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[54] **METHOD FOR CLEANING GASOLINE STORAGE TANKS**

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[58] **Field of Search**..... 134/22 R, 24, 34, 10; 210/58

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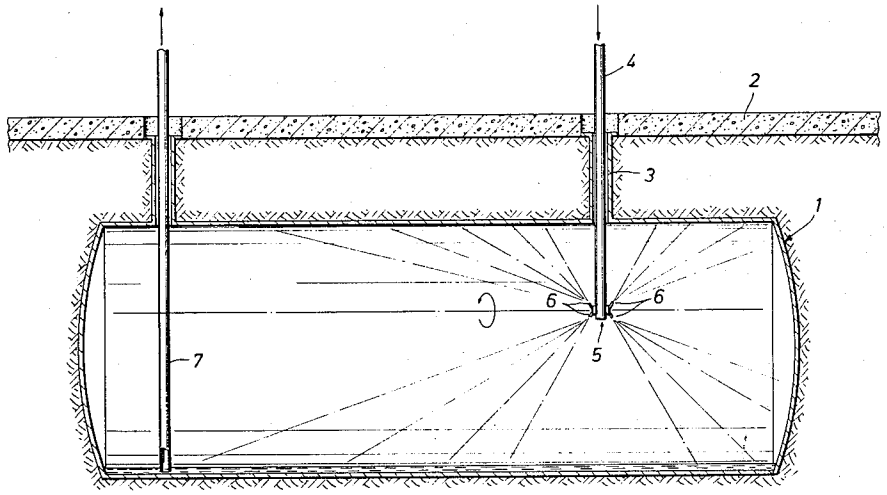
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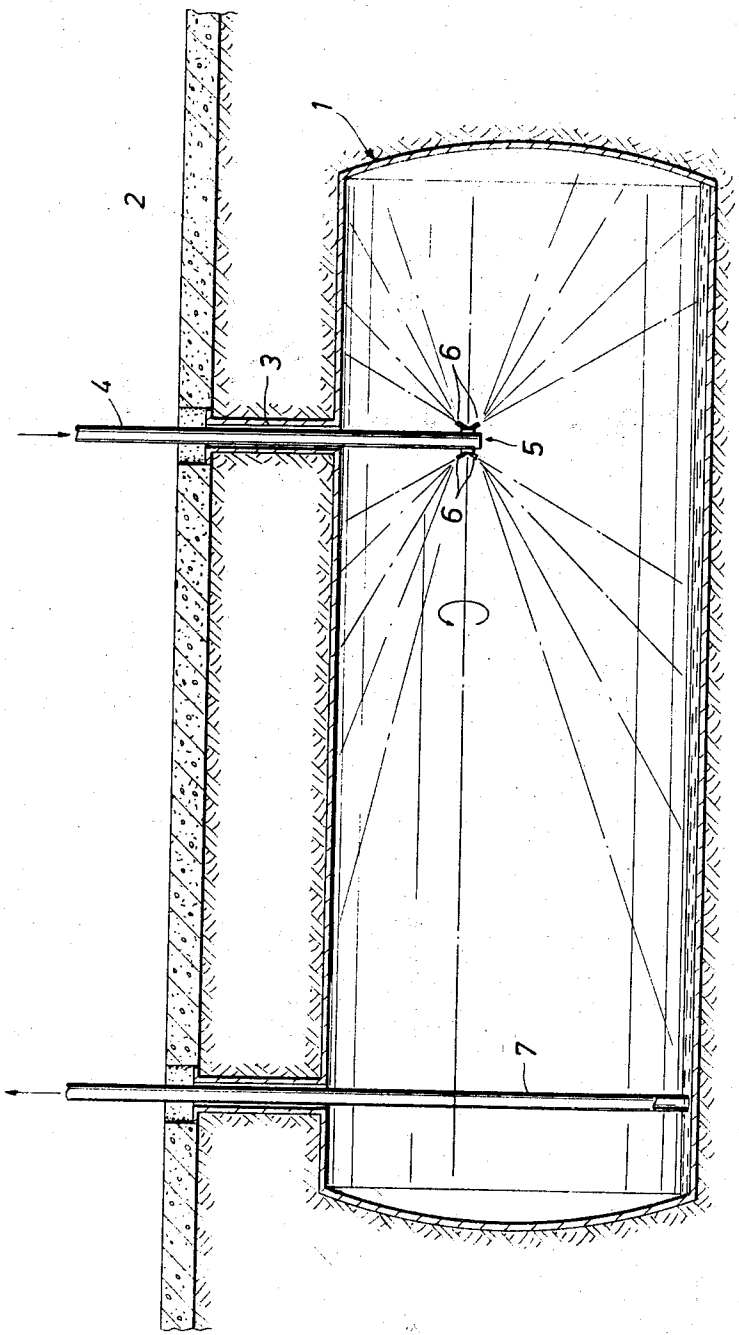
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[57] **ABSTRACT**

