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STORAGE OF PETROLEUM PRODUCTS

Filed March 20, 1964

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3,288,321

9 Sheets-Sheet 3
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Filed Mar. 20, 1964, Ser. No. 384,564

13 Claims. (Cl. 226—18)

This application is a continuation-in-part of my copending application Serial No. 216,801, filed August 14, 1962 (now abandoned).

This invention relates to the underground storage of petroleum products which includes tanks, welded in piping, island eight anchor bolts and pump islands. The invention is made up of two systems each of which will be described in detail. The first system can be used as a part of every new underground petroleum tank and dispensing system now being installed in all service stations.

The second system incorporates all of the first system in its design plus the entire balance of the underground dispensing system needed for handling petroleum fuels.

Following is a detailed description explaining the first system of my invention:

FIGURE 1 shows a perspective view of a complete gasoline service station underground tank system with piping to a dispensing pump island. Shown also is a tank truck making delivery to the station.

FIGURE 2 illustrates a typical underground tank with female tank flanges 2 welded over the tank openings. Male pipe plugs 3 or metal disks of some type are placed in the female flange openings and the tank is then ready for shipment to the site and placement in the ground. Once in the ground ballast is provided and the tanks are ready to be piped.

FIGURE 3 illustrates an underground tank prepared for installation with piping attached.

FIGURE 4 illustrates a tank package.

FIGURE 5 illustrates how a typical piping system would be connected to a welded pipe and tank package.

FIGURE 6 is a cross section of the modified system. It illustrates the principle of installing drop pipes into a tank as outlined in my first system.

FIGURE 7 is the same system as shown in FIGURE 6 except that all the horizontal piping is done inside of the tank and is not exposed on top of the tank as shown in FIGURE 6.

FIGURE 8 shows a complete storage and dispensing system illustrating the relationship between the tank, the piping, the pumps, the tank island and the island light pole.

FIGURE 9 illustrates the relationship of the tank truck and the underground package dispensing system and the method of tie-in of the fill line and vent line in order to make a closed vapor recovery system.

FIGURE 10 illustrates the system of FIGURE 6 using submersible pumps.

FIGURE 11 is a plan view of the system of FIGURE 6.

FIGURE 12 is a plan view of a conventional multi-tank and island installation.

It is the accepted practice in the petroleum industry to install below ground the tanks necessary for the storage of gasolines, diesel oils and fuels oils to be sold to the public at retail outlets. These tanks are fabricated in the shop to standards set up by the petroleum industry and in many areas require Underwriters' Laboratories, Inc., approval. Thckings are built using a metal gauge thickness depending on the diameter of the tanks. The user of the tanks specifies the size and number of openings desired in the tanks.

I intend to use a new principle in fabricating piping to underground storage tanks now commonly installed in all gasoline service stations and properties using below ground storage.

The present method of piping an underground tank is as follows (see FIGS. 1 and 3):

To install a vent line 25 a nipple 11 is screwed into the female flange 2r of the tank and the vent line is then extended to its termination through a series of fittings and pipe.

To install a gauge line 26 a stand pipe 4 is screwed into the female flange 2e of the tanks and extended to grade.

To install a siphon line 27 (for automatic syphoning of product from one tank to another) a drop pipe 5 is cut a specified length and threaded on one end. A double tapped bushing 6 is screwed on the drop pipe 5 and the bushing 6 is screwed into the female flange 2d of the tank. A nipple is then screwed into the double tapped bushing 6. From the nipple through a series of the screwed fitting and pipe the line is connected to the adjacent tank.

One or more suction line 29 systems may be installed in a single tank. A drop pipe 8 is cut a specified length and threaded on one end. A double tapped bushing 9 is screwed onto the drop pipe and the bushing 9 is then screwed into the female flange 2c on the tank. A nipple 10 is screwed into the double tapped bushing 9 and a valve 12 is screwed on the nipple 10. At this point, a siphon system could be activated by placing a T 13 fitting between the nipple 10 and the valve 12.

(Note.—Some valves are manufactured with the double tapped bushing cast into the body of the valve. This permits screwing the valve body into the female tank flange when clearances permit and a direct suction from tank to pump is possible.) The balance of the suction line system is then extended from the valves 12 to the dispensing pumps.

To install a fill line 30 a drop pipe 14 is cut to a specified length and threaded on one end. A double tapped bushing 15 is screwed onto the end of the drop pipe 14. The bushing 15 is screwed into the female flange 2f on the tank. A stand pipe 16 is cut, threaded and then screwed into the double tapped bushing 15. The stand pipe (or fill pipe) extends to grade.

