

May 15, 1934.

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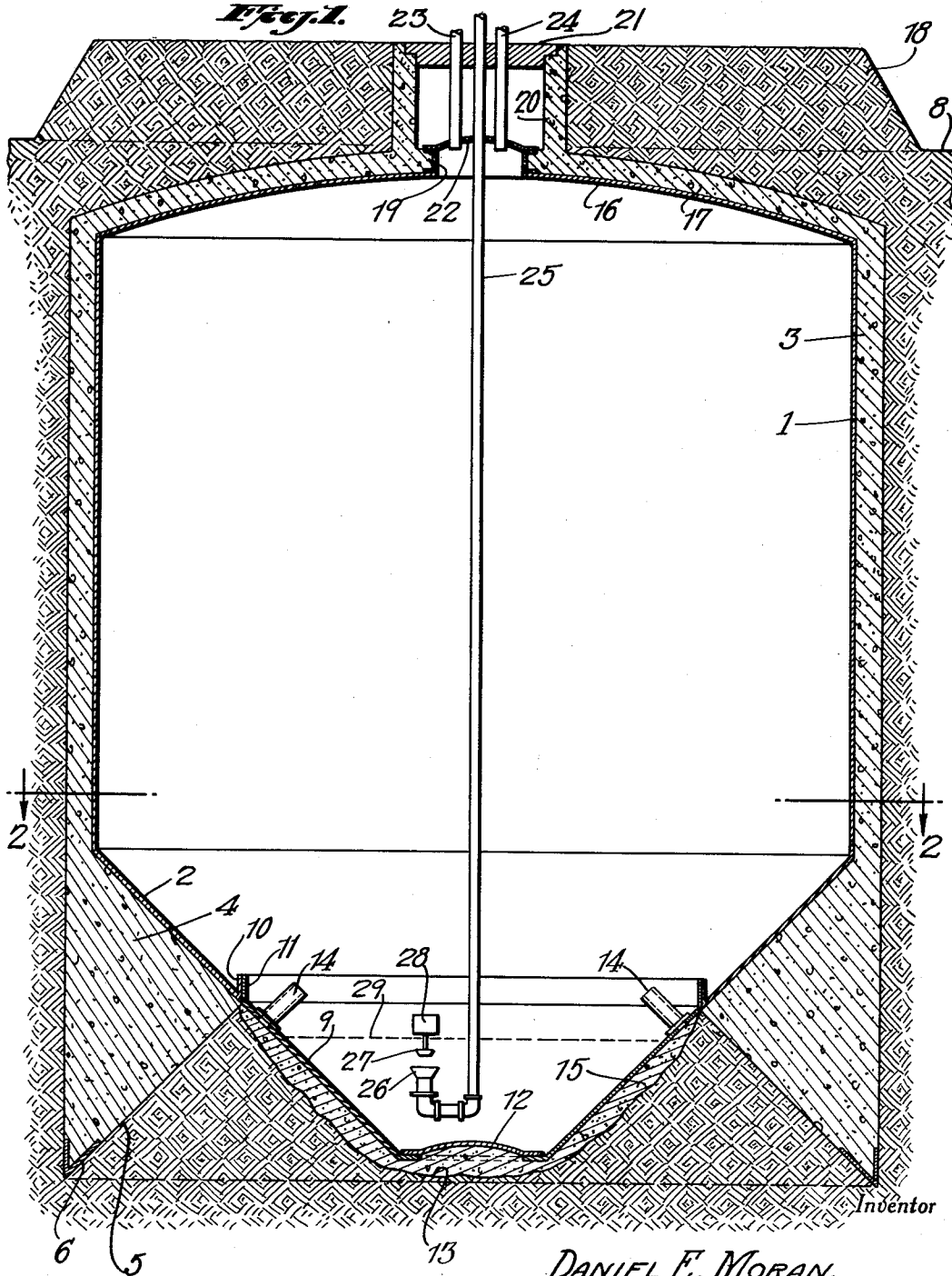
1,958,487

