

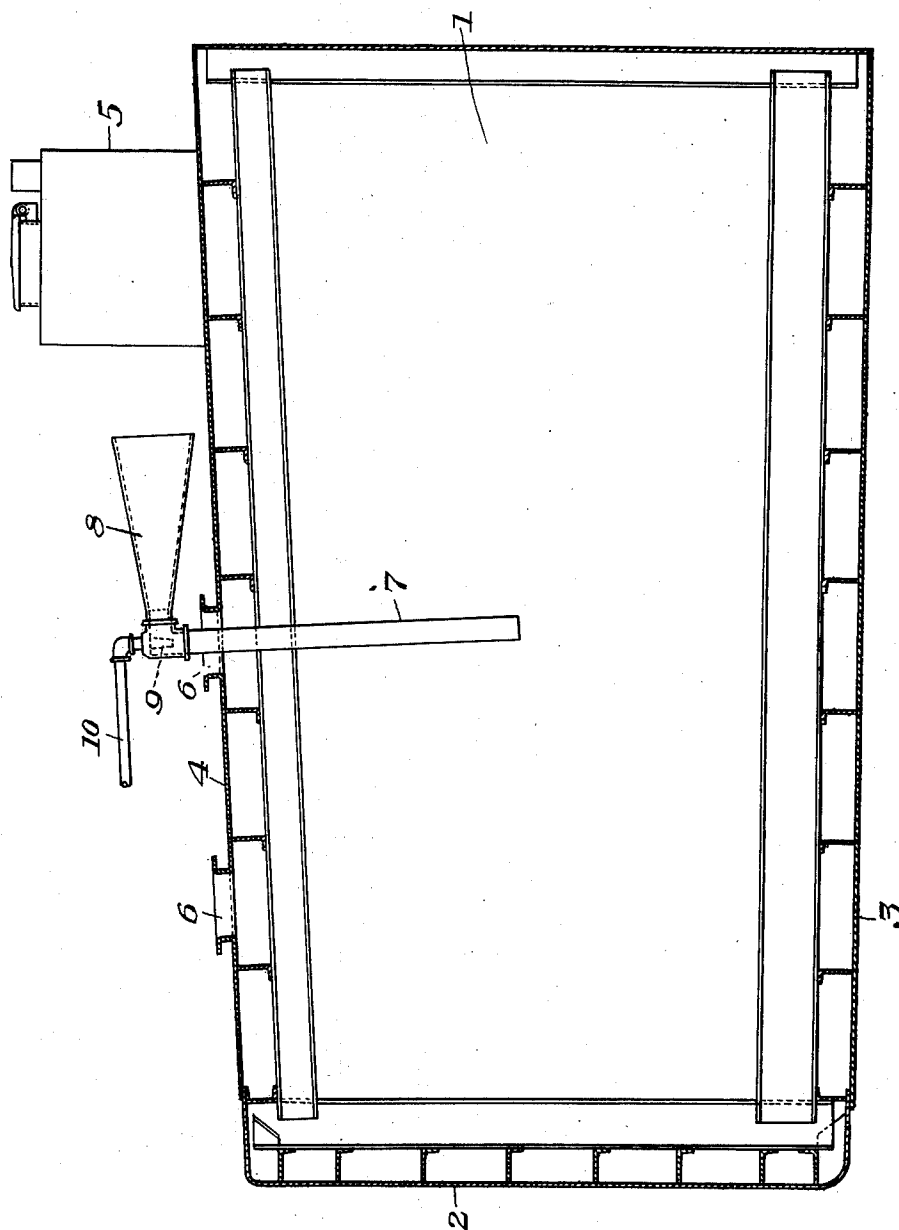
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PURGING OF HYDROCARBON-CONTAINING CHAMBERS

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PURGING OF HYDROCARBON-CONTAINING CHAMBERS

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5 Claims. (Cl. 134-22)

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The invention concerns the purging of chambers, and finds practical application in the removal from chambers in which oil and gasoline have been carried in bulk (as, for example, the cargo compartments of barges) the dregs that remain, after the chambers have in usual manner been emptied. The dregs that remain are in the form both of vapor disseminated in the air that has replaced the cargo and of volatile liquid that adheres to the chamber walls. Explosive mixtures are likely to form in such emptied chambers, and it is in avoidance of such a condition with its attendant danger that the invention has been conceived.

