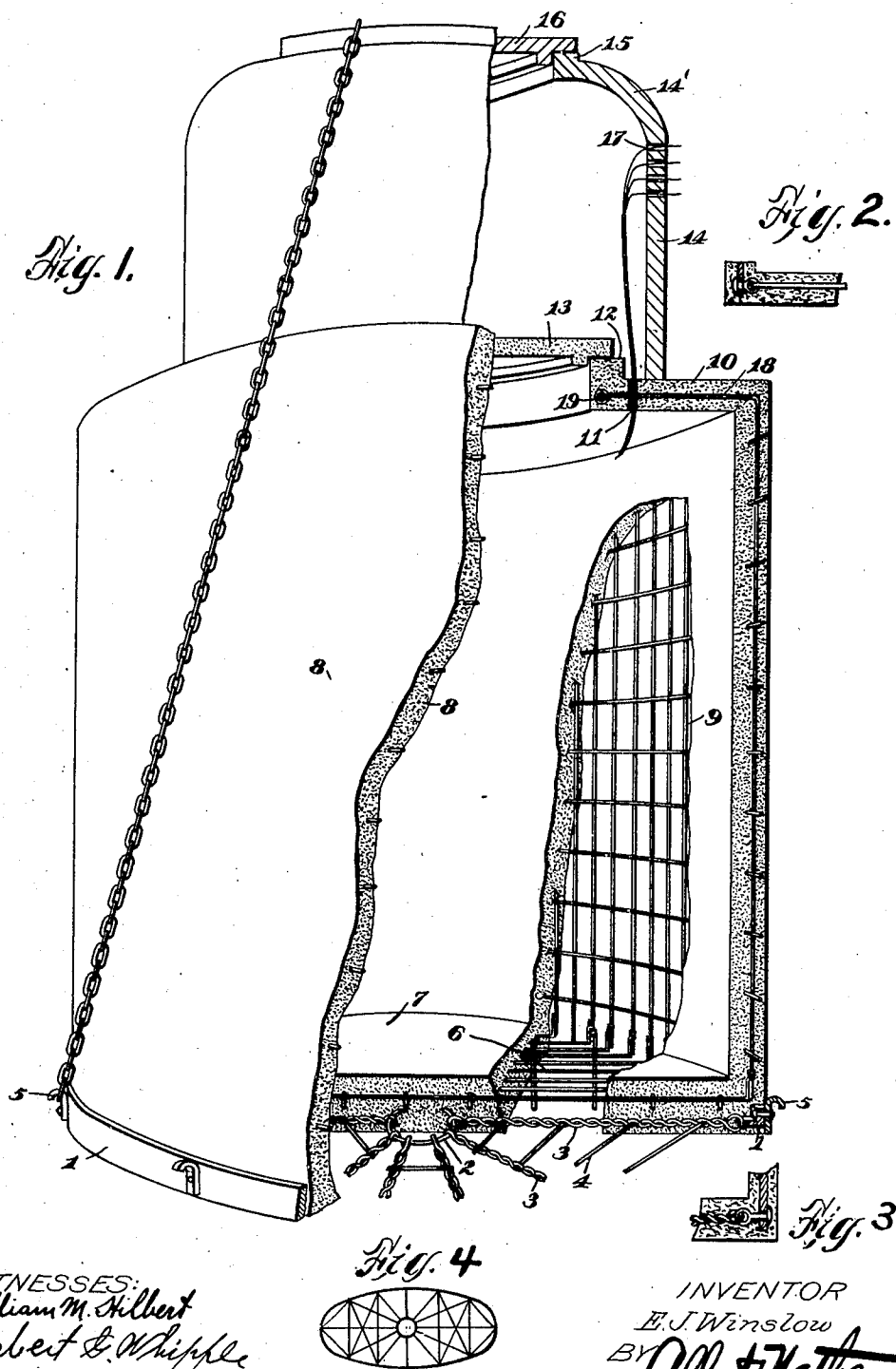


No. 871,655.

PATENTED NOV. 19, 1907.