STORAGE OF GASOLINE AND THE LIKE

Filed July 31, 1929

3 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

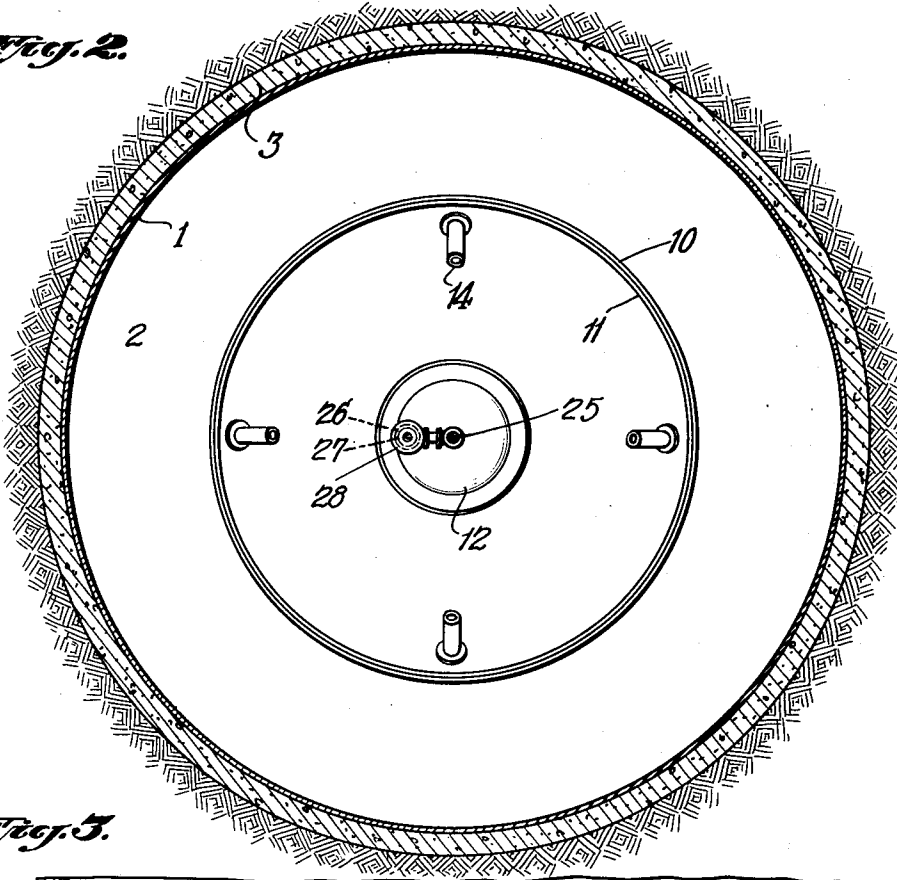
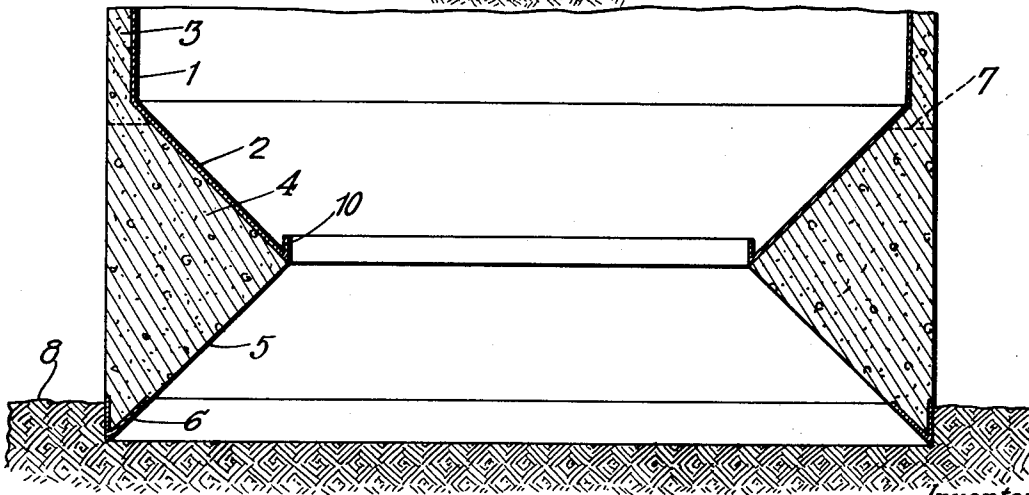


Fig. 3.



