June 24, 1930. T. J. SHEA 1,765,947

TANK AND ROOF STRUCTURE THEREFOR

Filed Sept. 4, 1928 2 Sheets-Sheet 1

FIG. 1

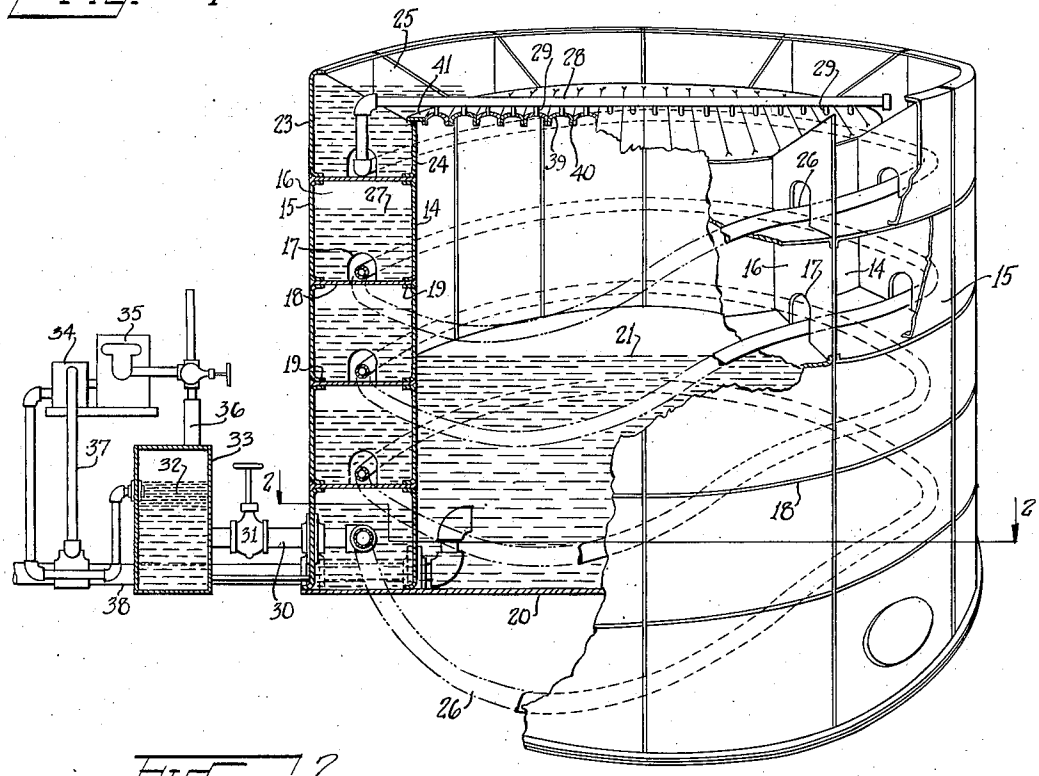
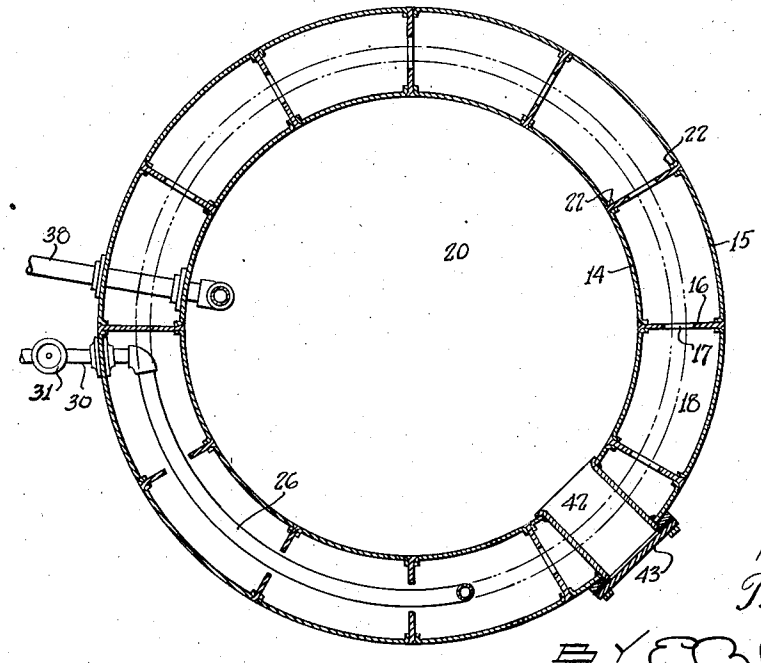


FIG. 2



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Filed Sept. 4, 1928 2 Sheets-Sheet 2

