Fraser & Calkins,

Petroleum Tank.

No. 50,348. Patented Oct. 10, 1865.

Fig. 1.

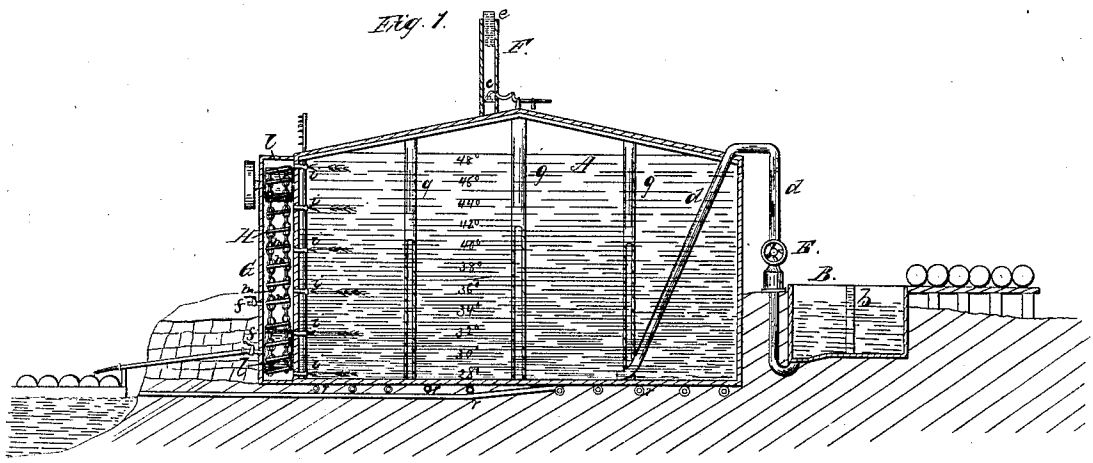


Fig. 2.

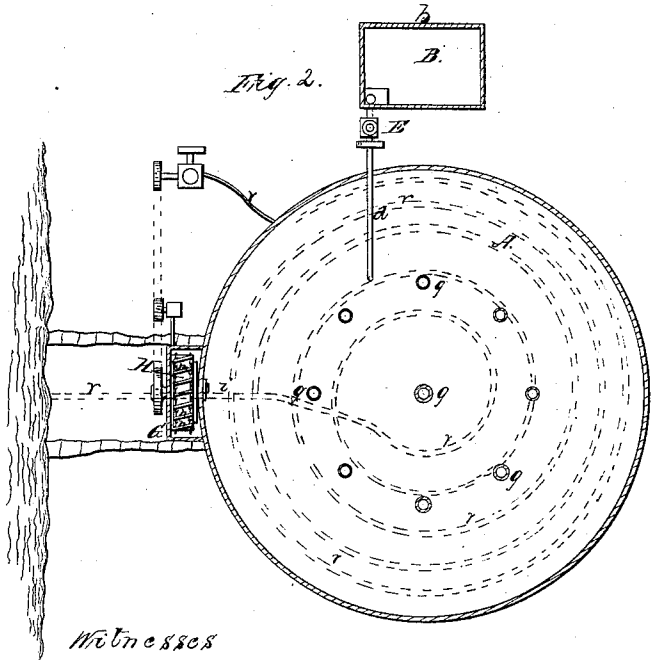
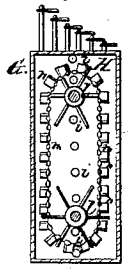


Fig. 3



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IMPROVEMENT IN TANKS FOR STORING PETROLEUM.

Specification forming part of Letters Patent No. **50,348**, dated October 10, 1865.

To all whom it may concern:

Be it known that we, J. FRASER and JAMES CALKINS, both of the city of Buffalo, in the county of Erie, in State of New York, have invented a new and Improved Apparatus for the Storage and Preservation of Petroleum and other Volatile Liquids; and we do hereby declare that the following is a full and exact description thereof, reference being had to the following drawings, in which—

Figure 1 is a vertical section of a storage-tank and its appurtenances. Fig. 2 is a horizontal section and plan of the same. Fig. 3 is a separate view of the equalizer, the front being removed to show the agitator and graduating-valves.

Like letters indicate corresponding parts in all of the drawings.