E. J. WINSLOW.
REINFORCED VAULT.
APPLICATION FILED OCT. 17, 1905.



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UNITED STATES PATENT OFFICE.

EDWARD JARVIS WINSLOW, OF CHICAGO, ILLINOIS.

REINFORCED VAULT.

No. 871,655.

Specification of Letters Patent.

Patented Nov. 19, 1907.

Application filed October 17, 1905. Serial No. 283,114.

To all whom it may concern:

Be it known that EDWARD JARVIS WINSLOW, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, has invented certain new and useful Improvements in Reinforced Vaults, of which the following is a specification.

This invention relates to improvements in water-proof containing vessels or vaults, and it refers more particularly to that class of such vessels as are constructed mainly of cementitious or plastic material.

My invention has in view, among other objects, the production of a vessel of the character above described, which shall be so devised as to be capable of being readily made in one place, transported to another and there set up and otherwise handled as a unit without damage. It has been difficult heretofore to properly handle large vessels and the like when constructed mainly of water-proof plastic material on account of the fact that, in general, such vessels and the plastic material employed in the making thereof have so little tensile strength as to be insufficiently resistant against rupture; especially so when subjected to the rough usage that must necessarily attend any translocation of the vessel. Broadly speaking, I realize a vessel free from such recited defects by introducing elements of great tensile strength in such a way that they will receive and rebut the major tensile strains that may arise throughout the structure, and yet not interfere with the advantageous properties of the plastic material comprised in the structure. Prior constructions have been particularly lacking in the provision of suitable points of attachment for the long chains employed in the lifting of such vessels. Such points will usually be in the form of a protruding hook or eye which I brace against movement by a peculiar tensional framework hereinafter described. This bracing is advisable, inasmuch as the distortive strain, imposed upon the hooks by the lifting ropes or chains, considerably increases the tendency to fracture the plastic structure. It will be found in practice that my present invention overcomes such defects and that a vessel made in accordance with the herein stated description will be capable of being safely handled with great facility by means of hog chains or the like.

A further object of this invention is to devise and formulate a waterproof cell of any

size or form, within the limits of convenient transportation and handling, which will be adapted to be manufactured in one locality and subsequently set up in another, either underground or otherwise as the preference may be. In this way, the vaults may be most cheaply and well made and their permanent installation accomplished without loss of time in accumulating materials and skilled constructors in given localities.

As this invention may be better expressed and made comprehensive to those skilled in the arts to which it more specifically relates, I have appended, as a part of this specification, drawings showing a preferred embodiment of the underlying principles of my invention.

Further objects and advantages of the same will be had upon reference to such drawings in which like characters denote corresponding parts throughout.

Figure 1 is a sectional perspective illustration of the invention as a whole and furthermore showing details of certain of the peculiar features of the invention. Fig. 2 shows details of the eye-bolt attachment as applied to the top of the vault. Fig. 3 shows the same as adapted to the bottom. Fig. 4 illustrates one manner of disposing the tensioned strands when the vault has a general elliptical shape, adapting it for use in narrow and restricted spaces.

Referring now to such figures by means of reference letters, it will be seen that the base of the vessel comprises among other elements, a taut skeleton frame-work. This feature has a two fold function; it perpetually serves to assist in supporting and otherwise bracing the floor of the vessel rendering the whole more rigid, but it especially assists in preserving the integrity of the vault when it is being temporarily hoisted by means of chains or the like affixed to the periphery of the base, in that it directly takes up the strain imposed upon such base by said chains. This is apparent when it is noted that the chain pull will be mainly resolved along the radial tension members. As in the embodiment here disclosed, I may construct such base frame-work in a most simple manner by providing an exterior or rim of iron or other rigid material, and in form either circular, elliptical or otherwise, with an interior ring located centrally therein and connecting radial strands. Such hoop I have designated on the drawings by 1, and