FIG. 3

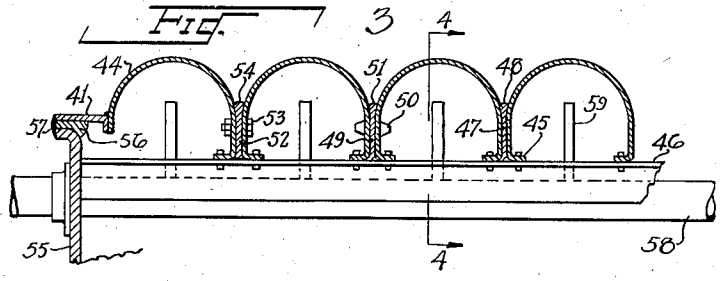


FIG. 5

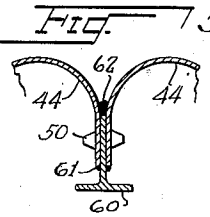


FIG. 4

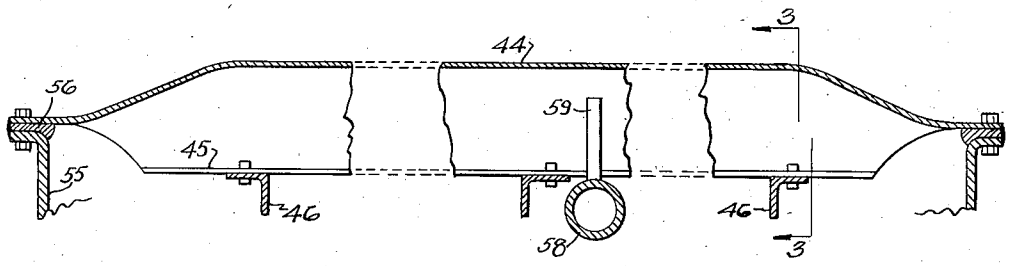


FIG. 6

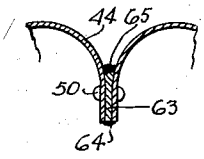


FIG. 7

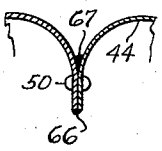


FIG. 8

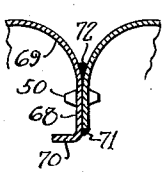


FIG. 9

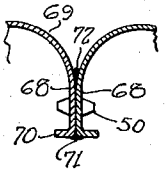


FIG. 10

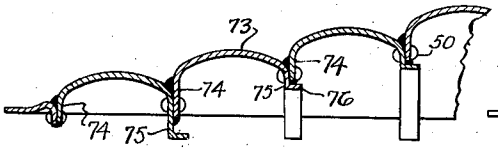


FIG. 11

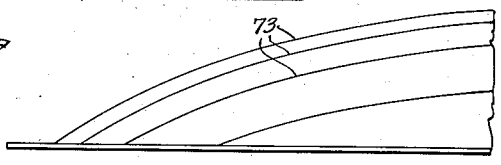


FIG. 13

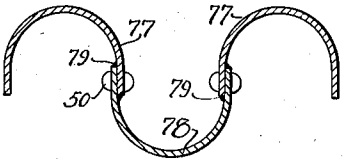
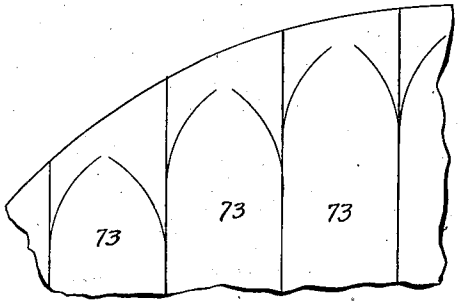


FIG. 12



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Patented June 24, 1930 1,765,947

UNITED STATES PATENT OFFICE

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TANK AND ROOF STRUCTURE THEREFOR

Application filed September 4, 1928. Serial No. 303,748.

This invention relates generally to containers for volatile liquids and particularly to a tank construction for this purpose.

The main object of this invention is to provide a tank for volatile liquids which will practically eliminate evaporation of the contents.

The second object is to produce a fireproof tank.

The third object is to re-claim any gas which may have formed and to return same to the container in liquid form.

The fourth object is to construct an exceedingly strong tank at a relatively low cost, and one which is easy to fabricate and assemble.

The fifth object is to so improve the roof structure of the tank that it can be made of exceedingly light gauge metal and at the same time will be able to withstand internal and external pressures without the employment of expensive reinforcements.

The sixth object is to so construct the roof element that it may be successfully used, not only on tanks, but on structures of all kinds such as digesters and gas tanks.

