Nov. 28, 1950 E. S. POMYKALA 2,531,742

UNDERGROUND STORAGE TANK

Filed April 23, 1945

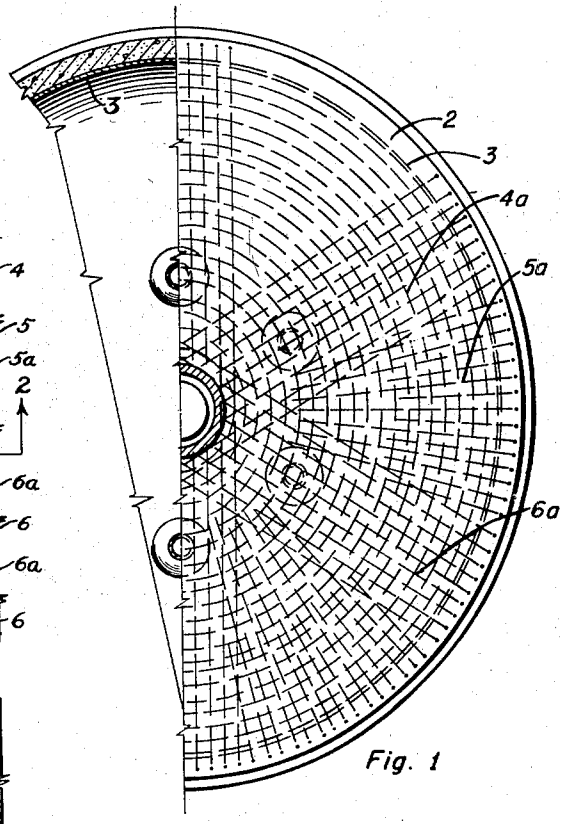


Fig. 1

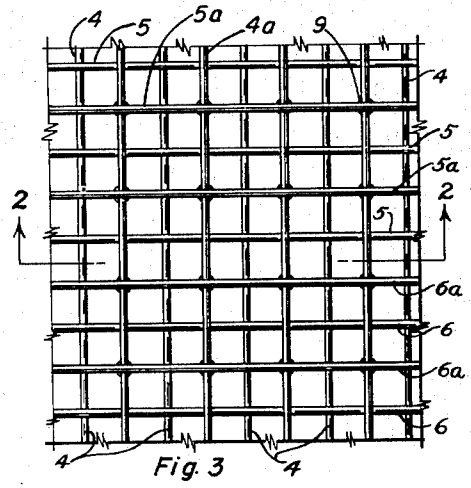


Fig. 3

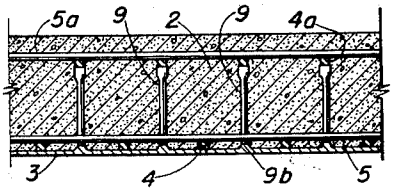


Fig. 2

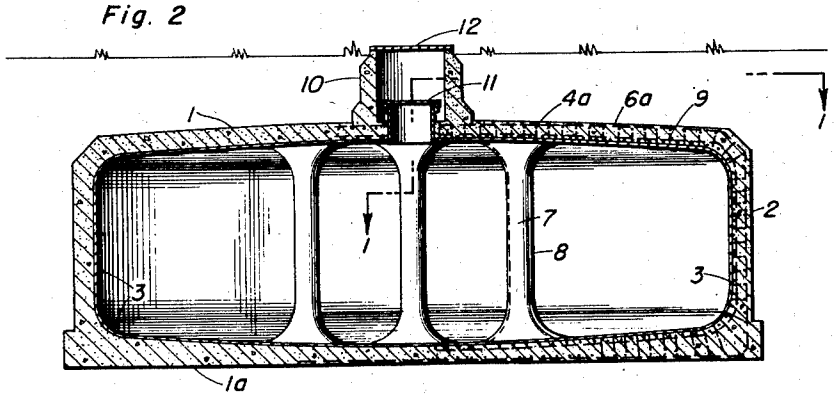


Fig. 4

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UNDERGROUND STORAGE TANK

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Application April 23, 1945, Serial No. 589,923

6 Claims. (Cl. 72—14)

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This invention relates to improvements in underground tanks, particularly to tanks which are intended for storage of inflammable liquids such as gasoline or the like. More specifically, it has to do with novel forms and construction of these tanks, whereby great strength and resistance to bombing stresses are obtained at a minimum expense in materials and labor. The general form of tanks to which the present invention might be applied consists of a continuously curved side wall which may be circular, oval, etc., and substantially flat but slightly arched top and bottom walls.

