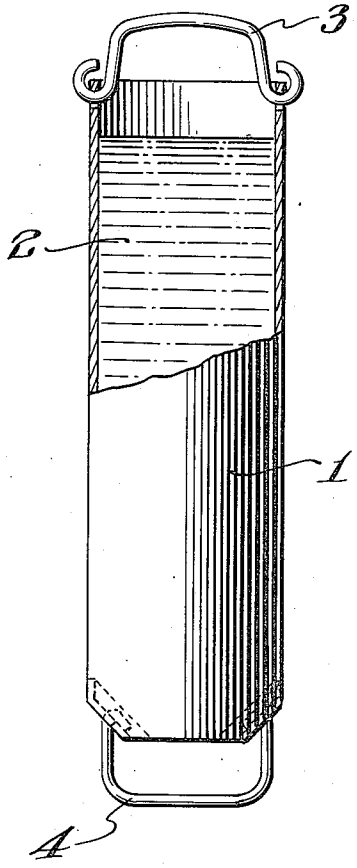
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OIL WELL TORPEDO

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OIL WELL TORPEDO

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This invention relates to an improved torpedo for oil well shooting, and more particularly to a torpedo for oil well shooting characterized by high explosive strength and reduced sensitivity to impact.

This application is a continuation in part of our copending application Serial No. 536,603, filed May 20, 1944, now abandoned.

The use of torpedoes in the shooting of oil wells has been a common practice for many years, either to start the flow of oil or to increase the flow in partly exhausted wells. The torpedo generally comprises a container adapted to be lowered into an oil well to a predetermined depth, and a high density explosive charge of high strength and velocity. Liquid nitroglycerine is frequently used as the explosive charge. Various attempts have been made to use non-liquid explosives, such as dynamites and the like, but to date these attempts have not met with success due to the high density requirements and the adverse conditions in the wells.

While torpedoes loaded as described above have been used with considerable satisfaction in shooting oil wells, they have had the disadvantage of being relatively sensitive to impact, such that very careful handling has been necessary to insure safety in use.

This has introduced undesirable potential hazards in the transportation as well as in the use at the well itself.

An object of the present invention is to provide an improved torpedo characterized by reduced sensitivity to impact. A further object is such a torpedo wherein the reduction of sensitivity to impact has been accomplished without undue sacrifice of explosive strength. Additional objects will be disclosed as the invention is described more at length in the following.

We accomplish the foregoing objects when we provide in combination a container adapted to be lowered into an oil well and an explosive charge having reduced sensitivity to impact, said explosive charge containing a liquid explosive nitric ester, an aromatic dinitrocompound and an aromatic nitrocompound having more than two nitro groups attached to each molecule. The aromatic nitrocompounds are dissolved in the liquid nitric ester in an amount sufficient to reduce materially the sensitivity to impact of the solution.

The present invention is illustrated by the accompanying drawing, in which the container 1, having the lower end closed and the upper end open, is filled with the liquid explosive 2. The container is lowered into the well by attaching

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lowering means to the bail 3, and, if more than one torpedo is to be used, a string of torpedoes is formed by attaching the next container to the bail 4.

Straight nitroglycerin in liquid form is generally used as the liquid explosive nitric ester because of its availability and because of its favorable properties. In many cases, however, it is desirable to dissolve another liquid nitric ester in the nitroglycerin to lower the freezing point thereof so that the torpedo can be used at winter temperatures without danger of freezing. Nitroglycerin alone, for example, may freeze at around 55° F., whereas nitroglycerin having a content of 30% dissolved ethylene glycol dinitrate will have a freezing point probably as low as 0° F. Dissolved tetranitrodiglycerin, or nitrated polymerized glycerin, will likewise have a similar effect in reducing the freezing point. When the term nitroglycerin is used, therefore, it is intended to designate either the pure nitric ester or the combination of the nitric ester with another liquid explosive nitric ester.

In accordance with the present invention, a container suitable for use in oil well shooting is loaded with an explosive having a composition similar to that shown in the following specific examples.