These, and other objects, will become more apparent from the specification following as illustrated in the accompanying drawing, in which:

Figure 1 is a perspective view with parts broken away to disclose the interior of the tank. Figure 2 is a horizontal section taken along the line 2—2 in Figure 1. Figure 3 is the section taken along the line 3—3 in Figure 4.. Figure 4 is the section taken along the line in 4—4 Figure 3. Figure 5 is the fragmentary section showing an alternate form of joint showing a T bar between the sections. Figure 6 is same as Figure 5, but showing a straight filler strip. Figure 7 is similar to Figure 6 showing no filler strip being used. Figure 8 is similar to Figure 7 without a filler strip and with one side bent to form an angle. Figure 9 is similar to Figure 8 but showing both sides bent. Figure 10 is a fragmentary section showing a portion of a dome shaped top. Figure 11 is a side elevation of the form of the top for roof shown in Figure 10. Figure 12 is a plan of Figure 10. Figure 13 illustrates a modified form of room section.

Similar numbers of reference refer to similar parts throughout the several views.

Referring in detail to the drawing, the tank in its preferred form consists of a plurality of curved sections, each of which consists of a plurality of curved sections, each of which consists of a curved inner wall 14 and a curved outer wall 15 between which are the radial side walls 16, each of which is provided with an opening 17 near its lower edge. Between the sections are the horizontal dividing plates 18 which are welded to the inturned edges 19 of the members 14 and 15. The lowermost sections are mounted on a horizontal floor plate 20 which forms the bottom of the tank itself in which is confined the liquid 21. It will be understood that the side walls 16 act as vertical divisions between the sections and are of course welded between the sections to the vertical inturned edges 22. The various sections are placed in super-imposed tiers in order to form a cylinder or tank of sufficient height, and the uppermost sections for the outside walls 23 somewhat higher than the inside walls 24 and vertical dividing partitions 25 are preferably sloped accordingly. While the walls 16 and 25 are referred to as dividing walls, they are in reality not dividing walls at all but are rather brace walls or radial web plates between the inner and outer walls 14 and 15. A condensing pipe 26 is somewhat spiral in form and passes through the various openings 17 and is cooled by the water 27 which covers each of the plates 18. The uppermost end of the pipe 26 is connected to a collector manifold 28 and provided with a plurality of down turned branches 29.

While the condenser pipe 26 is shown as a continuous pipe approximately in the form of a true spiral it will be found preferable to employ upright risers passing through the various floors and connecting same to sloping curved pipes within the individual courses as this would be much easier to construct and the additional bends thus formed

would offer no objectionable amount of resistance.

To the lower end of the pipe 26 is attached an outlet pipe 30 provided with a valve 31 which discharges the liquefied gas 32 into the tank 33 from whence it can be returned to the interior of the container by means of a pump 34 which is operated by an engine 35 which may be supplied with fuel in the ordinary manner or may draw a portion or all of its fuel from the tank 33 through the pipe 36, which would be the unliquefied portion of the gas. The liquefied gas is returned by the pump 34 through the pipe 37 into the horizontal pipe 38 which serves as an inlet and outlet fuel pipe for the container.

In actual practice an internal combustion engine would not be used at all, it being preferable for obvious reasons to use an electric motor for operating the pump 34.

Turning now to the roof of the structure, it would seem to consist of a plurality of inverted U-shaped channels whose curved portions 39 and whose sides 40 are welded together, either with or without a filler strip which will be described later. The various branches 29 of the collector manifold 28 pass through the curved portions 39. The outermost portion 41 of the portions 39 is welded to the walls 24. It is desirable to provide a manhole 42 in roof and lowermost sections in order to provide ingress and egress to the tank. These manholes are provided with welded reinforcing rings around manhole openings in both inner and outer walls on lower manhole and around manhole opening in roof.

Manholes are of standard practice for this type of work and are not an intrinsic part of this invention. Upper manhole would probably have "breeching" or "saddle" barrel if placed in central portion of roof. The cover 43 would be outside only, fastened with stud or tap bolt system.

Turning now to Figures 3 to 12 which illustrate a number of modifications of my roof structure, it will be seen in Figure 3 that the curved sections 44 are provided with inturned lower edges 45 which rest upon a supporting beam 46. In Figure 3 one pair of sections are shown as joined together by a filler strip 47 which is merely welded in position by means of a weld 48. The next pair of sections are joined by a filler strip 49 which is held in position by means of a rivet 50 and subsequently secured by means of a weld 51. The next pair of sections 44 are joined by means of a strip 52 which is secured by the bolts 53 and a weld 54. The outermost section 44 has secured thereto the horizontal member 41 which is secured to the side wall 55 by means of a filler strip 56 and weld 57. In Figure 3 the collector manifold 58 is shown on the under side of the roof instead of above same and the branch inlets 59 project upwardly instead of downwardly.