Service station gasoline storage tanks are cleaned by jet spraying a high viscosity cleaning fluid such as aqueous cellulose gum solution by means of a rotating nozzle over the interior surface of the tanks with sufficient pressure to break loose rust and hydrocarbon deposits and pumping out the cleaning fluid containing the suspended deposits along with other debris.

6 Claims, 1 Drawing Figure




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METHOD FOR CLEANING GASOLINE STORAGE TANKS

BACKGROUND OF THE INVENTION

Over a period of years deposits accumulate on the interior surfaces of service station gasoline storage tanks. These deposits consist largely of rust, water, and hydrocarbons and may adhere to the tank interior in thicknesses up to about one-half inch. Problems occur from time to time when small amounts of the deposits are broken away by the action of gasoline filling the tank and are carried into customers vehicles where they block filters or carburetors.

There are three major problems associated with cleaning such gasoline storage tanks. First, there is the problem of access. The access to the tank is a pipe about 4 inches in diameter which extends into the tank. Accordingly, it is difficult to get cleaning equipment down through this pipe and into the tank in a position to afford cleaning of the tank. Second, there is the problem of the weight of the material to be removed. For the most part, such material consists of iron rust, dirt, and sand which are heavy and difficult to remove. Of course, not only is the weight of the material a problem but also the fact that the material is stuck to the tank and must be removed by some physical force. A third problem is the lack of flow which can be established through the tank. The tank has an entrance pipe located at one end and an exit pipe located at another end. The location of these two pipes along with dimensions of the tank make it impossible to establish a flow through the tank which will remove rust and similar material which is scattered over the entire inner surface of the tank.

In the prior art attempts have been made to clean gasoline storage tanks by utilizing the flow of gasoline through the tank, but this apparently does not work well. Techniques of the prior art such as revealed by Kearney et al., U.S. Pat. No. 3,042,553, which employs chlorinated hydrocarbons such as trichlorethylene, perchlorethylene and methylene chloride for cleaning tanks, and the method of Fitzgerald, U.S. Pat. No. 1,891,592, which relies upon the use of carbon tetrachloride for cleaning tanks along with a solution of calcium chloride to float out residual hydrocarbons, are not successful when removing the rust, scale, dirt and sand which collect in such tanks as above mentioned.

It is, therefore, desirable to periodically clean gasoline storage tanks to prevent such accumulation of deposits and the problems ensuing therefrom. The present invention overcomes the problems of the prior art and provides a successful solution thereto as will be apparent from the following description thereof.

SUMMARY OF THE INVENTION

The primary purpose of this invention resides in providing a method for cleaning deposits from the interior walls of storage tanks.

The above purpose has been achieved by using a cleaning fluid which is of sufficiently high viscosity so that the deposits are suspended in the fluid and are pumped out of the tank with the fluid.

More specifically, the present invention provides a method for cleaning storage tanks by directing a high viscosity cleaning fluid against the interior surface of a tank with sufficient pressure to break loose rust and hydrocarbon deposits, whereby the deposits are suspended in the fluid, and pumping out the cleaning fluid containing the suspended deposits. Preferably, the storage tanks are service station gasoline storage tanks, the cleaning fluid is jet sprayed against the interior surface of the tank, and a rotating nozzle is employed to distribute the spray over the interior surface of the tank. A preferred cleaning fluid is an aqueous solution of hydroxyethyl cellulose.

Within the framework of the above described method, the present invention not only solves the above mentioned problems of the prior art, but also achieves further significant advantages as will be apparent from the description of preferred embodiments following.

