

TRANSLATED FROM THE FRENCH

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The original French application No 94/08463 of 8 July 1994  
modified for the formalities of protection required in  
Singapore

An improved process for the destruction of under-sea objects,  
notably immersed mines.

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This invention relates to a process for the destruction of under-sea objects.

More particularly, the invention relates to a process for the destruction of seabed mines or anchored mines.

5       Known processes for the destruction of seabed mines consist of a stage of detection and/or identification of the mine and a stage of destruction by means of a powerful explosive charge, of power for example 50 to 100 kg, placed at a distance of a few metres from the mine by a submarine  
10       vessel that is generally remote-controlled.

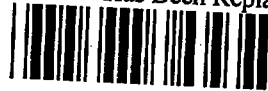
The mine is destroyed after the submarine vessel has been recovered on board a minesweeper.

Anchored mines are destroyed by similar systems of detection and/or identification followed by destruction  
15       consisting of attaching an explosive cutter to the anchoring cable by a submarine vessel that is remote-controlled or wire-guided, in order to cut the cable so that the mine floats to the service where it is destroyed.

In this case also, the submarine vessel is recovered and  
20       the explosive cutter is then fired by remote control from the surface ship.

To place the explosive charge on the seabed, it is necessary to approach the cable sufficiently closely, that is, to within a few metres, in order to place the charge near  
25       to the mine.

To give an example, a process based on this principle is described in the MARINE ENGINEERS' REVIEW (Volume 604, Octobre 1973, Pages 33 and 34).



These destruction processes can no longer be employed to destroy mines of new design which include devices permitting the particularly efficient detection of any submarine vessel approaching the mine by sensing its acoustic or magnetic  
5 signature of very low power, and causing the explosion of the mine and also the destruction of the submarine vessel that serves for detection and/or identification.

Neither can known destruction methods be used to destroy seabed mines which contain explosives of low sensitivity and  
10 do not explode on impact.

Document EP-A-0.547.937 has already been put forward with a proposal for the destruction of submarine objects, such as seabed or anchored mines, consisting of a stage of detection and/or identification by the use of facilities for  
15 the detection and/or identification of the object from a distance greater than the minimum distance called the safe distance, and a stage of destruction with an explosive charge that bursts to explode the mine or to cause its fragmentation, bringing charge near to the object from an  
20 intermediate undersea base previously placed on the seabed, and then exploding the charge.

The intermediate base may be dropped on the seabed by an intermediate submarine vessel or directly by a surface ship or an aircraft.

25 The purpose of this invention is to offer an improvement of this method by ensuring greater precision when bringing the charge near to the object to be destroyed, whether a



seabed or an anchored mine, and, when a anchored mine, bringing the charge near to the mine as if it were a seabed mine and exploding it in order to avoid, as occurs in certain cases, the use of an explosive cutter that only cuts the  
5 cable without exploding the mine which then floats to the surface.

For this purpose, the invention offers a destruction process of the type described above, characterised by the fact that the charge is carried by a vehicle operated from the  
10 intermediate base to which it is connected by a cable of length that can be controlled in order to control the vehicle's movements.

In accordance with other characteristics of the invention:

- 15       Ø the vehicle is self-propelled and is operated from the intermediate base,
- Ø the vehicle is buoyant,
- Ø the vehicle is fitted with powered propulsion devices,
- 20       Ø these devices are fixed and/or directional,
- Ø the cable is wound on a powered drum,
- Ø the drum can be motorised,
- Ø the drum is carried by the vehicle,
- Ø the vehicle is fitted with devices for guiding its  
25 movements along the anchoring cables of anchored mines,
- Ø the intermediate base placed on the seabed can be self-propelled and can move on the seabed,
- Ø the vehicle is remote controlled from a control  
30 station that controls its movements and/or the firing of the charge.



Ø the vehicle is connected to the control station by a remote-control cable,

Ø the intermediate base and the vehicle constitute a destruction unit which is placed in the sea by a surface ship  
5 or an aircraft,

Ø the destruction unit is operated from a submarine vessel guided by a surface ship or by any other means such as an auxiliary, recoverable or consumable, propulsion device,

Ø the control station is mounted on a surface ship,

10 Ø the remote-control cable is unwound when the destruction unit is being lowered from the surface ship to the seabed,

Ø as a variant, the remote-control cable is unwound when the submarine vessel is being raised to the surface ship  
15 after the submarine vessel has placed the destruction unit on the seabed,

Ø means are provided of releasing the connecting cable to allow recovery of the charge-carrying vehicle on the surface,

20 Ø the vehicle is provided with devices to detect and/or identify the object,

Ø the remote-control cable includes wiring to transmit firing signals to the charge.