Our invention has for its object the preservation of crude and refined petroleum or naphtha with absolute security against explosions or loss by fire, and evaporation or deterioration by exposure to the sun and air, and economy in saving insurance, cooperage, and the cost of barrels; and it consists of an air-tight tank or reservoir provided with a safety gas fuse and valve, and of a receiving, separating, and gaging tank in combination therewith, and also of an equalizing-chamber, in connection with the main reservoir, for regulating the gravity before delivery, and of the combination therewith of a series of graduating-valves for enabling any grade of oil that may be contained in the tank to be drawn and removed independent of the other grades or qualities; also, in the employment of an agitator, in combination with the gage-valves and equalizing-chamber, to secure uniformity in the quality delivered; and, further, in the method of delivering the oil from the separating and gaging tank into the main reservoir for preventing the accumulation of solid paraffine at the bottom, and for the preservation of the gas, and in the arrangement of a coil for conveying heat to the bottom to liquefy this sediment in cold weather, and also in the construction of the columns which support the top or roof of the main reservoir for economizing space.

As represented in the drawings, A is the main reservoir for the preservation of petroleum, which is built of metal, preferably of iron plates, of the required thickness to resist the pressure of its fluid contents, which will, of course, vary with its capacity. A convenient and economical size to construct is one which will contain ten thousand barrels, with a diameter horizontally of about sixty feet, and of a height of about twenty-four or twenty-five feet. It is preferably built of circular form, with a level or flat bottom, vertical sides, and top which inclines from the center toward the sides so as to shed rain freely. The iron should be thickest at the bottom, and for one-third, or thereabout, of the sides from the bottom upward, where the strain will be greatest, when a less thickness will answer equally well. It should be sunk below the surface of the ground a portion of its depth—say six or ten feet—in order to get a greater uniformity of temperature and to obtain the resistance of the soil to support the sides against the outward pressure of the contents. If the soil in which it is built is of compact nature, this resistance is very great, and enables lighter iron to be used than could otherwise be employed with safety. The plates should be thoroughly riveted and caulked at the joints where they are united in the manner of a steam-boiler, so as to render every part tight enough to pevent the escape of gas. The excavation in which it stands should be grouted with hydraulic cement to prevent the oxidation of the iron from contact with the earth.

At a convenient distance from the main tank or reservoir we provide an open tank, B, of less capacity, for receiving oil that is to be stored in A. Petroleum when obtained from the wells usually contains more or less water in a state of mixture, and in this case it is allowed to remain in the tank B a sufficient length of time to enable the water to separate and sink to the bottom. When this is accomplished the oil is gaged by means of a glass scale, *b*, inserted in the side of the open tank, which enables the exact height of the water and depth of oil to be measured, giving (with the specified area of the tank) the number of gallons contained in the receiving-tank. Previous to pumping it into the main tank the gravity of each lot is carefully ascertained by the hydrometer. It is forced into the tank A through the receiving-pipe *d* by means of a pump, as represented at E. The receiving-pipe passes through the roof by a gas-tight

joint, and terminates at the bottom of the tank, the purpose of which will hereinafter be explained.

A light hydrocarbon gas escapes freely from crude petroleum when exposed to the atmosphere, and, becoming mixed therewith in certain proportions, forms a highly inflammable compound. The results of this are seen in the frequency with which the oil kept in open tanks takes fire, consuming everything combustible around it, and in the bursting of barrels by the expansion of the gas arising from the oil contained therein. Aside from the dangers arising from this cause, there is a large loss in the quantity of the oil by evaporation, especially in hot weather. When confined closely from the atmosphere the tendency of petroleum to evolve gases is greatly diminished, and depends chiefly on the temperature of the oil being elevated; but in so large a quantity as ten thousand barrels in bulk the change of temperature is very gradual. Nevertheless we have provided a safety-vent in case sufficient gas is engendered to cause a strain upon the tank A, which might rupture any part of it. This consists of the pipe F, provided with a safety-valve, *c*, so loaded as to open before the pressure reaches a point that would be dangerous, and permit a portion of the gas to escape. A safety-fuse, *e*, consisting of a mass of woven wire or wire-cloth in many thicknesses, is preferably formed by rolling a piece of wire-cloth up until a coil is formed large enough to fill the pipe F. The gas which escapes through the innumerable meshes of this fuse may take fire from a spark on reaching the atmosphere, but as the flame cannot extend back through the fuse it may continue to burn, like the wick of a lamp, without danger of exploding the tank.

