaped upper edge.

As a consequence of the relatively linear relation which is found to exist between the depth of the floater with the wings mounted thereon below the water surface and the flow velocity, it is possible to limit the depth changes of the floater with changes of the flow velocity even further if a spring is incorporated in the cable connecting the anchor to the floater. In this manner an anchoring apparatus is obtained, which meets with very high requirements or reliability.

Finally, it is recommended by the invention, that the apparatus is provided with means for changing the cable length between the anchor and the river mine or other explosive charge and the cable length between the anchor and the floater in proportion to each other. As a matter of simplicity it is preferred that these means are situated at or adjacently to the anchor. The application of such means gives the possibility to adapt the anchoring device also to situations which differ from the situation at normal use.

The invention will be elucidated in the now following description with reference to the accompanying drawing. In the drawing:

FIG. 1 shows, diagrammatically, first, known apparatus for anchoring a river mine or other explosive charge;

FIG. 2, diagrammatically, a second, known apparatus for anchoring a river mine or other explosive charge;

FIG. 3, diagrammatically, an apparatus according to the invention;

FIG. 4 as side elevational view of the floater of the apparatus according to FIG. 3 and

FIG. 5 a back view of the floater according to FIG. 4.

FIG. 1, shows a known apparatus for anchoring a river mine **13** on the bottom **11** of a water **12** flowing according to the arrow. The river mine **13** is anchored by means of an anchor **14** in the bottom **11**, has an ignition device **15** and is mounted, together with this device **15**, in a floater **16** which is held in suspense underneath the water surface **17**, the anchor **14** and the floater **16** being mechanically connected to each other by means of a cable **18**. The disadvantages of this known apparatus are especially caused by the large dimensions of the floater. These disadvantages are: the occurrence of large forces on the anchor **14** and in the cable **18**, the conspicuousness of the floater **16** below the water surface **17**, the resulting risk of detection of the apparatus by an opponent and the difficulty to keep the very large floater at a stationary level of, e.g., 0.5 to 1 m. below the water surface and changing water levels and flow velocities. Finally, the known apparatus has the limitation that only one predetermined type or a very restricted number of types of a river mine or other explosive charge may be used because such a charge must always be mounted, together with the ignition device **15**, in the known floater **16** having a predetermined floating capacity.

FIG. 2 shows a second known apparatus for anchoring a river mine **23** or other explosive charge on the bottom **21** of a flowing water **22**. The river mine **23** is anchored in the bottom **21** by means of an anchor **24** and is connected to an ignition device **25** which is held in suspense underneath the water surface **27** in a floater **26**. The mine **23** or other explosive charge is mechanically connected to the anchor **24** by a cable **28** and is mechanically and electrically connected to the floater **26** or to the ignition device **25** mounted therein, respectively by a cable **29**. This apparatus has some advantages over the apparatus according to FIG. **1**, but also has the same difficulty in keeping the floater at a constant level below the water surface at changing water levels and flow velocities. Furthermore, the ignition device **25** is not situated vertically above the charge **23** in flowing water so that the charge **23** does not have its maximum effect at the location of the ignition device.

The disadvantage inherent in the apparatus according to FIGS. **1** and **2** are fully removed by application of an apparatus according to the invention, as represented in FIG. **3**.

This figure shows that on the bottom 31 of the water 32 flowing in the direction of the arrow a river mine or other explosive charge 33 is anchored by means of an anchor 34. The mine or charge 33 as well as the anchor 34 are connected to an ignition device 35 mounted in a floater 36. The anchor 34 is connected to the mine or other charge 33 by means of a cable 38, the charge 39 being connected to the floater 36 by means of a cable 39. Furthermore, the anchor 34 is connected to the floater 36 by means of a cable 40. The cables 38, 39, and 40 constitute therefore, the sides of a triangular configuration having the anchor 34, the mine 33, and the floater 36 as vertices, respectively.

The floater 36 has been represented in FIGS. 4 and 5 in a side elevational view and in a back view, respectively. The floater has a body 41 to which pivotally a pair of wings 42 are mounted. The wings 42 serve for compensation of the depressing force exerted on the floater 36, which increases with increasing flow velocity, and the wings may be kept in their operational positions (see FIGS. 3, 4 and 5) by springs 43. Furthermore, the wings 42 may be pivoted downwards against the force of springs 43 and may be clicked against the body 41 of the floater 36.

