Mine, particularly underwater mine.

The invention relates to a mine, particularly an underwater mine, comprising a container (1) of reinforced plastic for explosive. In the invention, in order to protect the explosive filler against various environmental effects and to improve safety during storage, the outer surface of the container (1) of reinforced plastic is covered by a flexible rubber or elastomer layer (2) having a density of about 0.7 to 2.0 g/cm³.
This invention relates to a mine, particularly an 
underwater mine, comprising a container of rein-
forced plastic for explosive.

Underwater mines of the type described above 
comprise a mine case typically made of aluminium. 
Although insensitive to corrosion, aluminium has sev-
eral problematic properties when used in the mine 
case. Aluminium is electrically conductive, on the ba-
sis of which it can be detected. Furthermore, alumi-
nium has an excellent thermal conductivity so that 
explosive substance contained in an aluminium case 
reaches the ambient temperature very rapidly. A fire, 
for instance, may thus cause a risk situation or an ex-
plosion. The aluminium case also contributes to the 
spreading of explosion, as it spreads splinters around 
when it explodes, and such splinters are able to pen-
trate into other similar mines, thus causing them to 
explode. Further, the coefficient of thermal expan-
sion of aluminium is somewhat higher, perhaps two 
times higher than that of typical explosives. For this 
reason, a gap tends to be formed between the alumi-
nium case and the explosive so that detection of 
the mine may become possible.

The above-mentioned disadvantageous prop-
eries in particular have led to attempts to provide un-
derwater mines in which the mine case is made of re-
forced plastic. A problem therewith is, however, that 
it is difficult to provide reinforced plastic with suffi-
cient strength without having to excessively increase 
the material thickness. Underwater mines are usually 
planted by dropping them to the sea bottom. When 
they hit the bottom, they are exposed to impacts 
which may damage the mine case.

The object of the present invention is to provide 
an underwater mine comprising an explosive contain-
er of reinforced plastic, which avoids the above-
mentioned problems. This is achieved by means of an 
underwater mine according to the invention which is 
characterized in that the outer surface of the contain-
er of reinforced plastic is covered by a flexible rubber 
or elastomer layer having a density of about 0.7 to 2.0 
g/cm³.

In most cases the mine case of an underwater 
mine is substantially cylindrical, and the centre of 
gravity of the mine is in the middle of the mine. On fall-
ing freely in water, the mine thus moves similarly as 
a falling leaf, swinging longitudinally to and fro. It is 
therefore to be preferred that the elastomer layer por-
tion covering the bottom of the container is several 
times, preferably about ten times thicker than the 
elastomer layer portion covering the sides of the con-
tainer. In this way the elastomer layer provides the 
best possible protection against impacts within con-
tainer portions which are likely to hit the sea bottom 
first, that is, within the bottom area of the cylindrical 
explosive container.

In the following an underwater mine according to 
the invention and advantages offered by it will be de-
scribed in more detail with reference to the attached 
drawing, the figure of which is a partial sectional side 
view of the mine case of the underwater mine accord-
ing to the invention.

The figure shows a mine case of a mine accord-
ing to the invention, intended to be used particularly 
as an underwater mine. The mine case comprises a 
container 1 of reinforced plastic and an elastomer lay-
er 2 surrounding the container. To be operative, the 
mine, of course, also needs a detonator and a fuse; 
however, for the sake of clarity, these fully conven-
tional mine components are not shown in the figure.
The container 1 of reinforced plastic forming the inner 
portion of the mine case comprises a substantially 
cylindrical central portion 6, and a bottom portion 7 at 
one end and an inlet portion 5 at the other end of the 
central portion. The container 1 of reinforced plastic 
may be integral, or more usually and more easily, it 
may comprise the above-mentioned three portions 5, 
6 and 7, the bottom portion 7 and the inlet portion 5 
being attached to the cylindrical body portion 6 by glu-
ing. For this purpose, the joint surfaces between the 
portions are bevelled suitably to achieve a sufficiently 
long joint surface. The container may be made of con-
ventional fibre reinforced thermostet plastics, that is, 
reinforced plastics comprising glass, carbon or other 
similar fibre, and plastic such as epoxy resin, vinyl es-
ter or polyester. Reinforced plastic used in the con-
tainer 1 may further contain conventional additives to 
improve its flexibility.