Other characteristics and advantages of the invention  
25 will appear when reading the following detailed description. For better comprehension, readers should refer to the appended illustrations of which:

Ø Figure 1 illustrates the principal elements needed to



destroy a seabed mine according to a first variant of a destruction process, in accordance with the invention,

Ø Figures 2 and 3 illustrate, on a larger scale, two successive stages of the destruction of a seabed mine,

5        Ø Figure 4 is similar to Figure 3 and illustrates a process of destroying an anchored mine, in accordance with the invention,

Ø Figure 5 is similar to Figure 4 and illustrates a variant of the process,

10       Ø Figure 6 is similar to Figure 1 and illustrates a variant of operation of the destruction unit,

Figures 1 and 2 schematically depict a surface ship "VS", which may be for example a mine sweeper with the mission of destroyng a seabed mine "MF" placed on the seabed "F".

The surface ship remote-controls, for example by a wire or cable "CP", an intermediate submarine vessel "VSM" that carries a detachable destruction unit "UD".

20       As is illustrated notably by Figure 2, the destruction unit includes a cradle or frame constituting the intermediate base "EF" designed to be placed on the seabed "F" by the submarine vessel VSM at a safe distance from the seabed mine MF.

25       The intermediate seabed base EF carries a charge-carrying vehicle "EPC and also a reel "B".

Reel B carried on the cradle of intermediate base EF is designed to unwind, while submarine vessel VSM is being lowered, a remote-control cable "CT" connecting the destruction unit to the surface ship which is provided with



a control station to control and guide the charge-carrying vehicle "EPC".

As can be seen from Figures 1 and 2, charge-carrying vehicle EPC carries charge C and is also fitted with  
5 directional propulsion devices "PO" (schematatically illustrated), for its own propulsion.

The charge-carrying vehicle carries a drum "T" on which is wound a connecting cable "CL" which, as can be seen notably in Figure 3, connects vehicle EPC to the cradle of  
10 seabed base EF which forms an anchoring point for the connecting cable.

The winding off of connecting cable CL from drum T, and also its winding on in the event that the drum is motorised to constitute a winch, are controlled from a control station  
15 which may be, for example, onboard surface ship VS to which vehicle EPC is connected by remote-control cable CT running from reel B to vehicle EPC and which may, for example, be included in connecting cable CL.

In accordance with a particularly advantageous concept,  
20 the charge-carrying vehicle is buoyant and naturally rises to the surface.

Thus, the variations of length of connecting cable CL when unwound which are controlled from surface ship VS provide a means of varying the depth of charge-carrying  
25 vehicle EPC which tends to rise to the surface when the cable length increases, and vice versa.

Directional propulsion devices PO, associated with the buoyancy, also constitute means of self-propulsion of charge-bearing vehicle EPC to allow it to approach very precisely



and possibly to come into contact with seabed mine MF.

In practice, when submarine vessel VSM has placed seabed base EF on seabed F and has moved away to a distance, an operator in surface ship VS controls the horizontal and vertical movements of charge-carrying vehicle EPC through remote-control cable CT so that vehicle EPC approaches seabed mine MF very closely and with great precision.

The approach is facilitated by visual and/or acoustic detection devices "MD" mounted on vehicle EPC and connected to the control station by dedicated channels in the remote-control cable.

When charge-carrying vehicle EPC and thus charge "C" is sufficiently close to seabed mine MF or in contact with it, the operator triggers the charge which explodes and destroys the seabed mine.

In the case of an anchored mine, as illustrated in Figure 4, it is possible to very precisely approach anchored mine "OM".

In accordance with a variant illustrated schematically by Figure 5, the approach to and coming into contact with an anchored mine can be facilitated by guide devices MG which take up position automatically on anchoring cable O of anchored mine MO at the start of the operation by means notably of directional propulsion devices "PO"; guide devices MG then allow, simply by unwinding connecting cable



CL, charge-carrying vehicle EPC to rise along cable O until it contacts anchored mine MO to destroy it.

Figure 4 schematically illustrates a variant by which transmission cable CT can be initially connected to submarine vessel VSM.

By this variant, transmission cable CT is only unwound from reel B when submarine vessel VSM is rising to return to the surface ship to allow connection of the remote-control cable to the control station on the surface ship.

In accordance with another variant which is not illustrated, charge-carrying vehicle EPC can be remote-controlled by a remote-control cable divided into two main sections with one connecting surface ship VS to submarine vessel VSM and the other connecting VSM to destruction unit UD.