This tank falls in the general category of hydraulically prestressed tanks (all are steel lined and concrete encased for which patents have been applied for by the petitioner). The construction of all these tanks is similar in that the sheet steel lining and concrete case are prestressed during construction by the contained water, or other suitable liquid in the tank, while the casing is being poured in place. The advantage in this mode of constructing tanks is that the concrete is generally always in compression, minute cracks are eliminated and the underlying plate lining is preserved. This, however, is not the only advantage. It is not only desirable to prestress the steel lining and the concrete casing, but it is necessary if economy of construction is to be secured, to bond the two materials intimately. When the steel sheet lining and concrete casing are well bonded, they act as a unit very much like reinforced concrete, beams, arches or domes. The novelty of this invention is the method of securing this bond. The invention also covers the manner of building up the caging of the steel plate and the superimposed reinforcing rods, all welded together to form a very stiff frame. This framing, together with the contained water in the shell, resist the deforming forces of semi-liquid concrete, while it is being poured for the casing.

A further object is to so tie the two faces of concrete casing similar to a tied reinforced concrete column, so that a greater load can be carried in compression per unit area. The ties also help to overcome diagonal tension existing in the domed slabs in the vicinity of the columns. Other and more specific objects will become apparent as the description of the details of this invention proceeds, having reference to the accompanying drawing, wherein:

Fig. 1 is a plan view, partly in section of one form of tanks formed in accordance with the present invention.

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Fig. 2 is a cross section to a large scale of the average construction of the shell and casing showing a section of the concrete fill in the background.

Fig. 3 is a plan to the same scale of the reinforcing rods forming the frame or the caging and showing where the section of Fig. 2 was taken.

Fig. 4 is a typical diametrical cross section through the tank. The structure illustrated in Figs. 1 to 4 is composed of a vertical cylinder shown as being of somewhat oval form, wherein a concrete domed roof 1 and a dished bottom 1*a* are connected by a cylindrical wall 2 and columns 7. 3 is a metallic sheet lining or shell attached firmly to the concrete by means of circumferential rods 4 and stud rods 9, which are firmly welded to the sheet lining as may be seen, for example, at 9*b* in Fig. 2. Circumferential rods 4*a* in the outer face of the concrete are in turn welded to stud rods 9. To these circumferential reinforcing rods 4 in the inner and 4*a* in the outer face, crossed rods 5 and 6, and 5*a* and 6*a* respectively are welded in turn. In general, rods 5 and 5*a* are radial rods, 5 being in the inner face and 5*a* in the outer face. Rods 6 and 6*a* are band rods. The reinforcement shown is preferred. In general, the reinforcement in either face of the concrete is similar, but it may be varied if so desired. What is intended, however, is to make a very rigid frame or self-supporting structure, composed of the lining or shell and two main crossed layers of reinforcing rods welded and connected together, forming a two-way truss-like cage. Columns 7, equally spaced along a circle (or series of circles) are surrounded with sheet metal 8 bonded to the enclosed concrete with metal studs welded to the metal lining. The lining of the columns flares at the top and bottom and fair into the main lining of the roof and bottom. Studs 9 may be corrugated or plain and preferably upset as shown to secure a better bond and offer better surface for welding thereto the reinforcing and caging steel. All crossed rods in each layer are welded to each other. Access pit 10 has concrete walls. It may be made large enough to hold necessary pumps as desired. Preferably this pit should be circular in plan. Numeral 11 indicates the metal manhole cover, and numeral 12 indicates the surface pit cover, which may be made of any suitable material.

The two cages in these tank structures cooperate to form a framework for the thin metal lining, providing a maximum number of points of

support for the lining with the result of a most rigid structure, producing maximum binding effect in the reinforced slab with the least amount of metal reinforcement. The outer cage is not only an additional layer of reinforcement in the concrete slab but cooperates with the inner cage in doubling the number of points of support of and binding with the thin lining. In addition the outer caging together with the lower caging and plate is also part of the basic preliminary framing for supporting the concrete while it is still in a plastic state, because the whole framework forms a spaced truss like structure. The outer reinforcement serves to act as an outer chord of this truss like framing, adding immeasurably to the rigidity and strength of this preliminary framework. This is very necessary to resist distortion of the plastic concrete. The outer cage is necessary for the reasons given above.