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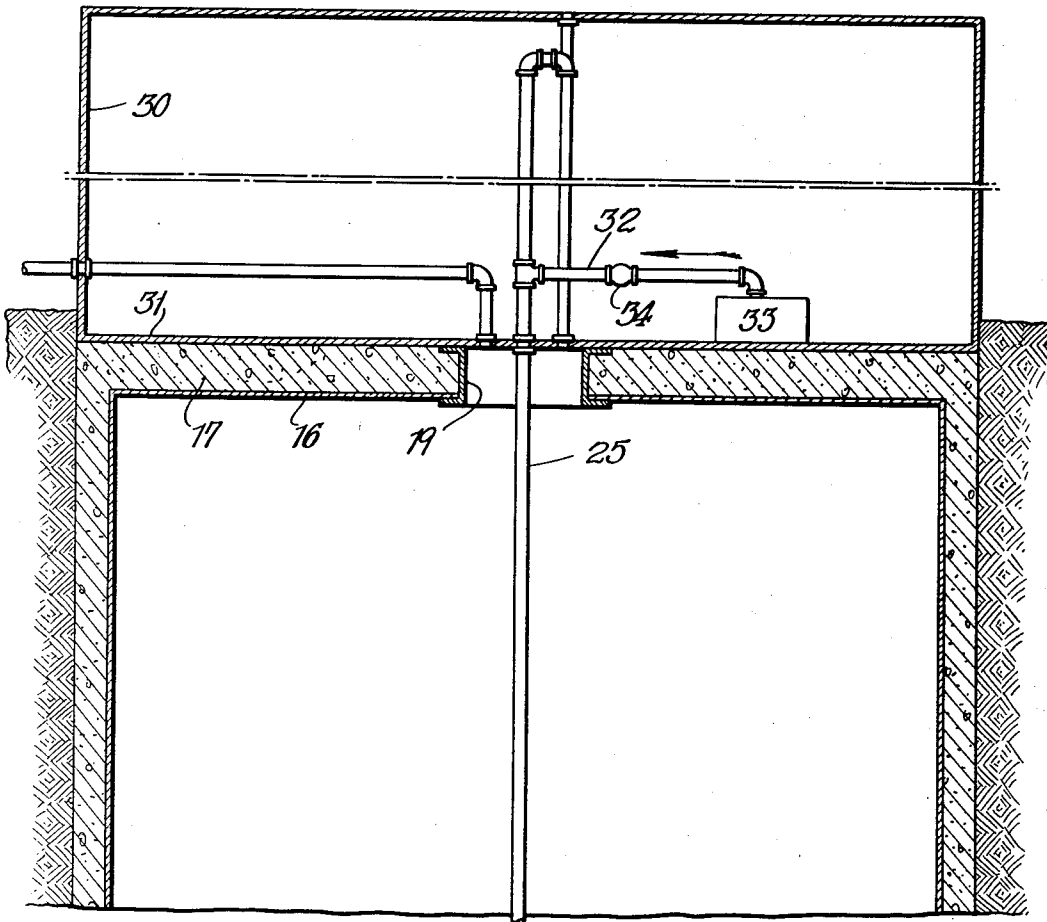
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Fig. 4.



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UNITED STATES PATENT OFFICE

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STORAGE OF GASOLINE AND THE LIKE

Daniel E. Moran, Mendham, N. J.

Application July 31, 1929, Serial No. 382,295

6 Claims. (Cl. 220—1)

The invention relates to the storage of gasoline and other liquids in tanks. For gasoline and other liquids whose fumes mixed with air are explosive, it is dangerous to have in the tank any space in which such a mixture can collect. I propose to provide a tank of this type arranged below the level of the ground where it is protected from lightning, from overheating by the sun and from other fire risks and where also any leakage is less liable to cause a fire than in a case of tanks above ground.

The construction of large tanks or reservoirs below ground by ordinary methods is comparatively difficult and expensive, particularly where there is underground water. Even where there is no such water in the ground, the cost of bracing the sides is considerable and the braces interfere with the construction of the tank within the excavation.

My invention provides a tank below ground and a method of building it which have certain advantages as described below.

The accompanying drawings illustrate an embodiment of the invention.

Fig. 1 is a vertical section of the completed tank;

Fig. 2 is a horizontal section thereof on the line 2—2 of Fig. 1;

Fig. 3 is a partial section similar to Fig. 1, showing an intermediate stage in the operation;

Fig. 4 is a vertical sectional view illustrating a water tank used with the gasoline tank.

The tank is made with a lining of steel (or other metal) and an outer wall of concrete. Starting above ground the tank lining is built with a cylindrical portion 1 and a conical bottom portion 2 with a fairly large opening at the centre. Ordinary tank steel is used of sufficient thickness to ensure satisfactory caulking of the joints which may be riveted or welded. It needs to be only thick enough to prevent its being de-formed during erection by wind stresses.