The standards *g g* are made tubular, with apertures at the bottom, so that the oil may rise to the same height within that it does around them. This form gives all the strength required, even in thin wrought-iron pipe of diameter varying from two to three inches, while very little space is occupied.

It is desirable that these tanks should be erected in a convenient position for the shipping or removal of the oil, as on the bank of a navigable stream or by a railroad-track. On the side from which the oil is to be delivered we build a compartment, G, projecting from and of equal height with the tank; or the same may be made by forming a corresponding partition within the tank. The area of this compartment need not be large—say sufficient to contain sixty or one hundred barrels of oil. On its outside are arranged the cocks or faucets *f f* for drawing the oil into the barrels or other packages, the number and position of which may be made to suit the convenience of the location and use. On the inner partition a number of valves, gates, or other equivalent devices *i i*, are provided, arranged at equal intervals from the bottom to the top of the side of the tank, for opening or closing a corresponding number of apertures between the tank and the compartment G. These valves are operated by rods extending to the top, or to any part most convenient of access, and each opens or closes independent of the other. It is the object of this arrangement to take advantage of the tendency which is possessed by the hydrocarbon series of fluids to separate when remaining undisturbed and subjected only to the influences of temperature, into different grades, according to their altitude in the reservoir containing them, the paraffine and heavier combinations depositing at the bottom, and each lighter one superimposed till the top is reached. It is obvious, therefore, that with a large bulk in store, which has remained long enough to conform to this law, the lightest grade will be drawn from the top of the contents of the reservoir, and so down by degrees of increasing gravity till the heaviest is reached at the bottom. Thus if a particular gravity is required it may be obtained with sufficient exactness for commercial purposes by the aid of our graduating-valves and equalizing-chamber, as follows: By opening any one of the valves *i i* the oil passes into chamber G before it is delivered. This chamber is provided with an agitator, H, consisting of a series of floats, *n n*, attached to one or more endless chains, *m*, which are kept in motion by two reels, *l l*, arranged at top and bottom of the chamber, the upper one of which, being driven by any suitable power, keeps that portion of the liquid which enters the chamber G in constant agitation.

In supplying any particular gravity of oil from that on store, if any one of the valves *i* does not furnish that of the required gravity, or in sufficient quantity, it is only necessary to draw simultaneously from two, one being above and the other below the required standard, and combine them in the equalizing-chamber before drawing from the discharge-cock.

The reunion of the different grades is quickly effected, and by keeping the chamber G filled, or nearly so, a rapid delivery may be effected without loss of time, as the capacity of the equalizer is sufficient to supply as great a quantity as can be received in several barrels at the same time by discharging from several cocks. It is advisable in thus combining gravities to unite two grades differing as little as possible.

By separating and enabling the heavy grades of oil to be marketed by themselves an important advantage is attained by the dealer, as heavy oils always command a high price. To prevent this separation of the different grades from taking place to an extent that would be attended with expense and inconvenience, as would be the case if it were so complete as to deposit the paraffine as a solid on the bottom of the tank, we employ two distinct devices.

The first, for constant use, consists in extending the delivery-pipe *d* to the bottom of

the tank, and so arranging its mouth that the oil as it escapes spreads over the surface thereof. By this means oil that is introduced into the large reservoir A reaches the bottom before it is allowed to mingle with that already in store. As the new is more recently from the wells, and consequently abounds more in naphtha and the lighter hydrocarbons, which readily combine with the heavier, the fresh oil thus introduced commingles with the lower stratum of the contents of the tank, dissolving and rendering fluid any solid deposit of paraffine, and the stream, by spreading over the level bottom, aids mechanically in making this result more complete and effectual. If the fresh and light oil were delivered into the tank at the top it would simply rest on the top of that already in the tank, but being delivered at the bottom its difference of gravity causes the lighter portions to rise through the quantity in store, thus tending to maintain the fluidity of the entire lot.