DESCRIPTION OF THE DRAWINGS

The drawings provide a schematic showing of cleaning fluid distribution within a service station gasoline storage tank.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

All cleaning methods have three basic element: a cleaning material, a means for delivering the cleaning material, and a means for removing the cleaning material with displaced soil. The selection of a cleaning technique for service station gasoline storage tanks is unusual for two reasons: the nature of deposit, which is of high density because of the presence of iron; and the access to the tank, which is extremely limited and usually is a small diameter pipe which penetrates the gas station apron and tank backfill. Accordingly, in accordance with the invention a cleaning material is selected which is of sufficiently high viscosity so that it may be employed to float out the high density soil containing iron. Further, the cleaning fluid distribution technique of the invention involves jet spraying the cleaning fluid by means of a rotating nozzle so that rust, water, and hydrocarbon deposits may be broken loose from the interior of the gasoline tank. Inasmuch as such soil then becomes suspended in the cleaning material, it is easily removed by pumping out the cleaning material.

The material for removing rust, sand, soil, etc. from the tank generally has the following properties: (1) high viscosity, (2) water base, (3) pumpable, (4) hydrocarbon insoluble, (5) low or non-existent reactivity with the hydrocarbon, and (6) preferably biodegradable. The preferred material is an aqueous cellulose ether solution, preferably a solution in water of hydroxyethyl cellulose. Preferably less than about 5 percent by weight hydroxyethyl cellulose in water is utilized and most preferably about 1 percent by weight is mixed with water. The hydroxyethyl cellulose solution preferably has a viscosity between about 2,500 and about 4,000 centipoises with an average viscosity of about 3,000 centipoises. Other materials also find excellent use with the invention, for example water soluble polymers including polysaccharides, natural gums and their derivatives such as arabic, karaya, tragacanth, carageenin, agar, alginates, starch, pectin, xanthates, guar and hydroxy-alkyl guar; cellulose ethers such as methyl cellulose, sodium carboxymethylcellulose, hydroxyethylcellulose, mixed alkyl celluloses; polyacrylamides; polyethylene oxides; polycarboxy vinyls; polyvinyl ethers; poly (methyl vinyl ether/maleic anhydride); and

polyvinyl alcohols. The preceding cleaning materials may be used in any combinations thereof or employed with other solvents more suited to removing other deposits, e.g. sludge or oil. Also, various additives may be used to facilitate cleaning such as detergents, and/or defoamers.

The present invention is particularly concerned with a method for cleaning service station gasoline storage tanks. However, it is manifestly adapted to cleaning all manner of tanks wherein there is a problem of accumulation of rust and other heavy solid or semi-solid materials on the interior of the tanks. Thus, the invention would be useful for cleaning tanks containing crude oil or refined oil or other chemicals. In general, the invention is most useful where there are three major problems associated with cleaning the storage tanks, namely, limited access to the tank, heavy weight of the material to be removed, and inability to establish good flow through the tank. Given one or more of these problems, the present invention is highly useful for cleaning any tank wherein such problems occur.

Referring now specifically to the gasoline tank as shown in the drawings, it will be noted that tank **1** which is usually constructed of steel is buried in the ground beneath a concrete or asphalt apron **2** which makes the tank relatively inaccessible for cleaning. Access to the tank is through a small pipe **3** normally about 4 inches in diameter. The cleaning fluid distribution system includes a pipe or hose **4** terminating in a nozzle **5** which is preferably rotatable. The nozzle may be rotated by any mechanical means but is preferably rotated by the force of the cleaning fluid in a manner similar to the rotation of lawn water sprinkling devices. The jet produced by the nozzles **6** must go a maximum of about 20 feet which may be achieved usually with a flow rate of about 8 gallons per minute of water at about 250 psi. Generally, several 50 gallon washes of a 1 percent by weight solution of the preferred cleaning fluid of the present invention are required for cleaning purposes. The tank **1** is from 6 feet to 20 feet in length and from 4 feet to 7 feet in diameter with a capacity from 500 to 4,000 gallons. After the treatment with a high viscosity solution, the tank is generally washed with two water washes of about 30 gallons each. A periscope should be employed for inspection of the tank before and after cleaning to detect the amount of rust to be removed and efficiency of the method.