Using this portion of the tank as an inner form, an exterior wall 3 of concrete is cast around it using an outer removable form of ordinary construction. The lower portion 4 of the concrete is of annular shape with its outer face vertical. The inner face bears against the bottom portion 2 of the lining. It extends below the bottom 2 with a flaring inner face 5 so as to provide an outer cutting edge which may be reinforced by an angle 6. The face 5 is also cast against a temporary removable conical form.

The shape shown in Fig. 3 is built up to the desired height. The lower portion of the con-

crete to about the dotted line 7 is first built on the ground 8. The bottom lining 2 is used as part of the form for this concrete. The cylindrical lining 1 is then erected and the several plates thereof united before the outer wall 3 of concrete is cast.

The construction thus described is a sort of curb which can be sunk as the ground below it is excavated by dredging through the central opening. The opening is left large enough for workmen to get through it and excavate with pick and shovel, hoisting the material in buckets. Or other dredging and excavating methods may be used. As the excavation proceeds the curb sinks by its own weight. The open excavation thus provided is more economical than any method which could be used if the bottom were originally closed.

When the curb is sunk to the desired depth, a conical closing plate 9 is made with a small opening at its centre and is set in the central opening of the bottom lining plate 2. The plates 2 and 9 have internal flanges 10 and 11 respectively which are riveted or welded together and which stiffen the bottom and unite the two parts. The conical plate 9 is closed at its lower end by a flat or dished manhole plate 12. It is preferable to make the closing section 9 conical for several reasons. This form is adapted for supporting against external and internal pressures. It is a form which approximately fits into the space naturally formed in excavating the earth at the bottom, as indicated roughly by the line 13. A dredge will naturally remove the material at the centre to a greater depth than the material below the overhanging portion 4 of the concrete curb. Thus the conical form is better adapted for use than cylindrical or any other shape requiring excavation at the sides.

Having a bottom section of the steel tank or lining complete as described, any void spaces below it may be filled by forcing grout or a mixture of sand and water through pipes 14 on the inside leading through holes made in the section 9. Such a filling of grout is indicated roughly at 15.

Having completed the construction of the tank up to approximately the surface of the ground, a cover is applied consisting of a domed steel lining 16 connected with the cylindrical side wall 1. Instead of a dome 16, other shapes of cover may be used, such, for example, as a flat plate stiffened with angles.

On top of the cover plate 16 is a reinforcing layer 17 of concrete united to the outer concrete wall 3. Above the concrete reinforcement of the cover there is preferably a filling 18 of sand or earth to protect the tank and its contents from

external influences, such as extremes of temperature and fire hazards.

The top of the tank has a manhole at the centre lined with a steel channel 19. There is also a cylindrical concrete extension 20 above the top which is closed by a split cover 21. The central opening in the top of the tank is closed by a manhole cover 22 bolted to the ring 19. The several pipes required pass through the covers 21 and 22 to communicate with the interior of the tank. A gas line 23 is used to admit or to discharge gasoline or other liquid.

An air line 24 serves a similar purpose for air. These two pipes need pass only through the manhole. A third pipe 25 is for water, and extends nearly to the bottom of the tank where it has an upward bend 26. The open end of this constitutes a seat for a valve 27 carried by a float 28 which will float in water but not in gasoline. With the water level at the dotted line 29, or higher, the water will continue to rise and will thus force out the gasoline.

The float valve prevents gasoline from being forced out through the water pipe. In operation the tank is first filled with water. When a shipment of gasoline is to be stored, it is pumped into the tank at a pressure sufficient to force out the water until the latter is displaced to a level which will cause the closing of the valve 27. When gasoline is to be withdrawn, water is pumped or allowed to flow in through the pipe 25, forcing the lighter gasoline out through the pipe 23. At no time during this process will there be any void space in the tank.

If the curb is not necessarily sufficiently heavy to sink by its own weight in the excavation, additional weight may be added by changing the design or method of construction. A top may be applied to the central opening large enough to pass a dredge bucket, the surrounding portion of the top serving as a platform on which to place additional weight.

Where the soil contains a large quantity of water, too large to be readily controlled by pumping, special steps are required for closing the bottom of the tank. The curb is sunk by the dredging method above explained, allowing the water to rise to its natural level within the curb. The bottom closing section 9 is lowered to approximate position. The top or cover of the tank is placed thereon and loaded temporarily or permanently with earth or granular material.