while I prefer to make it of angle iron, other shapes and materials may be substituted according to the requirements arising out of special circumstances. Also such hoop may
 5 be made of an integral piece or formed in several sections, which are suitably united, as by means of rivets, bolts or the like, and the hooks or other points of hog chain attachment may be integral with said rim or
 10 may be separately attached thereto as when eye-bolts are employed. Centrally located with respect to the aforesaid hoop, is a device connected thereto by means of suitable tension members. While I do not limit my
 15 invention to the particular adaptation here shown, because many other modes of holding the converging tension member ends may be resorted to, such as pieces formed after the fashion of hubs of bicycle wheels
 20 and the like, I prefer to use for such device a simple ring 2, constructed of the desired material and of suitable strength, and radially emanating from points of attachment to said ring are a series of tension members 3. In-
 25 stead of this one ring however, I may employ a number arranged in a concentric or other relationship, in which case the strands would connect adjacent rings, or I may en-
 30 tirely dispense with any such device by connecting the strands at each end to the hook member. The general construction and ar-
 35 rangement of such tension members as here shown, is however the one I prefer to use in practice, mainly on account of its simplicity
 40 and ease of construction combined with the qualities of great durability and strength. Such parts may consist of double strands of tough wire, which are twisted to the requisite
 45 degree of tension by means of short pieces 4 inserted between such strands for that pur-
 50 pose, the twisted wire when so resilient and springy as to tend to untwist, being prevented from undergoing any such reflex action on
 55 account of positioning an end of said short pieces so as to be embedded between twists of the adjacent strand, or else resting it there-
 60 against so as to be maintained in such position by the torsional tendency of the tensioned member. In many instances, par-
 65 ticularly where the wire is particularly malleable and ductile, I find in practice that such short pieces may be entirely removed. The wire strands may be twisted together to such an extent as to secure the requisite tension therein and at the same time acquire a tem-
 70 porary set so as to prevent their premature untwisting. Such twisted strands, when embedded in cement permeating and filling all interstices, will resist any unbending
 75 tendency set up by various strains resulting from miscellaneous causes, the hardened cement entirely preventing any torsional movement. It is obvious that the wires may be twisted by any preferable means; for ex-
 80 ample, the instruments especially devised

for twisting fencing wire may be employed or other devices may be resorted to to attain this end. While I prefer to use wire for such tensioned members and run the same in dou-
 85 ble twisted strands, it is obvious that in some instances it may be desirable to resort to other expedients. Thus, for wire may be substituted rods and instead of obtaining the tension by means of twists, it may be de-
 90 rived from screws thread and nuts.

Again, it will be noted that the twisted wire work and the transverse twisting rods form a fabric exceedingly well adapted for the surrounding plastic material to cling to on account of the numerous irregularities
 95 and interstices afforded therefor. In case the wires are twisted by any sort of rods which are subsequently withdrawn, the plastic cement will flow into the openings left by such rods and set therein and therearound
 100 so as to form an interlocking entity which will be exceedingly durable. The same effect may be obtained by employing rods of irregular shape.

The tension members may be, if desired, 90 affixed directly to the ring, either rigidly or loosely, thus when wire is employed the attachment may be made to the ring and hoop by doubling the strands around portions of the same which may constitute side walls of
 95 perforations in the inner web of the hoop, or eye-bolts screwed, riveted or otherwise attached to a ring may be resorted to. The latter is the construction which I generally find preferable in practice, in which case, in-
 100 stead of a hoop shaped angle plate, I employ a flat piece of band steel into which are riveted eye-bolts. Such construction possesses many advantages, thus it admits of being
 105 completely covered with a protective coating of plastic water-proofing material in a more secure manner than the angle iron form.