It is also possible to recover charge-carrying vehicle EPC by separating and releasing it from the connecting cable either at the charge-bearing vehicle or at destruction unit UD, so that, being buoyant, it rises automatically to the surface and can be recovered there.

In accordance with another variant, it is possible to provide the intermediate base placed on the seabed with propulsion devices so that it can move independently on the seabed, and improve even more the precision of approach to seabed or anchored mines.



The use of directional propulsion devices allows the charge to be thrown against the mine to cause the charge to explode automatically, when needed.

5 It is of course also possible to place on the surface ship the reel on which is wound the remote-control cable, with the other end of the cable connected to the destruction unit and to charge-carrying vehicle EPC.

10 In the event that detection devices MD on charge-carrying vehicle EPC include a camera, it is possible to visually remote-control the charge-carrying vehicle by means of the video images supplied by the camera, thus controlling both position and distance.



CLAIMS

1. A process for the destruction of an undersea object such as, to give an example, a seabed mine (MF) or an anchored mine (MO), consisting of a stage of detection and/or  
5 identification of the object by implementing facilities for detection and/or identification from a distance greater than a set minimum distance called the safe distance, and a stage of destruction of the object by means of an explosive charge  
(C) that bursts to cause explosion or fragmentation of the  
10 mine, operating the charge so that it approaches the object from an intermediate undersea base (EF) placed previously on the seabed, and then bursts, characterised by the fact that the charge (C) is carried by a vehicle (EPC) which is operated from intermediate base (EP) to which it is connected  
15 by a connecting cable (CL) of length that can be controlled in order to control all movements of the vehicle (EPC).

2. A process in accordance with Claim 1, characterised by the fact that the vehicle (EPC) is self-propelled and is operated from the intermediate base (EF).

20 3. A process in accordance with Claim 2, characterised by the fact that the vehicle (EPC) is buoyant and naturally rises to the surface.

4. A process in accordance with one of Claims 2 or 3, characterised by the fact that the vehicle (EPC) is fitted  
25 with powered propulsion devices.

5. A process in accordance with Claim 4, characterised by the fact that the propulsion devices consist of fixed and/or directional devices (PO).

6. A process in accordance with any one of the above



Claims, characterised by the fact that the connecting cable (CL) is wound on a powered drum (T).

7. A process in accordance with Claim 6, characterised by the fact that the drum is motorised.

5        8. A process in accordance with one of Claims 6 or 7, characterised by the fact that the drum (T) is carried on the vehicle (EPC).

10       9. A process in accordance with any one of the above Claims, characterised by the fact that the charge-carrying vehicle (EPC) is provided with facilities for guiding (MG) its movements along the anchoring cable (O) of an anchored mine (MO).

15       10. A process in accordance with any one of the above Claims, characterised by the fact that the intermediate seabed base (EF) is self-propelled and can move around on the seabed.

20       11. A process in accordance with any one of the above Claims, characterised by the fact that the charge-carrying vehicle (EPC) is remote-controlled from a control station that controls its movements and/or the firing of the charge (C).

25       12. A process in accordance with Claim 11, characterised by the fact that the charge-carrying vehicle (EPC) is connected to the control station by a remote-control cable (CT).

30       13. A process in accordance with any one of the above Claims, characterised by the fact that the intermediate base (EF) and the charge-carrying vehicle (EPC) constitute a destruction unit (UD) that is placed in the water by a surface ship (VS) or an aircraft.



14. A process in accordance with Claim 13, characterised by the fact that the destruction unit (UD) is operated from a submarine vessel (VSM) controlled from a surface ship (VS).

5 15. A process in accordance with Claim 14 in combination with Claim 12, characterised by the fact that the control station is placed on a surface ship (VS).

16. A process in accordance with Claim 15, characterised by the fact that the remote-control cable (CT) is unwound from its drum when the destruction unit (UD) is being lowered to the seabed (F) by the submarine vessel

17. A process in accordance with Claim 15, characterised by the fact that the remote-control cable (CT) is unwound on its drum when the submarine vessel (VSM) is being raised to the surface ship (VS), after the destruction unit (UD) has been placed on the seabed (F) by the submarine vessel (VSM).

18. A process in accordance with any one of the above Claims, characterised by the fact that means are provided to release the connecting cable (CL) to allow recovery of the charge-carrying vehicle (EPC) on the surface.

19. A process in accordance with any one of the above Claims, characterised by the fact that the charge-carrying vehicle (EPC) is provided with facilities for detection and/or identification of the object.

20. A process in accordance with Claim 12, characterised by the fact that the remote-control cable (CT) also transmits the power required to fire the charge.