A section of shafting and an air lock are then attached above the opening at the top of the tank and compressed air is introduced to force out the water, or at least to force its level below that of the joint 10, 11. Workmen then enter through the air lock and make the joint 10, 11 tight against liquid pressure, the bottom 12 being fastened to the part 9 beforehand. The load on top of the tank is sufficient to prevent its floating upward when the air pressure is applied to dewater it. This is an important consideration because the location of large storage tanks for gasoline, kerosene and similar liquids, such as this invention contemplates, is frequently close to navigable water and the excavation of a deep pit in such locations is generally attended with serious difficulties.

In certain locations it may be practical to pump out the water in the tank and make the bottom joint 10, 11 in the open. Where the buoyancy of the tank would be sufficient to overcome the side friction in the excavation, this may be overcome by temporary or permanent weight

placed on the top. Where the flow of water is too great to permit pumping out, compressed air may be used as above described.

Where it is inadvisable to dewater the tank by the above described methods, the joint at the bottom may be made by divers or by means of a diving bell resting on the bottom section 2 which would permit of dewatering the part of the tank immediately adjacent to the joint.

It is important to use clean water with gasoline and other liquids. Where clean water is expensive the same water may be used a number of times. In that case a storage tank would be used for the water displaced when the gasoline tank is filled with gasoline.

The storage tank may be placed immediately above the submerged tank and when full of water will serve as a weight to overcome the tank when dewatered. The water from the storage tank may be allowed to flow by gravity into the gasoline tank through a hand controlled valve. It is preferable, however, to use a pump for this purpose so as to more effectively guard against accidental running of water into the gasoline tank. Fig. 4 illustrates such an arrangement.

A steel tank 30 has its floor 31 resting directly on the top 17 of the gasoline tank. The pipe 25 has an open upper end which extends nearly to the top of the water tank. A pipe 32 leads to a pump 33. A check valve 34 permits water to pass in the direction of the arrow when the pump is operating. The pump needs only to exert a pressure equal to the head of the water in the tank, since this is sufficient to displace the gasoline when the pressure on the latter is removed.

In the use of the gasoline tank, the filling of gasoline or water therein will generally exert a pressure equal or nearly equal to the external pressure of the surrounding earth so that the wall of the tank does not have to be of great strength. A light steel lining may be used. The outer wall of concrete gives considerable stiffness, sufficient to stand the strains involved in sinking the tank into the earth.

It is generally preferable to have the gasoline tank entirely under ground. But it may be exposed at the top or even slightly elevated above the surrounding ground.

Various modifications may be made by those skilled in the art without departing from the invention as defined in the following claims.

1. An underground storage tank for gasoline and other liquids, the sides and outer portion only of the bottom being formed as a unitary structure comprising an interior metal wall and a uniform exterior stiffening wall of concrete, the inner portion of the bottom comprising a separate closing section adapted for attachment to the remainder after sinking.

2. An underground storage tank for gasoline and other liquids having a cylindrical side and a conical bottom, the side and outer portion of the bottom comprising a unitary structure including an interior metal wall and a uniform exterior stiffening wall of concrete, and a separate closing section constituting the inner portion of the bottom and adapted for attachment to the outer portion after the sinking of the same.

3. An underground storage tank for gasoline and other liquids having a cylindrical side and a conical bottom, the side and outer portion of the bottom comprising a unitary structure including an interior metal wall and a uniform exterior stiffening wall of concrete, and a separate closing section constituting the inner portion of the

bottom and adapted for attachment to the outer portion after the sinking of the same and a separate filling of concrete in contact with the outer side of said closing section.

- 5 4. An underground storage tank for gasoline and other liquids, the sides and outer portion only of the bottom being formed as a unitary structure comprising an interior metal wall and a unitary exterior stiffening wall of concrete, the inner portion of the bottom comprising a separate closing section adapted for attachment to the remainder after sinking, the concrete of the bottom having a downwardly flared inner face and a vertical outer face.
- 10 5. An underground storage tank for gasoline and other liquids, the sides and a portion of the
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bottom comprising an interior wall and an exterior stiffening wall of concrete, the bottom having a central opening with an inward flange at the edge of the metal surrounding said opening, and a separate metal closing section fitting said opening and having an inward flange adapted for attachment to the surrounding flange.

6. An underground storage tank for gasoline and other liquids, the sides and a portion of the bottom comprising an interior wall and an exterior stiffening wall of concrete, the outer portion of the bottom being downwardly and inwardly tapered and a separate metal closing section shaped to form a continuation of such taper.

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