The accompanying drawing is a fragmentary view in vertical section, transversely through an oil-carrying barge for marine transportation, illustrating, somewhat diagrammatically, the instrumentalities by the use of which the invention may be practised.

In this drawing a compartment 1 is shown, filling all the space within the side 2 of the barge, from the bottom 3 to the deck 4. Let it be understood that the barge filled with oil or gasoline has carried its cargo to the port of delivery and has there been emptied. The atmosphere that has replaced the cargo is laden with the higher and more volatile hydrocarbons (typically methane, ethane, propane, etc.), while oil adherent to the walls and floor continues to give off to the atmosphere within the compartment such volatile substance.

The invention consists, primarily and essentially, in the displacement from below upwardly of the hydrocarbon-laden air with an introduced body of moisture-laden air. The moisture-laden air is heavier, and the displacement is gravitational. Secondarily (though by way of preparation) the walls and floor may be washed down with a hose and the accumulation of water and oil pumped out.

Upon the deck stands a structure 5 that includes pressure- and vacuum-relief valves that are useful at other times, but not when the present invention is in course of performance. The structure is included to afford complete showing, but, being mentioned, it may now be disregarded. Openings 6 through the deck are shown. During transportation these openings are capped, but while the purging operation is in progress they are uncapped.

Through one of these openings a pipe 7 extends downward. It may at its lower end approach more or less closely the bottom 3; it is here shown in exemplary way to extend about half way from the deck to the bottom. The pipe is provided above with a suitable air-intake 8. A nozzle 9

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is provided, adapted to project axially and downwardly within the pipe 7 a jet of steam; and it may be understood that from a suitable boiler steam, at a pressure of ninety pounds to the square inch, more or less, flows through pipe 10 and emerges as a jet through nozzle 9. The steam jet induces air flow through the pipe 7, and the air emerging from the lower end of the pipe and into the chamber 1 is laden with condensed moisture. The emerging substance is, indeed, a dense fog. This fog, emerging downwardly into a lighter atmosphere, accumulates at the bottom of the compartment, and as operation progresses and the depth of fog increases, it displaces the lighter, hydrocarbon-laden air, driving the lighter body out through the opening 6, until the whole has so been driven out. It will be understood that a succession of injector pipes may so extend through a succession of openings 20 throughout the length of the compartment. The effective size of the orifices 6 will be such and the size and number of the injection pipes will be such as to afford a pressure somewhat exceeding atmospheric pressure (say one-fifth of a pound greater within the compartment).

As I have said, this gravitational displacement within the compartment of one atmosphere by another may be, and ordinarily (though not necessarily) will be, preceded by a washing-down of the walls of the compartment with water. For such purpose hoses are provided, adapted to deliver high-pressure jets. A motor-driven pump with a discharge pressure of about one hundred and fifty pounds to the square inch will afford impulsion of suitable intensity. The wash water with the washed-away oil may be removed by the pumping service of the barge or by other suitable means.

The procedure is preferably, first, to wash down the walls of the compartment, including the bottom beneath and the deck above, with hoses, and to pump away the accumulated wash water with its burden of washed-away oil. The injectors then are brought into action, and they deliver to the lower portion of the compartment a volume of fog which, as operation progresses, accumulates. The tide of fog rises, displacing the superjacent body of vapor-laden air, until at length substantially all the vapor-laden air has been expelled and fog is pouring from the openings 6. This operation of purging with injected fog is ordinarily continued for about two hours.

Incidentally, the entering volumes of fog condense and entrap some small portion of the air-suspended hydrocarbon vapors, and there is some condensation of oil-carrying water that gathers at the bottom of the compartment. This, in like

manner with the water of the washing-down operation, is eventually pumped out.

The results of the practice of the invention are far better than those of the steaming procedure otherwise commonly used. Tests made with the M. S. A. methane testing apparatus show that, after purging according to the procedure here described, the compartments are free of gas. The procedure accomplished in two hours, as here described, is far more rapid than the steaming procedure, for the steaming procedure requires twenty-four hours in performance. Furthermore, the subsequently gathering residual gas that follows upon the purging of this invention is far less in quantity than that which follows upon the steaming procedure heretofore generally employed, and is indeed negligible.