	A	B	C	D
Nitroglycerin	[1] 50	[2] 55	[2] 60	[2] 70
Dinitrotoluene	35	31.5	28	21
Trinitrotoluene	15	13.5	12	9
	100	100.0	100	100
Density	1.44	1.5	1.5	1.5
Strength (TNT=10.0)	12.4	12.6	12.7	12.8
Velocity—m./sec.	6,600	7,170	7,250	7,250

[1] Actually a liquid blend containing 75% nitroglycerin, 25% ethylene glycol dinitrate.
[2] Actually a liquid blend containing 79% nitroglycerin, 21% tetranitrodiglycerin.

Torpedoes containing explosive charges such as those cited above have substantially all the advantages of those containing nitroglycerin alone, and in addition, they are highly preferable to straight nitroglycerin containing torpedoes because of the decreased sensitivity to impact resulting from the presence of the more stable explosive. The decreased sensitivity of the explosive is shown by tests of sensitiveness to various grades of blasting caps, by drop weight impact tests, friction tests, and bullet sensitiveness tests.

We find it important to use an explosive charge having an amount of nitroglycerin between 50%

and 80% of the entire composition. When more than 80% is present, the desensitization is insufficient to give the explosive the desired safety characteristics. With less than 50% nitroglycerin and with the additional amount of dissolved material, there is danger of failure of the explosive to propagate, in 2'' diameter containers for example.

As previously stated, we use an aromatic dinitrocompound combined with an aromatic nitrocompound of more than two nitro groups as a desensitizing agent for the liquid nitric ester. Dinitrotoluene is a suitable dinitrocompound to use, but other aromatic dinitro compounds such as dinitrobenzene, dinitroxylene, dinitronaphthalene, and the like may be employed. As the second ingredient we use a more highly nitrated compound in order to avoid sacrifice of strength. Desirably this latter compound will be soluble in the aromatic dinitrocompound or the two will be mutually soluble in the liquid nitric ester. When dinitrotoluene is used, for example, we find it advantageous first to dissolve trinitrotoluene therein, using an amount not greater than the amount of dinitrotoluene, and preferably less. Other nitrocompounds of relatively high degree of nitration may likewise be used as the second nitrocompound, e. g. trinitrobenzene, trinitroxylene, trinitronaphthalene, etc.

In formulating the torpedo charge in accordance with the invention, we use a predominant amount of liquid explosive nitric ester such as nitroglycerin, desirably between 50% and 80%. In our preferred charge we utilize a blend of dinitrotoluene and trinitrotoluene, the former being in excess of the latter. We find it desirable to have the ratio of dinitrotoluene to trinitrotoluene between 1 to 1 and 4 to 1, and a 7 to 3 ratio is a suitable one. With such a ratio, the blend contains substantially a maximum of dissolved trinitrocompound, which assures satisfactory strength. Because of the solubility of the trinitro in the dinitrocompound, there is no segregation of the two materials.

In the usual practice, the liquid explosive charge is loaded into the container in the proximity of the well, and the same procedure may be followed with the less sensitive charge of the present invention. However, due to the decreased sensitivity to impact, it is much safer to transport loaded torpedoes when the present explosive charge is used than was previously true.

It has been found that the use of the torpedo of the present invention not only increases the safety of handling, but also, surprisingly, produces a better shot in that caving of the well walls is minimized and the amount of clean-up after a shot is reduced. The torpedo of the present invention probably produces the most effective brisance and detonation velocity for well shooting, and, therefore is superior to torpedoes loaded with liquid nitroglycerin alone.

The present invention is subject to many variations in the structure and design of the container used to form the torpedo, as well as in the use of additional ingredients in the liquid charge, such as stabilizers, e. g., diphenylamine, centralites, etc., without departure from the scope of the present disclosure.

We intend, therefore, to be limited only by the following claims.

We claim:

1. An oil well torpedo of reduced sensitivity comprising a container adapted to hold a liquid explosive charge, means associated with said container for lowering the same into the oil well, means on said container for attaching another container below the first container in the well, and in said first container, a liquid explosive charge comprising from 50 to 80% by weight of nitroglycerin and dissolved therein a blend of dinitrotoluene and trinitrotoluene in a ratio between 1 to 1 and 4 to 1.

2. The oil well torpedo of claim 1, wherein the explosive charge comprises about 60% nitroglycerin, about 28% dinitrotoluene and about 12% trinitrotoluene.

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