In the mine case shown in the figure, the elasto-
mer layer 2 covers the outer surface of the container 
1. The elastomer layer 2 is preferably cast upon the 
container 1 in a closed mould where the container 1 is 
positioned centrally. In this way the elastomer can 
be provided with desired properties. In order that the 
elastomer would have sufficient strength and suffi-
cient flexibility, being thus similar to rubber, its den-
sity should range from 0.7 to 2 g/cm³, preferably about 
1 g/cm³. The elastomer layer 2 thus contains elast-
omer and an additive which causes the elastomer to be 
foamed to the above-mentioned density within the 
closed mould. In addition, it is possible to add a col-
ouring agent to the elastomer so as to dye it through-
out in a desired way. The most important function of 
the elastomer layer 2 is to protect the container 1 of 
reinforced plastic against external impacts. An excel-
lent resistance to impacts is achieved with a relatively 
small layer thickness when the elastomer layer 2 has 
the above-mentioned properties. As mentioned 
above, when the mine is dropped into the sea, im-
pacts mainly act on the ends of the mine, and there-
fore the elastomer layer is clearly thicker within the 
area of the bottom 7 of the container 1. The thickness 
of an elastomer layer 4 upon the cylindrical portion of 
the container is thus perhaps only 1/10 of the thick-
ness of an elastomer layer 3 upon the bottom 7 of the 
container on the central line of the case. As a result,
the case bottom and particularly the corners of the container will be extremely resistant to impacts. As appears from the figure, the bottom 7 and the inlet portion of the container 1 are rounded to increase strength, which is known from conventional mine cases.

As further appears from the figure, the inlet portion 5 of the container 1 is provided with various protruding parts and recesses for fastening the detonator and the fuse. These parts, however, are not particularly essential to the invention, and their shape and structure may vary according to the requirements.

The underwater mine according to the invention has a number of excellent properties particularly as compared with an underwater mine with an aluminium case. First, its material is not electrically conductive or magnetic, and so it cannot be detected on the basis of these properties. However, the material may be made electrically conductive, if required. On exploding the mine does not either spread splinters around it which might penetrate into other mines in its vicinity, e.g. in the same storage. Accordingly, the explosion of one mine in the storage is not likely to cause the other mines in the storage to explode. The coefficient of thermal expansion of the container of reinforced plastic is equal to that of a number of explosives. Gaps thus do not tend to form between the explosive and the container. The mine according to the invention is also extremely resistant to environmental effects as the layer covering it is of closed-cell, hermetic elastomer. On the other hand, the thermal conductivity of elastomer is only a fraction of that of aluminium. Accordingly, the mine according to the invention explodes only after a very long time even if it gets into a fire. As mentioned above, the material of the mine case may be dyed throughout so that no external impacts will change its colour. The structure of the mine according to the invention is also simpler than that of the mine with an aluminium case, in which several components are required to interconnect the different portions. A further advantage of the container of reinforced plastic is that it can be shaped as desired. Furthermore, the container of reinforced plastic around the explosive may be given a desired flexibility by varying the plastic material.

The mine according to the invention and the advantages offered by it have been described above only by means of a single illustrating embodiment. It is to be understood that the structural solution according to the invention may be applied to mine cases of almost any type without, however, deviating from the scope of protection defined in the accompanying claims. Accordingly, the outer surface of the mine case may be shaped in different ways, or the elastomer layer on the surface may be strengthened in a desired way at different points to achieve various properties, such as resistance to impacts, or to vary

the appearance.

5 Claims

1. Mine, particularly an underwater mine, comprising a container (1) of reinforced plastic for explosive, characterized in that the outer surface of the container (1) of reinforced plastic is covered by a flexible rubber or elastomer layer (2) having a density of about 0.7 to 2.0 g/cm³.

2. Mine according to claim 1, where the explosive container is substantially cylindrical, characterized in that an elastomer layer portion (3) covering a bottom (7) of the container is several times thicker than an elastomer layer portion (4) covering sides (6) of the container.

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**DOCUMENTS CONSIDERED TO BE RELEVANT**

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<th>Category</th>
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**TECHNICAL FIELDS SEARCHED (Int. Cl.)**

- F 42 B 22/00
- B 65 D 23/00
- B 65 D 25/00
- B 65 D 81/00

The present search report has been drawn up for all claims.

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