As I have said the invention finds practical application in the purging of compartments that have been emptied of cargoes of oil and of gasoline; and it will be understood that gasoline is indeed an oil of low gravity. In the ensuing claims I use the word oil as inclusive of gasoline.

I claim as my invention:

1. In a substantially empty tank or container having a compartment with hydrocarbon vapors therein, said container also having one or more gas or vapor outlet openings of substantial size in the top portion thereof indirect communication with the outer atmosphere for exhausting gases therein, and an inlet conduit adapted to inject into said container a stream consisting of a mixture of only steam and air forming a moisture laden vapor or fog of greater density than said hydrocarbon vapors, the method herein described of purging said compartment of hydrocarbon-vapor laden atmosphere, which consists in displacing the hydrocarbon vapor gravitationally upward through said outlet opening or openings by the injection into said container, of said stream consisting of a mixture of only steam and air forming a moisture laden vapor or fog of greater density than the hydrocarbon vapors causing a tide consisting of moisture-laden vapor or fog to rise within the compartment from below said hydrocarbon laden atmosphere, whereby said lighter density hydrocarbon vapors are evacuated from the container through said outlet opening or openings in the top of the container.

2. In an empty compartment having a hydrocarbon laden atmosphere, said compartment having one or more outlet openings in the top thereof, the method herein described of purging said emptied oil compartment of its hydrocarbon-laden atmosphere, which consists in projecting a steam-impelled stream of air into the lower portion of the compartment, causing an accumulation in the lower portion of the compartment of a rising tide of fog and the consequent gravitational displacement upwardly of the lighter density superjacent atmosphere of the hydrocarbon laden vapor, and the ejection of said hydrocarbon laden atmosphere through the exhaust opening or openings in the top of said compartment directly to the atmosphere.

3. The method of purging an emptied oil compartment of hydrocarbon-laden atmosphere produced by evaporation of portions of oil previously contained in the compartment, which comprises flooding the compartment with a vaporous stream containing oily moisture-laden air introduced into the compartment as a fog of greater density than the hydrocarbon atmosphere, and allowing the fog to displace upwardly from the compart-

ment the lighter density hydrocarbon-laden atmosphere contained therein until the hydrocarbon-containing atmosphere is completely displaced by the moisture-laden air.

4. The method of purging an emptied oil compartment of hydrocarbon-laden atmosphere produced by evaporation of portions of oil previously contained in the compartment, which comprises forcibly flushing interior compartment surfaces with high-pressure streams of water, removing accumulated oil-laden water from the compartment at the bottom thereof, and thereafter flooding the compartment with air laden with moisture produced by injection of a vaporous stream consisting of only an air-stream mixture, the moisture-laden air being introduced into the compartment at a point sufficiently approaching the bottom of the compartment to produce an upward displacement of hydrocarbon-laden atmosphere from the compartment by a rising tide of fog-laden air until at least substantially complete displacement of hydrocarbons vapors from the compartment is effected by the said rising tide of fog-laden air, and removing accumulated oil-laden water from the bottom of the compartment.

5. In a substantially empty tank or container having a compartment with retained hydrocarbon vapors therein and having one or more gas outlet openings of substantial size in the top portion thereof exhausting directly to the atmosphere, the method of purging said emptied oil compartment of oil vapor-laden atmosphere produced by evaporation of portions of oil previously contained in the compartment, which comprises injecting steam into the compartment under high pressure of the order of ninety pounds to the square inch, introducing air into the compartment with the steam, thereby producing a high-velocity steam-air mixture adapted to produce a fog in the compartment, introducing solely the steam-air mixture into the compartment sufficiently far to impart a rapid upward displacement of oil vapors floating upon a rising tide of fog, and continuing the introduction of the steam-air mixture until at least substantially complete displacement of the oil vapors from the compartment is effected by evacuation of the hydrocarbon vapors through the exhaust outlet opening or openings in the top portion of the container directly to the atmosphere.

HARRY H. LESTER.

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Certificate of Correction

Patent No. 2,497,946

February 21, 1950

HARRY H. LESTER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 3, line 71, for the word "oily" read *only*;
and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of June, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.