It will be clearly perceived that the base is particularly well adapted for being rein-
 110 forced in this manner to any desired degree of rigidity and tension, and in the construction here shown, it will be readily seen that the strands are so distributed throughout the whole as to most perfectly adapt them for
 115 reacting against the pull of the hoisting chains, and likewise are so placed as to be well adapted to permanently support the base or floor of the vessel, and render some resistance to pressure of soil, etc. In lifting
 120 the vault, the hoisting chains may be readily affixed to peripherally located hooks 5, which are provided on the exterior of the hoop and securely fastened thereto by means of rivets or other suitable uniting elements.
 125 In ordinary instances, four such hoisting or hog-chains will be employed, each affixed to a hook located at the distance of a quadrant from the adjacent ones. The chains or cables will converge in pairs toward an in- 130

5 inverted U shaped shoe, the cables running
 along the cylindrical surface of the vault and
 attaching to hooks at the extremities of the
 shoe arms. A beam or yoke is arranged
 10 above the vault and extends diametrically
 thereacross so as to protrude sufficiently be-
 yond the upper circumference to afford a
 support for the inverted U shaped shoes
 which straddle it. This arrangement will
 15 insure a uniform lift along the four cables;
 the yoke being suspended from a block and
 tackle attaching medially thereto. The
 aforesaid tensioned frame-work will prefer-
 20 ably be embedded in the cement constitut-
 ing the bottom structure of the vessel as
 shown in the accompanying illustrations,
 and will be nearer the under surface thereof
 in order that all possible tension may be
 25 eliminated from the cementitious material,
 which however, is well qualified to bear the
 compression components. In the course of
 constructing my invention, it will be easiest
 to first make the tensioned frame-work and
 then apply thereto and therearound the plas-
 30 tic material or cement in such a way as to
 thoroughly cover such frame-work and form
 as close a union thereto as possible.

In order that the floor may be further
 strengthened I may provide an additional
 35 embedded strengthening means consisting
 of an open mesh fabric or wire netting which
 may be of any form. Such wire work may
 be readily obtained in a great diversity of
 construction, or it may be made up in spe-
 40 cial adaptations for particular vaults. Such
 bottom wire work I have designated as 6,
 and as shown by the drawing it is embed-
 ded in a plastic material forming a part of
 the floor at a slight distance above the ten-
 sioned frame-work, this being the preferred
 45 location. However, if it is so desired, it may
 be otherwise positioned with relation to the
 tensioned frame-work, the purpose being
 to form a floor construction of the utmost
 strength and rigidity consistent with econ-
 50 omy, efficiency and durability of construc-
 tion.

It will be understood that the wire rein-
 forcing will not necessarily be of any particu-
 55 lar mesh, as I may merely employ parallel
 non-intersecting strands under certain cir-
 cumstances, and the same applies with re-
 gard to the tensioned skeleton.

The side wall of my improved vault may
 60 be constructed in various ways, either with
 or without the wire net work but as the
 latter adds to the strength and durability of
 the same, it will in ordinary instances be em-
 ployed. Such side net work, which I have
 65 here designated as 9, may be, as in the case
 of the flooring net work, of any preferred
 shape and design, but when employed it will
 preferably be joined to the floor-wire work
 by twisting the terminals of adjacent wires

70 attachment, such as soldering or welding, may
 be resorted to according to the preferences
 of the constructor. One mode of construct-
 ing such side walls, more particularly with
 respect to what is possibly the most advan-
 tageous manner of doing so may be under-
 stood by means of reference to my Patent No.
 772,117 granted Oct. 11, 1904, in which a
 method of making certain vaults comprising
 75 embedded wire mesh somewhat analogous
 to the herein described is covered, or I may
 make spiral circumferential convolutions of
 a long continuous wire so as to form a seam-
 less side reinforcement.

