

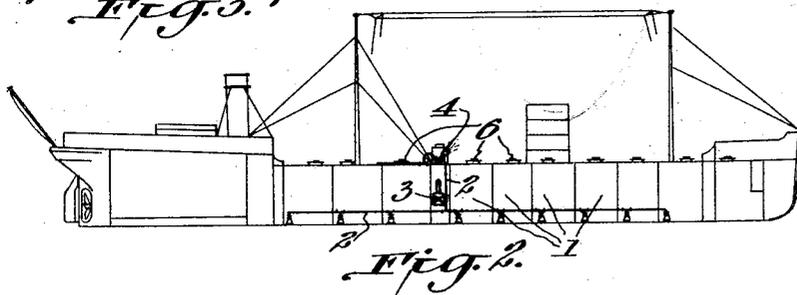
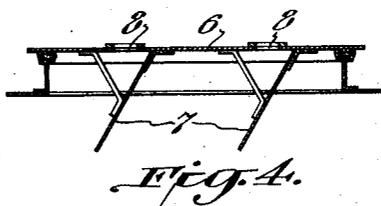
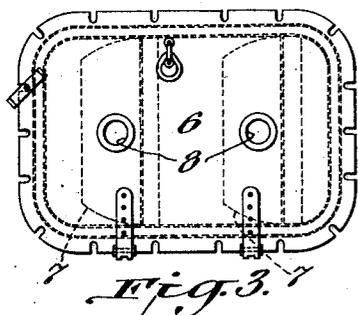
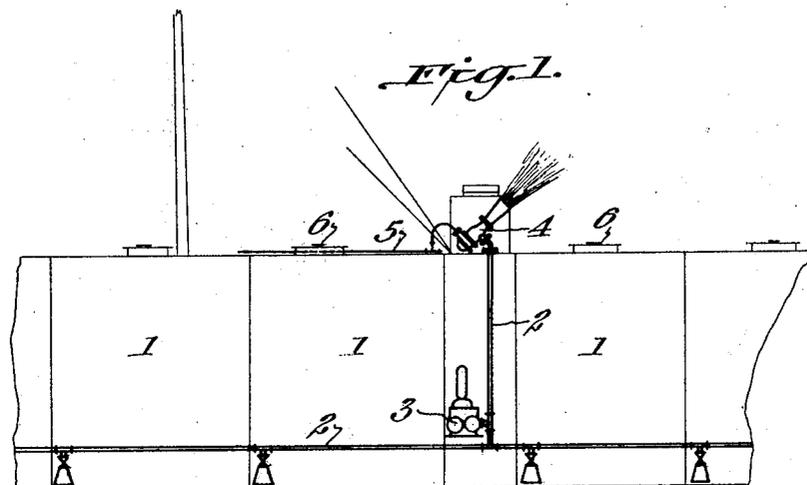
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VENTILATING DEVICE FOR TANK VESSELS

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# UNITED STATES PATENT OFFICE.

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## VENTILATING DEVICE FOR TANK VESSELS.

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On tank vessels for the transport of volatile oils such as petroleum, petrol and the like, the tanks and pipes or ducts cannot be so completely emptied by the pumps that no gases and liquid residuals remain behind. If such gases and residuals are not removed they constitute a continuous danger from explosions. Different directions have been given therefore that in such tanks no repairs or other work may be carried out, so long as they have not been made entirely free of gases. From the aforesaid it follows that in emptying the tanks care should be taken that the liquid residuals shall be evaporated and that the gases are removed as quickly as possible.

Hitherto the freeing of the tanks from gases was accomplished by either of the following methods:

1. The introduction of steam near the bottom of the tanks whereby the gases were driven out through the open hatches or doors.

2. The use of cooling sails. These are long tubes of cloth which are brought with their lower ends into the tank through the open doors of the hatches, their upper ends being provided with wind catching valves. The wind caught by these valves is driven into the tank through the tubular cooling sails and drives the gases out through the hatch doors into the atmosphere.

The driving out of the gases by means of cooling sails makes it necessary to entirely open the large doors of the tanks which must be done whilst the tank is possibly still filled with combustible gases. The opening of these large tank doors is cumbersome and requires much time and labour. Moreover it is possible that for the opening of these doors tools are used such as steel hammers and the like whereby through the falling of steel on steel sparks may occur which may be the cause of an explosion.

3. The use of small gas-ejectors. In this method each tank is provided with a long tube extending to the lower part of the tank. Through these tubes the gases are sucked off by means of an ejector, atmospheric air entering through the holes in the tank doors. With the usual gas ejectors the lower end of

the tube should remain at a considerable distance from the bottom of the tank, since these ejectors do not produce a sufficient vacuum to suck off liquids in addition to the gases. (In connection with a possible list of the tank vessel, the said distance should amount to about 20 cm.) The consequence is that after the sucking off operation a great part of the heavy gases will remain behind on the bottom of the tank. With the method hereinafter described and forming the subject of the present invention this difficulty does not present itself, because the lower end of the sucking tube is only at a very small distance from the bottom of the tank (about 2 cm.). Furthermore the capacity of the sucking apparatus is so large that at the end of the process the air in the lower part of the tank is so stirred up that it mixes with the heavy gases in the lower part of the tank, the mixture being completely sucked off even from the remotest parts of the tank. In the case of the methods used up to now, it was necessary after the gases had been sucked off by means of ejectors to apply the cooling sails in order to obtain the complete removal of the gases.