In Figure 5 the sections 44 are shown joined by a T bar filler strip 60 which is secured by means of the welds 61 or 62. In Figure 6 a flat filler strip 63 is employed with the welds 64 and 65. In Figure 7 no filler strip is employed but only the welds 66 and 67. In Figure 8 no filler strip is employed, but one leg 68 on section 69 is provided with an inturned flange 70. In Figure 9 the same construction is employed but both the legs 68 are provided with inturned flanges 70, the union being completed by means of the welds 71 and 72.

In Figures 10, 11 and 12 is shown a still further modification of roof structure in which the roof is composed not only of inverted U-shaped channels as previously described, but these channels 73 are curved longitudinally as well as transversely. In this form the various sections increase in height as they approach the center of the container forming a dome shaped roof of unusual strength and ability to resist pressures in either direction. In this form of the device the outer leg 74 is approximately vertical, although not necessarily so, and the inner leg 75 is also vertical and has its lower portion 76 turn laterally to form an L-shaped foot for the purpose of increasing the strength of the part. In Figure 10 is also shown two manners of assembling the section 73, one in which the lowermost end of the leg 74 rests upon the lower portion 76, and the other in which there is some distance between these elements. It will be understood of course that the need for providing the additional reinforcements above described will depend largely upon the diameter of the tank and the thickness of metal employed therein. With the smaller tanks these reinforcement members may be dispensed with altogether.

It can be seen that by this construction it is possible to form an absolutely tight fireproof container of unusual strength for a given weight of materials employed and the usual waste of the most valuable portion of the fuel is eliminated due to the fact that such valuable gases as have formed are condensed and return to the storage compartment in liquid form. But it must be borne in mind that even this evaporation is reduced to the minimum due to the fact that a wall of water surrounds the sides and covers the roof of the structure.

While I have illustrated an apparatus for returning condensed gases to the original container, it is obvious that same could also be delivered to a separate storage tank, should this be desired, and this of course could be done without departing from the spirit of my invention. It would also be observed that with this design of roof struc-

ture that the roof and shell can be taken down by cutting out the burning strip with a gas torch without damaging the metal and can be put back again when desired, which is often desirable in moving of tanks from one field to another.

The details of tank 23 may also be varied to suit the peculiar requirements of the individual case, but these of course are merely details which enter into the construction of my entire apparatus. It can be seen in Figure 1 by this method the side walls as well as the entire roof can be completely covered with water, therefore the contents of the tank will be thoroughly protected against danger from fire.

In Figure 13 is shown a modified form of roof section in which the various sections 77 and 78 are placed alternately in upright and inverted positions as shown thereby increasing the depth of the corrugations and its strength without increasing its weight.

The usual rivets 50 and welds 79 are employed to join the sections.

It will of course be understood that when making the individual sections of roof that a great variety of shapes could be employed, either of curved or straight faces; for example, a single break could be made in a sheet and the sections joined as before, either in alternate fashion as shown in Figure 13, or all in one direction.

It will of course be understood that when the angularly formed sections are employed instead of the curved as shown in the drawing, that the fabrication of the structure is greatly simplified.

While I have illustrated and described a specific type of tank and roof structure therefor it must be understood that this invention is not limited to the specific embodiment described herein, but is intended to cover all forms of modification thereof as fall fairly within the appended claims.

I claim:

1. A tank for storing volatile liquids having a water space around the sides and tops thereof, said water space having dividing partitions whereby same is broken up into a plurality of horizontally connected water containing units and a coil passing through said units for condensing and returning evaporated liquids to the interior of said tank.

2. A container for volatile liquids consisting of a plurality of arcuate hollow sections joined together in cylindrical form in a manner that each of said sections shall form a portion of a circular water container and a plurality of said water containers when superimposed forming a cylindrical water container, a gas collecting pipe in the uppermost portion of said tank passing through all of said water containers in a manner to be cooled by the water therein and pump means for drawing the condensation of said pipe and returning same to the interior of said container.

3. In a tank for volatile liquids the combination of a cylindrical water jacket having a plurality of horizontal dividing floors formed around same whereby water may be held within said jackets at different elevations, a condensing coil passing around said jacket and through successive horizontal dividing floors, radial web plates dividing each water compartment into a series of horizontally connected compartments, each of said web plates having an opening therein through which said condensing coil passes, a roof structure over that container, a manifold for taking gases from the under side of said roof structure and delivering same to said coil, and means for returning condensation from said coils to said container.

4. The combination of a double wall tank having a plurality of superimposed dividing floors between said double walls dividing same vertically with a condensing coil passing around successive floors, said condensing coil having its upper end forming a collector at the top of the tank, a closure over said tank, and means for drawing gaseous vapors from said tank and forcing same through said coil for the purpose of condensing same.

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