Since in some cases but little strain will
 80 fall upon the top 10 of the vault, and more-
 over as such top will ordinarily be braced
 against downward pressures by the cellular
 interior frequently fitted up in the vault, I do
 not always incorporate the wire mesh fabric
 85 therewithin, though it will be convenient in
 other instances, as when an interiorly placed
 yoke is used for hoisting purposes, to do so
 after the embodiment of my principle as
 shown by the mesh designated as 18. With
 90 a top suitably reinforced to resist strains im-
 posed by the weight of the entire structure,
 this mode of hoisting the same, by means of a
 supporting yoke extending diagonally across
 the vault within the same and bearing up
 95 against the under side of the top, is very sat-
 isfactory in practice in some instances.
 Such yoke is medially suspended from a
 suitable tackle extending through the man-
 hole in the top. As the weight of the soil
 100 carried by the top will ordinarily produce
 transverse strains of progressively increas-
 ing intensity toward the under surface, the
 wire mesh will be located as near such sur-
 face as possible in order that it may effi-
 105 ciently carry such tensile strains. Such
 mesh may be firmly united to a central ring
 19, in any suitable way such as heretofore
 referred to with respect to the bottom con-
 struction to further enhance the effective-
 110 ness of the supporting power. The plastic
 top is commonly formed integral with the
 plastic side walls and may be built thereon
 in the manner outlined in my said prior
 patent, or any other preferred manner of con-
 115 structing the same may be resorted to within
 the underlying principle of my invention.
 When the vault is used for containing elec-
 trical cells or when other like need arises, such
 top will be provided with a suitably located
 120 aperture or vent 11, in order that a suitable
 conduit will be provided for the electrical
 conductors running therefrom. Such aper-
 ture may be lined with an ordinary porcelain
 insulating tube or otherwise as may be desired.
 125 An upturned flange 12 provides for the secure
 reception of a suitable cover 13 for closing
 the corresponding hatch-way.

A subsidiary feature of importance lies in
 the dome 14, which is advisably so applied 130

thereto as to be perfectly water-tight in its joints. Such union will preferably be made by grouting or otherwise cementing on the cover thereby causing it to cohere to the underlying main chamber or vault by means of a suitable quick setting water-proof cement. Such cover may be made of any suitable material and in practice I find that a cementitious substance similar to that employed in the main chamber proves to be very satisfactory.

The bend or reduction 14' may be either made of like material or a suitable dome of iron or metal of conical shape may be adopted but in such minor details the particular construction employed must needs largely depend upon the circumstances surrounding such case. This dome will be flanged at 15 so as to provide for receiving a man-hole cover 16. In case the vault is used for electrical cells, transformers, or the like, a series of tubes or apertures 17 will be provided in the cap so that the conductors may be properly lead therethrough. The cap or dome is also frequently strengthened by a reinforcing which may be embedded in the walls and top and in the rise around the hatch and may have a ring if preferred around the hatch-way in much the same manner as in the underlying chamber.

The vault as a whole is generally useful when buried underground with the superposed subsidiary cap or chamber protruding. Such vault will be found to be of service in affording a satisfactory means of storing combustible or dangerous materials, electrical batteries and the like. The dome permits of a ready handling and inspection of the conductors or the like passing there- through.

It will be obvious that many variations may be made in detail in the construction described by the foregoing without departing from the spirit of my invention; the scope whereof is comprehended in the following claims.

1. A water-proof vault comprising a main underlying chamber of substantially cylindrical shape and provided with a centrally located hatch-way in the top thereof, said hatch-way being provided with a removable cover, and a relatively high subsidiary cylindrical dome superposed upon said chamber and covering the aforesaid hatch-way, and grouted hermetically onto said chamber, said dome provided with a top man hole and a removable cover therefor.

2. A water - proof vault comprising an underlying chamber and a top hatch-way provided with a removable cover, said hatch-way being protected by a superposed impervious dome having a top man hole, said chamber providing suitable conduit apertures leading into said dome, and the latter providing suitable exit apertures, whereby

an electrical conductor may pass from within the chamber into and through the dome to the exterior of said vault.

3. A water - proof vault of cementitious material comprising a main chamber adapted to be buried deeply underground for safely containing electrical batteries, said main chamber being provided adjacent its bottom with a plurality of protruding members adapted to be engaged by a suitable elevating means, whereby the vault may be hoisted, a means arranged to reinforce said members to said chamber and distribute the hoisting strains to prevent the rupture of said chamber, and a superposed smaller chamber through which the conductors from said batteries will pass, and openings into said smaller chamber and from thence into said larger chamber for the admission of a person.

4. A water-proof vault comprising an underlying main chamber provided with a substantially flat top, a hatch-way having a circumscribing raised hoop located in said top, said main chamber being provided adjacent its bottom with a plurality of protruding members adapted to be engaged by a suitable elevating means, whereby the vault may be hoisted, a means arranged to reinforce said members to said chamber and distribute the hoisting strains to prevent the rupture of said chamber, and a superposed dome resting upon said top in water-proof union therewith and covering said hatch-way.