The body 41 extends from its spherical head 44 tubelike backwards and terminates in a frustoconical part 45 having a vertical caudal fin 46 at both its upper and lower sides. At its upper edge the caudal fin 46 sprouts V-shapedly (see 47 in FIGS. 4 and 5). The floater 46 will assume a position in the water which corresponds to the equilibrium of the forces exerted thereon. These forces are:

1. the upward force according to Archimedes' law,
2. the force exerted by the flowing water on the floater and on the wings,
3. the force exerted on the anchor 34 by the cable 40,
4. the reaction force of the substantially vertical cable 39 between the floater and the mine 26, and
5. the downward force resulting from the weight of the floater with its contents.

The forces mentioned under (1) and (5) are constant and exclusively dependent on the volume and the weight of the floater and the fins and on the specific weight of the amount of water which is displaced. The force mentioned under (2) has been rendered less dependent on the flow velocity by the special wing construction, combined with the special mounting of the floater to the cable 40 (see lines 48 and 49 in FIGS. 3, 4, and 5, which meet in one point). Consequently, few variations occur in the height of the floater underneath the water surface and in the horizontal position of the floater in the direction of the flow. These effects are still enhanced by the fact that a spring 53 has been incorporated in the cable 40.

Since the point of application of the wings 42 on the body 41 of the floater has been chosen below the center of gravity of the body 41 and since the wings themselves are relatively heavy with respect to the body, the center of gravity of the complete floater is situated below that of the amount of water displaced by the floater, which enhances the stability of the floater. Horizontal displacements of the driver vertically to the flow direction are thereby also reduced.

The apparatus according to the invention has none of the disadvantages attributed to the known apparatuses and has the following advantages: the floater with the ignition device is kept small so that only small forces are exerted on the anchorage and a not very conspicuous and consequently a difficulty detectable whole is obtained; the charge, for which a mine of any type, e.g., an A.T.-mine, may be used, is situated practically vertically underneath the ignition device, which ensures a maximum effect in situ.

As has been represented in FIG. 3, the anchor 34, has a reel or coiler 50. The reel 50 has two coiling rolls 51 and 52 which serve for coiling up the cable 40 and the cable 38, respectively and have different diameters so that always cable portions are coiled up having lengths which are proportional to the lengths of the cables 40 and 38, respectively.

What I claim is:

1. An underwater explosive arrangement comprising, in combination;
   - a river mine or other explosive charge disposed on the bottom of a flowing waterway;
   - an anchor engaging the bottom of the flowing waterway at a position upstream from said mine;
   - a floater having an ignition device therein and being dimensioned to be suspended beneath the water surface;
   - means for detonating said river mine in response to actuation of said ignition device; and
   - cable means for locating said floater substantially vertically above said river mine, said cable means comprising three cable sections, one cable section connecting said anchor to said floater, a second section connecting said river mine to said anchor, and a third section connecting said floater to said river mine.

2. An apparatus according to claim 1, characterized in that the floater is provided with two wings extending at least along part of their surfaces horizontally and protruding at both sides of the floater respectively.

3. An apparatus according to claim 2, characterized in that the wings have a higher specific weight than the floater together with said ignition device and have a common center of gravity which is situated below the center of gravity of the amount of water displaced by the floater.

4. An apparatus according to claim 2, characterized in that the wings are pivotally mounted to the floater, an elastic member keeping the wings in their operational positions.

5. An apparatus according to claim 2, characterized in that the floater is provided with a vertical caudal fin.

6. An apparatus according to claim 5, characterized in that the vertical caudal fin has a V-shaped upper edge.

7. An apparatus according to claim 1, characterized by a spring incorporated in the cable section connecting the anchor to the floater.

8. An apparatus according to claim 1, characterized by adjusting means for changing the cable section length between the anchor and the river mine or other explosive charge and the cable section length between the anchor and the floater in proportion to each other.

9. An apparatus according to claim 8, characterized in that said adjusting means are situated at or adjacent to the anchor.

10. An apparatus according to claim 3, characterized in that the wings are pivotally mounted to the floater, an elastic member keeping the wings in their operational positions.

11. An apparatus according to claim 3, characterized in that the floater is provided with a vertical caudal fin.

12. An apparatus according to claim 4, characterized in that the floater is provided with a vertical caudal fin.

13. An apparatus according to claim 11, characterized in that the vertical caudal fin has a V-shaped upper edge.

14. An apparatus according to claim 12, characterized in that the vertical caudal fin has a V-shaped upper edge.

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