Although the use of ejectors for the sucking off of the gases already considerably reduces the danger of fire or of explosions, because it is not necessary to completely open the large tank doors, but only to open the small port holes provided in the said doors, the danger of fire is nevertheless not completely excluded, for if it is desired to obtain a complete removal of the gases, it is inevitable to put the cooling sails to work after the ejectors have been used, when it is necessary to completely remove the tank doors with which the above mentioned objections are connected and further with the use of the cooling sails the objection always exists that combustible gases must be carried off into the atmosphere, with the consequent danger of fire.

The above described methods hitherto employed are moreover very inefficient, since the removal of the gases by these methods takes much time and depends upon atmospheric conditions. The usual gas-ejectors

have a relatively small capacity and the cooling sails are especially inefficient in the case of calms.

The cooling sails moreover have the objection that they only commence working after the heavy gases have been sufficiently mixed up with air, which from the nature of things consumes still more time.

Besides the said methods do not provide means for removing the liquid residuals from the pipes or ducts for which purpose up to now steam has been introduced into the ducts, which method takes a great deal of time and besides is not always efficient. Experience has shown that the majority of accidents occur when repairs are carried out in ducts or valves, even for weeks after the certificates for freedom of gas have been passed. Moreover, the small gas-ejectors in the tanks could only create a very small vacuum and tests have proved that an increased vacuum greatly improves the evaporation of benzine or spirit oils. With the new method a much higher vacuum can be obtained.

The invention has not only for its purpose to do away with the above said objections and to make the tanks free of gas in a very short time, but also to provide means for making the whole system of pipes, ducts, valves and pumps completely free of gas in a simple manner.

To this end and according to this invention the gases are sucked off from the oil tanks through the same ducts which are used for filling or emptying the said tanks.

In the accompanying drawings which illustrate apparatus adapted for use in carrying out the invention,

Fig. 1 is a side view of a portion of a tank vessel,

Fig. 2 is a similar view, but on a smaller scale, of a typical tank vessel.

Fig. 3 is a plan view of a hatch cover and Fig. 4 is a vertical section through the same.

In the drawings the several compartments which are indicated by the numeral 1 are provided with oil filling and discharge ducts 2 and an oil pump 3, which parts may be of any usual or desired construction. The air or gas ejector 4 is coupled to a duct system in series with and at the exterior side of the oil pump 3, and to a steam line 5 in the usual manner. The hatch covers 6 are preferably provided with baffles 7 below the ports 8, for directing the incoming air towards the side walls of the tank compartments to sweep the gases therefrom and towards the duct inlets. In practicing the invention, however, the only essential modification of the existing ship equipment is the coupling of a large capacity air or gas ejector to the oil duct system.

By opening and closing the several valves the contents of each tank may be sucked off

through its inlet and outlet duct, atmospheric air entering through the openings of the tank doors.

In some cases use can be successfully made of air directing surfaces or the like for guiding the air entering the tank and ensuring the most efficient distribution thereof.

Where the oil gases are specifically heavier than air, the method employed according to the invention also has the advantage that the gases are sucked off from the lowest point of the tank, where also the greater part of the liquid residuals have remained behind. These residuals are from the beginning of the operation exposed to a strong current of air, so that they will quickly evaporate.

The generated vapors do not first disperse in the room of the tank, as was the case with the methods usual up to now but are directly sucked off through the ducts.

Another advantage of the invention is that the filling-and-emptying pipes or ducts are at the same time made completely free of gas. By opening and closing the several valves the current of air, can be made to pass through all the ducts and also the pumps, so that the safety of the vessel and of the persons in the case of forth-coming repairs is much better guaranteed than when using any of the older methods.

When the invention is carried out by the use of ejectors, the further advantage is obtained that the gases sucked off are intimately mixed with the steam of the ejector and are rendered incombustible.

From the foregoing it will be clear that the invention makes it possible to suck off the gases in a very short time and that the removal of the undesirable gases will be complete.

Besides this removal is done in an absolutely safe way and requires but few men.

What we claim is:

1. In the process of removing residual gases and liquids from tanks by exhausting the same through the permanent duct and pump system of the tank, the step which comprises establishing the suction in series with and at the exhaust side of the pump, whereby the pump and the ducts external thereof may be freed from gases.

2. The method of removing gases from tanks having a permanent pump and duct system for supplying liquid thereto and withdrawing the same therefrom, which comprises establishing a suction at the outlet side of said pump, whereby gases are removed from said tank and air may flow into the same, and directing the incoming air laterally of said tank to sweep the gases towards the duct inlets.

3. In a tank vessel, the combination of a tank, a liquid pump and ducts for supplying

and withdrawing liquid thereto, of an air or gas ejector connected in series with and externally of said pump for freeing the tanks, pump and ducts of gases after the liquid has  
5 been withdrawn. laterally of said tank, and ducts for supplying liquid to and withdrawing the same  
10 from said tank, of a large capacity ejector connected to said ducts for exhausting gases from said tank.

4. In a tank vessel, the combination with a tank for holding liquid, a cover for said tank having ports therethrough, baffles below said ports for directing air currents  
15 In testimony whereof we have hereunto set our hands.

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