5. A water - proof vault comprising an underlying main chamber provided with a substantially flat top having a man hole therethrough, said main chamber being provided adjacent its bottom with a plurality of protruding members adapted to be engaged by a suitable elevating means, whereby the vault may be hoisted, a means arranged to reinforce said members to said chamber and distribute the hoisting strains to prevent the rupture of said chamber, and a superposed dome having a like opening and covering the former, said top providing conductor orifices leading into said dome and the latter providing exit orifices for said conductors such orifices extending through the side wall of said dome.

6. A vault having top, bottom and side walls of homogenous impervious plastic material having embedded therein a continuous wire cage terminating in a rigid ring circumscribing a top vault hatch-way, and a subsidiary dome having a top man-hole and resting in hermetic union with said vault top around said hatch-way, and conduit orifices passing through the top of said vault into said superposed chamber and corresponding outlet orifices within the side walls of said chamber whereby an electrical conductor may pass therethrough.

7. In a vault, a bottom of plastic material, a tension frame-work embedded therein and

members attached to said frame-work and protruding exterior thereof, whereby an elevating means may be affixed thereto and said vault be lifted without fracturing the same.

8. A water-proof vault of plastic material having as an element of construction of the bottom thereof a frame-work composed of a number of tensioned twisted wires embedded within said plastic material, and members extending from attachment to said frame-work to the exterior of said vault and adapted to be engaged by a suitable means for hoisting said vault.

9. In a containing vessel, a base hoop and a series of converging tensioned members attached thereto, said hoop and members being embedded in the plastic imperforate floor of said vessel, and a plurality of external hooks attached to said hoop, whereby lifting strains applied to said hooks will be evenly distributed throughout said floor.

10. A vault having a floor of plastic material converging tensioned members embedded therewithin and extending from the center thereof, and a supporting hoop affixed to the aforesaid members and external hooks affixed to said hoop whereby lifting strains will be evenly distributed throughout said floor.

11. A water proof vault comprising a chamber having a substantially flat top surrounding an opening therethrough, a ring of rigid material embedded within the plastic material constituting said top around aforesaid opening, eye-bolts affixed to said ring, and a web of tensioned wires extending from attachment with said eye-bolts to the side wall of the chamber, a reinforcement in the bottom of said vault, and rigid members bonded to said reinforcement and protruding externally of said side wall whereby said vault may be elevated by means of said members.

12. In a water proof vault, a base hoop, a series of radially disposed eye-bolts interiorly

extending therefrom, a series of converging tension members strained between said eye-bolts and affixed thereto and means externally protruding from said hoop adapted to be engaged by hoisting members and distribute the resultant strains evenly throughout said reinforcing members.

13. In a water proof vault, a floor of plastic material, a ring centrally embedded therein, a series of tensioned and twisted wires radially and horizontally extending therefrom, a hoop peripherally extending within said floor and a plurality of intermediately positioned eye-bolts in attachment to said hoop and wire strands

14. A water-proof vault comprising in combination; a main chamber having substantially flat top and bottom walls connected by a cylindrical side wall, said walls being composed of cement, the top wall being provided with a centrally located hatchway; a removable cover fitted over said hatchway and having a hoop in peripheral engagement therewith; a relatively high subsidiary dome of substantially cylindrical shape superposed upon said top and covering said hatchway, said dome being grouted to said underlying chamber and provided with exit orifices for electric conductors, said dome being provided with a hatchway in the rise thereof; a removable cover normally in interfitting relation with said hatchway; a wire mesh embedded in said main chamber and continuously extending from the bottom thereof to attachment with an embedded ring circumscribing the hatchway in the chamber top, a series of twisted tensioned wires embedded in said bottom and radially disposed; and a hoop to which said wires are affixed.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD JARVIS WINSLOW.

Witnesses:

EDITH C. SARLES,

ALBERT F. NATHAN.