The manner of fixing the outer cage to the shell by the studs or connecting rods not only properly spaces the outer cage with relation to the inner cage but also provides twice as many points of support for the thin shell to hold it against deformation in the first place during the pouring operation, to produce a better binding effect between the concrete and the shell whereby the shell acts as a part of the reinforcing material and to prevent cleavage and deterioration by seepage between the shell and concrete.

Limited changes in the arrangement of reinforcement may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A structural frame for a storage tank comprising a thin metal container, a layer of crossed metallic rods welded to the outer surface of the container, a secondary layer of crossed rods spaced outwardly from the first layer, and connecting rods welded to said surface at points substantially in the center of the areas defined by the first mentioned crossed rods, and to the secondary layer adjacent points at which the rods of the secondary layer cross each other.

2. A storage tank wall comprising a structural frame including a thin metal inner plate, crossed metallic rods welded to the outside of said plate and forming one layer, a secondary layer of crossed rods spaced from the plate, connecting rods extending outward from and welded to the plate and to the secondary layer, the junctions of said connecting rods with the plate being spaced between said first mentioned crossed rods, and concrete encasing said layers and the outside of said plate integrally into one solid mass.

3. A tank comprising a relatively thin metal inner shell forming a substantially cylindrical fluid impermeable vessel with a substantially circular top and bottom, an inner cage secured against the outer surface of the shell comprising relatively rigid spaced metal rods extending substantially radially of the top and bottom of the vessel and substantially parallel to the axis of the vessel along its cyindrical sides, and other rods forming spaced concentric rings crossing and secured to the first mentioned rods around the top, bottom and sides of the vessel, truss rods secured to the vessel and extending outwardly substantialy normal to its surface from points within and spaced from the sides of the areas defined by the crossed rods of the inner cage, a similar outer cage comprising additional spaced rods extending respectively radially and axially of the shell and in spaced concentric circles relatively thereto, said rods of said outer cage being secured at their points of intersection to each other and to the outer ends of the truss rods, and monolithic concrete enclosing all said rods and bonded thereby to the outer surface of the shell.

4. A tank comprising a relatively thin metal inner shell forming a substantially cylindrical fluid impermeable vessel having substantially flat ends, an inner cage secured against the outer surface of the shell comprising relatively rigid metal rods extending substantially radially of the ends of the vessel surface and substantially parallel to its axis along its cylindrical sides, and other rods forming spaced concentric rings secured to the first mentioned rods around the ends and sides of the shell, truss rods secured to the shell and extending outwardly substantially perpendicular to its surface from points within and spaced from the sides of the areas defined by the rods of the inner cage, a similar outer cage comprising additional rods extending respectively radially and axially of the shell and in concentric circles relatively thereto, said rods of said outer cage being secured at their points of intersection to each other and to the outer ends of said truss rods, some of said axially extending rods being jointed across the ends of the vessel to form continuous bands around the vessel and monolithic concrete enclosing all of said rods and bonded thereby to the outer surface of the shell.

5. Concrete slab reinforcement consisting of a metallic plate rigidly attached by welding to a layer of crossed rods and a secondary layer of crossed rods fastened to the aforementioned plate by means of connecting rods welded to the plate at points between the crossed rods of said first layer at one end and to the secondary layer at the other end.

6. A container wall structure comprising a relatively thin sheet steel lining, reenforcing crossed rods adjacent to and welded at intervals to the outer surface of said lining, reenforcing crossed rods spaced from said outer surface and fixed thereto by connecting rods at intermediate points between the first named crossed rods intimately encasing all said rods and said outer surface in load-strained condition to reduce the tendency of forming pores, fissures, or cleavages in said structure upon successive loading and unloading.

EDMUND S. POMYKALA.

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The following references are of record in the file of this patent:

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Certificate of Correction

Patent No. 2,531,742 November 28, 1950

EDMUND S. POMYKALA

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 53, after "rods" insert the comma and words , *and monolithic concrete*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of March, A. D. 1952.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.