FIGURES 2 and 3 illustrate an underground tank that was prepared for installation and piping as outlined in the above paragraphs. The piping of the tank which includes the double tapped bushings, suction, siphon and fill stubs (drop pipe) are all cut and installed at the site. Special care must be taken to cut, thread, and install the correct length of suction, siphon and fill stubs. The double tapped bushing which is screwed into the female tank flange and the drop pipe and nipple which is screwed into the bushing presents a very vulnerable area in which a leak in the system can and does occur. Leaks at these threaded joints in the suction and siphon lines will tend to make the pumping system inoperative. They can be repaired only at considerable cost.

The leaks that do occur at these joints are usually the result of any one of the following reasons: (1) defective threads on the pipe, bushings, or female tank flanges; (2) carelessness on the part of the piping installer (such as using the wrong type of pipe thread compound or crossing of threads); or (3) defects in the castings of the double tapped bushings and female tank flanges. Also, if the suction drop pipe is cut too long and is closer to the bottom than specified water in the tank due to condensation, etc., will be picked up and dispensed with the gasoline. This is not acceptable.

The maximum amount of time is taken to pipe a tank in this manner since every fitting and pipe is "custom fitted" to the job.

In contrast to the above described tank and pipe system, the new principle of my invention consists of the fabrication in the shop of a complete package under-
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ground tank 17 including welded in suction 18, syphon 19, and fill 20 drop pipes. FIGURE 4 illustrates an underground tank in which all the pipe stubs have been welded into the tank in the shop at the time of fabrication.

When the tank is being fabricated at the shop, the syphon 19, suction 18, and fill 20 pipes (drop pipes) will be welded 21 into the openings at the top of the tank. These drop pipes will have been precut to proper length and threaded on one end 22. The pipes will be spaced a given distance off the bottom of the tank and then welded at the point 21 they pass through the openings in the tank. The threaded ends will protrude a given distance from the top of the tank so that the proper valves and fittings may be attached to complete the piping installations. A weldnut coupling or nipple 23 is welded on top of the tank openings that will be used for the vent and gauge connections. Pipe caps can be screwed onto the threaded stubs protruding from the top of the tank to protect the threads until the “package tank” is ready for delivery.

Small diameter iron rods or support brackets 24 are tack welded to the inside bottom of the tank during fabrication of the tank in alignment with the openings in the top of the tank. These rods provide support for the pipe to locate them in a vertical position and to keep the pipes from “pendulating” when the tanks are rolled or being transported from the factory to the building site.

As noted above, FIGURE 4 illustrates a welded pipe and tank package that will be fabricated in the shop as a unit and delivered to the job site and placed on the ground ready for the exterior field piping. This is my invention, a welded pipe and tank package for underground storage tanks.

The pipe welded into the tank system at time of fabrication lends itself readily to the remote pumping system used at gasoline service stations. Underground tanks of large diameter and capacity can have large diameter fill lines welded into the tank in the shop, thus gaining the same advantage as used in a suction pipe system. My invention will eliminate all of the inherent weaknesses that exist around the tank openings for the piping system shown in FIGS. 2 and 3 and described above. My invention calls for the elimination of the female tank flanges, double tapped bushings and threaded pipe joints that screw into the double tapped bushings. My invention eliminates the need for the piping man in the field to install and work inside the tanks. Therefore, this invention will eliminate all possible areas on the tank where leaks could occur if screwed joints were used. By precutting the drop pipe so that the length is equal to the diameter of the tank and then welding the pipes into the tanks with the specified clearance between the pipe and bottom of the tank, all possible error as to proper lengths of the drop pipes are eliminated. One significant advantage of this invention is in the welded in fill pipe. Presently, most gasoline fill lines are made up of three inch pipe. This diameter pipe can be satisfactorily handled on the site without special handling equipment and large hand cutting tools. However, with the advent of larger diameter underground tanks and greater storage capacities, the size of the fill lines are increasing. Four, five, and six inch diameter fill pipes are being planned for future underground tank installations to enable large capacity tanks to dump their loads in the shortest possible time.

These larger diameter pipes cannot be handled by contractors using their present equipment and the cost of installation is rapidly rising. Therefore, this invention readily solves this problem. The large diameter drop pipes or fillers are welded into the tank at the factory thus eliminating the need for special handling and equipment at the site. The package tank saves one to two full days of installation time when three or more tanks are installed.

