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CLEARING WATER SURFACES OF OIL

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This invention relates to a method of clearing water surfaces of oil and to compositions used therewith. In particular the invention is concerned with the protection of the crews of torpedoed or sinking ships where fuel oil or gasoline from the ship has spread over the water.

The fuel oils, lubricating oils and the gasoline escaping from a bombed or torpedoed ship or storage tank often spread out over the water forming a layer or blanket which may be anywhere from less than a thousandth of an inch to many inches deep, depending on the viscosity of the oil, the amount of escaping oil and the effects of the wind. If the oil film is of the order of a thousandth of an inch thick it is not a serious menace since it is kept cool by the water underneath, although it may cause discomfort to swimmers. On the other hand, films or blankets only one-fourth of an inch thick are a fire hazard and even when not burning they tend to blind and suffocate swimmers.

This invention provides a method of clearing limited areas of water surfaces of oil where the original oil film or layer is not greater than about one-fourth to one-half inch thick, and it is especially adapted to the protection of swimmers and survivors in life boats or on rafts by holding the oil film at a distance. The length of time which the oil film may be held at bay depends largely on the weather prevailing at the time, as rough weather tends to counteract the effects of the method. However, moderate winds tend to blow the oil film away from the vessel so that there is a better chance of escape by leaving from the windward side, whereas in calm weather the oil tends to form a blanket or pool equally extensive in all directions about the ship. It is under the latter circumstances that the method of this invention is most efficacious. The invention also includes certain compositions of matter used in repelling the oil film.

The principle of the invention resides in the use of certain agents to repel the oil when they are applied to the water. Those agents are certain polar organic compounds which are insoluble or slightly soluble in water and which therefore spread out over the water surface in an invisible layer one molecule thick. In addition the compounds are insoluble or nearly so in fuel oils, gasoline and the like, they are not harmful to human beings and they have unusually high spreading pressures, the latter enabling them to repel oil layers of thicknesses of the order of one-fourth to one-half inch. Another essential characteristic of these compounds is the fact that they

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are liquid (i. e., not solid) and also maintain high spreading pressures at temperatures as low as 40° F., thus enabling them to operate effectively in cold waters.

The compounds used in this invention are liquid esters of higher fatty acids and hydroxy compounds selected from the group consisting of sugars and sugar derivatives. In particular esters of oleic and ricinoleic acids are most suitable because they remain liquid at low temperatures, and the esters of these acids which show the greatest oil and water insolubility and highest spreading pressures are those of sorbitol and mannitol and derivatives of sorbitol and mannitol. Particularly desirable compounds include sorbitan monooleate, sorbitan monoricinoleate, sorbitan trioleate, modified sorbitan diricinoleate, monolaurate and hexaricinoleate, modified mannitan monooleate and mannide monooleate. The spreading pressures of these compounds in dynes per centimeter, measured at the boundary line of the oil film, is given in the following table.

Table

Compound	Spreading pressure	
	77° F.	40° F.
sorbitan monooleate	40.6	46.5
modified sorbitan diricinoleate	34.3	37.4
modified sorbitan monolaurate	34.8	37.3
sorbitan monoricinoleate	34.3	36.8
modified mannitan monooleate	39.0	37.5
sorbitan trioleate	36.8	35.6
modified sorbitan hexaricinoleate	33.8	37.6
mannide monooleate	37.0	39.0

The esters shown above are all derivatives of sorbitol and mannitol. The sorbitans and mannitans are the products obtained by removing one molecule of water from sorbitol and mannitol, forming an internal "ether" linkage or "lactone" ring in the molecule, and the sorbides and mannides are the products resulting from the removal of two molecules of water from sorbitol and mannitol, respectively. Since sorbitol and mannitol are hexahydroxy compounds, it is obvious that the sorbitans and mannitans have four hydroxy groups available for esterification or other reaction, and the sorbides and mannides have two available hydroxyls. The "modified" esters listed in the table were those in which one or more hydroxyls of the sorbitan or mannitan not used in ester linkage were reacted with polyalkylene oxides to give polyoxyalkylene side

chains to the ester. This side chain renders the ester less oil soluble and more water soluble.

It is obvious that mixtures of the above have almost any desired characteristics of oil and/or water solubility (or insolubility), to yield spreading agents of maximum efficiency. In fact the compounds employed in the above tests contained small amounts of other similar esters inasmuch as they were of "commercial grade" when used, rather than chemically pure.

In use the ester is applied to the water either in the form of a solution in some organic solvent, such as hexanol or octanol and the solvent allowed to evaporate, or it may be applied by smearing it on part of a swimmer's clothing or life jacket, as only a relatively small amount is needed.

Tests with the esters listed in the table showed them capable of holding back a one-fourth inch wall of fuel oil on a water surface for over twenty-four hours without apparent diminution of strength. These tests were made under ideal conditions, so that further tests were undertaken at sea. With a wind velocity of a few miles per hour and calm sea at a temperature of about 48° F., a puddle of oil amounting to between 800 and 900 gallons spreading over a circular area about 300 yards in diameter was forced back from a spot in its center to a distance of about 35 feet from the ship by dumping about two gallons of a 25% solution of the ester in hexanol into the water. Where the oil layer was churned by the propeller the effect of the ester was quite evident in assisting breaking the oil up into small discs which floated on the water rather than emulsified with it.

For individual use in swimming in the sea the ester is better applied in concentrated form to the water surface by means of a sponge or other absorbent material soaked in the ester, or it may be applied from a collapsible tube, as only a few ounces per person are necessary. However, prolonged contact of the ester with the filling in life jackets should be avoided because the buoyancy of the latter is adversely affected in time. Of course the esters have no such effect on inflatable types of life rafts and preservers.

Many variations will be apparent to those skilled in the art, and the invention should not be limited other than as defined by the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. A method of opening an oil-free area in a water surface oil blanket not exceeding one-half inch in thickness comprising impelling the oil from the area into the surrounding region by introducing to the water surface at a position within said blanket a solution of a compound selected from the group consisting of sorbitan monooleate, sorbitan monoricinoleate and mannide monooleate, the said solution consisting of about twenty-five percent by weight of said compound dissolved in a solvent selected from the group consisting of hexanol and octanol.

2. The method as defined in claim 1 in which the solution introduced to the water surface within said blanket consists of about twenty-five percent by weight of sorbitan monooleate dissolved in a solvent selected from the group consisting of hexanol and octanol.

3. The method as defined in claim 1 in which the solution introduced to the water surface within said blanket consists of about twenty-five percent by weight of mannide monooleate dissolved in a solvent selected from the group consisting of hexanol and octanol.

4. The method as defined in claim 1 in which the solution introduced to the water surface within said blanket consists of about twenty-five percent by weight of sorbitan monoricinoleate dissolved in a solvent selected from the group consisting of hexanol and octanol.

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