The second device for preventing the accumulation of solid deposits on the floor of the tank consists in the employment of a coil of pipe, *r r*, laid in the cement on which the bottom of the tank rests. In winter, when the low temperature produces a crystallization of the paraffine, its accumulation on the bottom may be prevented by forcing steam or hot air through this coil of pipe (one end being connected with a boiler or furnace for that purpose) at times when the heavier grades of oil are to be drawn, and thus render it fluid for removal. This does not require that the temperature be raised to that point that will melt paraffine, but simply to 55° Fahrenheit, at and above which paraffine dissolves in the naphtha and remains of a fluid consistency.

It will be seen that one of the objects of our invention is the preservation of the gaseous and volatile portions of the oil, that they may be condensed and utilized. This is accomplished by making the store-tank A hermetical, and retaining the gas, unless its accumulation is liable to burst the tank, provision against which has been made in the gas-vent heretofore described. The gas thus retained condenses when the temperature is reduced, either by changes of weather or by the introduction of large quantities of oil fresh from the wells, which is always of a low temperature, and being drawn off in a fluid state forms a light grade of oil. The pressure under which it is kept favors its absorption by the oil, which takes place in some degree over the large extent of surface thus exposed, and experiments have induced the belief that when the light oil is drawn from the surface of that in store, and the gas is then placed in contact with a heavier grade, a new combination takes place between the gas and the oil, producing an intermediate grade.

The preservation of the gaseous portion is important, as it effects a large saving over the mode in general use, in which the loss by evaporation is unrestrained and immense. By terminating the delivery-pipe *d* at the bottom an effectual means is provided for preventing the escape of the gas, since a depth of a few inches of oil in the tank closes the aperture of this pipe against its escape. This arrangement of the pipe *d* also effects a saving power in filling the tank A, as it acts as a siphon until it is filled to a level with the gaging-tank B, after which the pump has to be used.

One of the advantages obtained by this system is that the oil is prevented from deteriorating. When exposed to the action of the sun and air in open tanks it becomes discolored by oxidation, which prevents a pure and light-colored oil being made from it when refined. Our apparatus not only excludes all light, but air also, which is expelled by the gas as soon as any considerable quantity of oil is introduced.

For storing in the regions where petroleum is produced, at refineries and in cities, or at points of shipment, our apparatus provides a system which is perfectly safe against fire, and therefore requires no insurance, which prevents loss from the usual causes of leakage and evaporation, and enables the holder to withdraw from his store any grade which may be required to meet his orders, thus obviating a great difficulty which has heretofore prevailed in the trouble and expense necessary to purchase the particular grades required by refiners and manufacturers.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. A hermetically-constructed metallic tank or store-house, A, provided with a safety gas-vent and fuse, F *c e*, for preserving petroleum and other hydrocarbon fluids, substantially as described.

2. The combination of a receiving, separating, and gaging tank, B, with the hermetical tank A, arranged in the manner and for the purpose set forth.

3. In combination with the hermetical tank A, an equalizing delivery-chamber, G, when the same are connected by a series of valves, *i i*, arranged at different altitudes, each independent of the others, for the purpose of drawing oil of different gravities from the amount in store, substantially as set forth.

4. The agitator H, in combination with the chamber G and store-tank A, for the purpose of combining and equalizing the oil in G before delivery, when different grades are taken from A at one time, substantially as described.

5. Constructing the supporting-columns *g g* of tubular form, with one or more openings at the base, for utilizing the space in tank A, substantially as set forth.

6. In combination with the tanks A B, the arrangement of the receiving-pipe *d*, entering through the roof and descending to the floor of A, whereby the fresh oil is always introduced first in contact with the heavier stratum of oil and paraffine deposited on the bottom, and is discharged with a force acquired by its descent

from the top of tank A, substantially in the manner and for the purposes set forth.

7. In combination with the hermetical tank A and delivery-chamber G, the heating-coil *r r*, arranged and operating as and for the purpose shown and described.

8. The metallic safety-fuse *e*, in combination with a hermetical incombustible reservoir, A, for hydrocarbon oils, for preventing the burning of the escaping gas from igniting the contents of the reservoir, substantially as set forth.

9. The combination and arrangement of the hermetical store-house A, with the receiving, gaging, and separating tank B, equalizing delivery-chamber G, and agitator H, operating conjointly, and constructed as described.

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