To remove the high viscosity solution from the tank, pumps of about one horsepower which can remove about 10 gallons per minute of liquid preferably are employed. Such pumps may be employed outside the tank or a submerged pump inside the tank may be used. Where an outside pump is used, it is of course limited to a height of about 28 feet in theory but 15 feet practice. The submerged pump is generally used where the solution must be raised higher than 15 feet. The cleaning fluid may be pumped out through pipe **7.**

Any convenient container may be used to mix the cleaning fluid of the present invention with water to form a solution useful for cleaning a tank. Generally, a barrel is suitable for such purposes. On the other hand, pre-mixed cleaning fluid may be supplied to a nozzle which is connected to a water source so that dilution with water occurs in the nozzle without resort to a mixing container. All of the apparatus and equipment necessary for the practice of the invention can easily be carried in a small truck. Thus, the amount of cleaning fluid necessary is generally very small, especially in the case of the preferred cleaning material, hydroxyethyl cellulose, which is only used preferably in a 1 percent by weight solution in water. As above noted, the rotatable nozzles are necessarily limited to less than about 4 inches in size so that this device can likewise be easily carried by truck.

Disposal of the removed cleaning solution is not a problem inasmuch as it is preferably biodegradable. While rust and other debris may be filtered out and the solution reused during the day, such use is generally restricted to a single day since the preferred polymer, hydroxyethyl cellulose, quickly deteriorates. The removed solution may be put in a sewer or left to evaporate.

The cost of cleaning such tanks is generally quite low inasmuch as the amount of cleaning fluid is only a few dollars per cleaning. Generally, a period of about eight hours for cleaning the tank is required for removing gasoline from the tank, spraying with cleaning solution, pumping out the cleaning solution containing debris, and then washing down the tank with one or more washes and pumping out the washes.

EXAMPLES

In accordance with the invention, the following tests were conducted:

1. Field Test at an Abandoned Service Station

A full scale portable system was conducted for testing at an abandoned service station in Houston.

The cleaning procedure consisted of two polymer-solution washes followed by two water washes; each wash used about 30 gallons of fluid, and took approximately eight minutes. After spraying the first polymer-solution wash into the tank the fluid was pumped into a holding drum and was found to contain large quantities of rust and dirt. The second polymer-solution wash was performed, and the used fluid was found to be only moderately dirty. Although a third polymer-solution wash might have been used in a real cleaning operation, it was decided that the procedure was adequately demonstrated, and a water wash was then used. The extracted water was found to be rather dirty and was slimy to the touch, indicating the presence of polymer. A second water wash was clean, with no indication of polymer, and with only occasional specks of rust. It was decided that within the limitations of the test it was successful.

2. Field Test in an Abandoned Terminal Storage Tank

A second test was conducted on a large tank having a manhole. The tank was 40 years old and contained very large quantities of rust and sediment. Six polymer solution washes, each of 50 gallons, were used and large quantities of solid material were removed. Samples of the polymer solution, with the suspended solids after the cleaning operation, were analyzed and it was found that the polymer solution removed between 0.5 pound and 1.0 pound of sediment per gallon of cleaning solution.

We claim as our invention:

1. A method for cleaning a hydrocarbon storage tank comprising:

directing a high viscosity cleaning fluid selected from the group consisting of aqueous solutions of polysaccharides, natural gums, cellulose ethers, polyacrylamides, polyethylene oxides, polycarboxyvi-

nyls, polyvinyl ethers, polymethylvinyl ethers, polymaleic anhydrides, and polyvinyl alcohols against the interior surface of the tank with sufficient pressure to break loose rust and hydrocarbon deposits, whereby the deposits become suspended in the cleaning fluid; and

pumping out the cleaning fluid containing the suspended deposits.

2. The method of claim **1** wherein the hydrocarbon is gasoline.

3. The method of claim **1** wherein the storage tank is a service station gasoline tank.

4. The method of claim **1** wherein the high viscosity fluid is jet sprayed.

5. The method of claim **1** wherein the high viscosity fluid is sprayed through a rotating nozzle.

6. A method for cleaning a service station gasoline storage tank comprising:

directing a 1 percent by weight solution in water of hydroxyethylcellulose having a viscosity which ranges from about 2,500 to about 4,000 centipoises against the interior surface of the tank with sufficient pressure to break loose rust and hydrocarbon deposits, whereby the deposits become suspended in the aqueous solution; and

pumping out the cleaning fluid containing the suspended deposits.

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