Another significant advantage is the complete elimination of any possible leaks in the suction and supply systems as they pass through the tank shell such as does occur in the conventional system where flanges, bushings, and screwed joints are used.

My invention provides a simple, fool-proof, maintenance-free underground tank piping installation at a lower initial cost as well as a lower operating cost than is now possible under the present accepted method of tank piping.

The second system of my invention is a direct result of improvements and additions to the first system described above.

Following is a detailed description of a system, the object of same being to incorporate in one compact unit an entire underground storage and dispensing system that can be built in the factory, delivered to the site by truck and placed in the ground ready for use.

FIGURE 12 is a plan view of a conventional multi tank 80 and island 81 installation. Note the great amount of piping 82, 83 that must be done on the job when making this installation. In the conventional system all the piping including the suction lines 82, the vent lines 83, and the drop pipes 5, 8, 14 into the tanks are field erected. Inside of the tank, advantage was taken of the welded-in pipe stubs and drop pipes were outlined in the description of the first system.

The system of FIGURE 6 is a totally integrated underground gasoline or petroleum dispensing system that includes a storage tank 51 which is divided into two compartments by a bulkhead 52. Continuous pipe used as fill 53 lines, suction 54, 54a, 64 lines and vent 55 lines are welded into these respective compartments and extend a given distance through the top skin of the tank shell permitting their accessibility above grade level once the tank has been buried in the ground. A pump island 56 form is secured to the top of the tank at a given distance from same by supports 57. The elevation of the island form is such that fill 53 lines and suction 54, 54a lines, vent 55 lines terminate at the top of the island form at a point where they are accessible. An anchor bolt frame 58 is welded to the top of the tank and the anchor bolts 59 extend upward through the pump island to a given point permitting the installation of an island light pole 60 on top of the island. The vent 55 pipes extend to a point above the pump island and adjacent to the light pole permitting easy installation of the vent lines 61 above the pump island. The island form 56a results in a bridge truss type structure. A flat strap 63 which forms a diamond figure is secured to the two fill 53 pipes and the bulkhead 52 at the third points to further stabilize the bulkhead 52.

To provide two different products at each end of the pump island 56, one suction 54 line is installed at each end of the island using a one-piece straight vertical pipe extending from near the top of the pump island to the bottom of the tank. The other suction 54a line at each end of the island extends from near the top of the island through the top skin of the tank then horizontally and through the inside bulkhead 52. Where additional pump islands are needed field piping may be attached to the spare suction 64 stubs that are welded into the tank 51.

A framework of angle iron 58 and steel threaded rods 59 are welded to the tank to provide a structure to hold and support the island light pole. Through the center of the island light anchor bolt support is installed so a vertical pipe stub 55 is placed. One pipe 55 extends vertically from the top of the pump island down through the top skin of the
tank and permits venting of that compartment. The second vent pipe 55 extends from the top of the island down through the top skin of the tank and then horizontally and through the inside bulkhead (see FIG. 7). This permits the venting of the second compartment.

A pump island 56 frame is supported at a given height above the tank depending on the tank bury. Steel rods 57 threaded on one end are welded to the tank. Adjustable nuts 65 are installed to permit leveling of the pump island 56 once in place.

The extension of the vent 61 pipes above the pump island 56 and through the island light pole 60 is also a part of this invention. An opening is set over the vent 55 pipe stubs that come from the tank and protrude above the island. This opening 66 is provided in the base of the island light pole 60. Once the island light pole 60 has been secured to the anchor bolts 59 that has been welded onto and is a part of the package tank system the vent 61 pipe extensions are installed to their proper height and secured to the island light pole at the cross bar 67. Thus, the island light pole 60 becomes a part of the package dispensing system because of its additional function of supporting the vertical vent 61 pipes. This is called venting at the island.

The island light pole 60 as illustrated consists of two vertical poles or tubes slightly canted in between which the vertical vent 61 pipes extend directly out of the tank and become an architectural part of the pole.

There are other combinations of light poles and vents that will also support and do the job intended however the method illustrated proves to be most functional and has aesthetic appeal. Once more that can be added to the package dispensing system which included the filling and venting at the island is the closed or tight system principle. Since the tank truck 68 will be adjacent to both the fill 53 lines and the vent 55 lines when delivering product, a portable flexible tube 69 can be attached to the vertical vent 70 pipes at the island light pole 60 and be attached to the vent dome 71 on the truck. Upon opening the unloading valve 72 on the truck, the product proceeds to fill the underground tank. The vapors in the underground tank which are normally vented into the atmosphere are then directed through the flexible tube 69 into the top of the tank truck. This tight and closed system has two never before realized advantages. First, the pressure of the vapor coming out of the vent is applied to the top of the liquid in the truck, thus increasing its gallon per minute unloading rate, and secondly, and most important, this tight, closed system eliminates the venting and dispensing of the gas vapor into the atmosphere. The vapors in fact replace an equal volume of liquid product in the tank truck and are returned to the bulk plant where they are reclaimed in the vapor recovery system. This system of closed venting would be a great boon in areas where air pollution is becoming a problem.

Once the tank 51 is set in the ground, no additional underground piping is needed. Concrete is poured in the metal island form 56 and the system is ready for the dispensing pumps 73, 77 and the light pole 60.

This system eliminates all openings in the driveway since the fill lines and all piping is under the pump island which itself is a part of the integrated system. This system, as described, is built for the use of a suction type of pump 73 mounted on the island.

A modified system tank incorporating all of the above described components except the suction lines can be built for the use of a submersible pump. A FIG. 15-URF pumping 74 unit is installed in each compartment and is accessible through a manhole 75 opening in the island 56. The discharge piping 76 from the pump extends just above the top of the tank to the discharge dome 77 spots on the island.

Both systems are designed to be built as an integral unit in the factory and shipped intact to the site. All welded construction in the piping system will tend to eliminate leaks in the pipes.

The entire system could be fabricated on the building site, if so desired.

I claim:
1. An integrated storage and dispensing system for the underground storage and dispensing of petroleum products contained in one compact package utilizing the components of a closed tank continuous piping connected to the tank, a pump island, means attached to the tank and supporting the pump island, an island light vent pole for venting of the interior of the tank up thru the island light vent pole, means attached to the tank and supporting the island vent pole, the island light vent pole being fabricated to permit vent lines to be installed and become a part of the vent pole, fill pipes, gauge pipes, vent pipes, suction pipes and discharge pipes located within the confines of the island and attached to the tank, so that the entire package can be installed in the ground as a complete unit back filled to grade and ready for use.
2. The system as set forth in claim 1 that includes in a package all the necessary underground piping for a one island installation.
3. The system as set forth in claim 1 that is so designed, constructed and installed so as to only require the addition of supply lines reaching from said system to other pump islands in a multi-island station.
4. The system as set forth in claim 1 including anchor bolts that are permanently secured to the tank and extend upward from the bottom to receive the permanently attached pump island.
5. The system as set forth in claim 1 including a permanently attached pump island that is secured to the tank by anchor bolts which holds the pump island in a fixed position and keeps the island from tipping or settling.
6. The system as set forth in claim 1 including anchor bolts that are permanently secured to the top of the tank and project upward from the top of the pump island a given distance to receive and hold the base plate of the island light vent pole.
7. The system as set forth in claim 1 including an island light pole so designed as to include an opening in the base of said pole to accommodate the vent pipes which pass thru the pump island then pass thru the base of the pole and extends vertically a required distance and becomes a part of the island light vent pole.
8. The system as set forth in claim 1 including separate vertical vent lines for each compartment fabricated with the tank and projecting up thru the attached pump island and thru the opening in the base of the island light vent pole and from there being extended vertically to a terminating position near the top of the island light vent pole resulting in the shortest possible required length of vent pipe.
9. The system as set forth in claim 1 includes fill pipes that pass thru and welded to the top shell of the tank and rise vertically up thru the attached pump island and terminating with a fill connection on top of the pump island.
10. The system as set forth in claim 1 that includes all the piping attached and passing thru the tank shell and terminating in the attached pump island and which can be used with either the suction pump type dispensing system or the submersible pump type dispensing system.
11. The system as set forth in claim 1 can be assembled in one package at a point of fabrication and shipped to the site for installation or assembled into an integrated package on the construction site.
12. The system as set forth in claim 1 that permits immediate conversion to a fully closed type of vapor recovery system by venting the tank directly back into the top of the truck and this being made possible by the relative positions of the package tank fill lines and vent lines which are located in the attached pump island and the position of the delivery truck adjacent to the pump island.
13. A prefabricated underground storage tank assembly for petroleum products wherein the tank assembly is a welded prefabricated, unitized pipe tank package with
all pipe being made an integrated part of said tank when said tank is being fabricated.

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