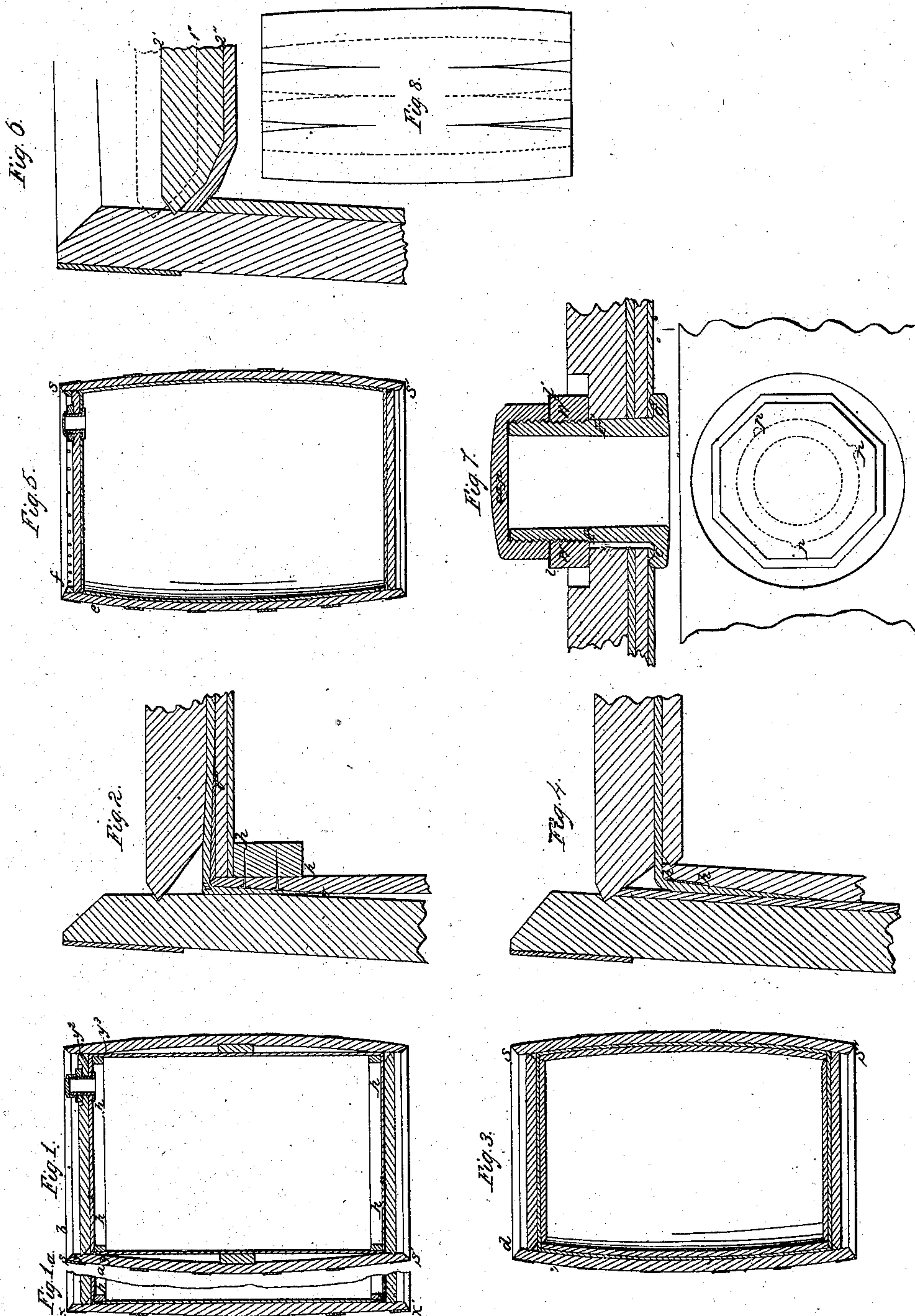


No. 81,441.

PATENTED AUG. 25, 1868.

E. WATERS.
VESSEL FOR HOLDING PETROLEUM AND OTHER LIQUIDS.



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IMPROVED VESSEL FOR HOLDING PETROLEUM AND OTHER LIQUIDS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, ELISHA WATERS, of Troy, in the county of Rensselaer, in the State of New York, have invented a new and useful method of making hermetically-sealed packages suited to commercial purposes, for holding and transporting petroleum and its products, spirits of turpentine, and other liquids of a volatile nature, by which all loss by leakage or evaporation, and its resultant dangers, is prevented; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, in which—

Figure 1 represents a section taken through the vertical axis, and also a perspective view of a cylindrical vessel, of paper, prepared for holding petroleum or other volatile liquids, enclosed in and protected by a barrel, made in the usual manner, but of which the inner surface terminates at each end in a short cylinder, $y y^1 y^2 y^3$, for the purpose of supporting the ends of the cylindrical paper vessel, as shown, the latter being further sustained by a belt of wood, placed midway between the ends, and between the inner surface of the barrel and the outer surface of the paper cylinder, its plane parallel to those of the ends, and of a thickness equal to the bilge of the barrel. An iron screw-bung is placed in the head.

Figure 1^a represents a section and perspective view of one side of a package similar to the one above described, except that the protecting-vessel, in this case, has the form of a polygonal prism, of twenty or more sides, each side formed by a straight stave, supporting the paper cylinder along the middle right-line element of its inner face, the draught for the hoops being obtained by turning off the exterior surface, so as to give it the form of two truncated cones placed base to base.

Figure 2 gives a vertical section, full size, taken through a corner of the package (fig. 1) at $a b$.

Figure 3 represents a section taken through the vertical axis, and also a perspective view of a light barrel, used as a mould, on which to form a solid shell of paper, made impervious to the liquid the vessel is designed to contain, the whole enclosed in and protected from the effects of rough usage by a barrel or cask, made in the ordinary manner. It is intended to use the malleable screw-bung in this package, in the same manner as shown in figs. 1 and 5.

Figure 4 gives a vertical section, full size, taken through a corner of the above-described package (fig. 3) at $c d$.

Figure 5 represents a section taken through the vertical axis, and also a perspective view of a barrel or cask, lined throughout its interior surface with a solid shell of paper, prepared for holding volatile liquids.

Figure 6 gives a vertical section, full size, taken through a corner of the above-described package (fig. 5) at $e f$.

Figure 7, a section, perspective elevation, and plan of a malleable-iron screw-bung, full size, adapted to the packages, or to the paper vessels herein described. The plug $P P'$ is kept from turning by the projections $p p'$. In cases where it is desirable to pass air directly out of or into the cask, to facilitate filling or emptying, it can be effected by drilling a small hole through the body of the plug $P P'$, and having the inner opening terminate in a small pipe running parallel to the head, and ending near the side of the cask furthest from the bung.

Figure 8, two developed sheets of paper, suited for covering the light barrel used as a mould, as in fig. 2, or the block-former, for making the shell of paper used as a lining in fig. 5, laid one on the other, to show the manner of breaking joints.

From the nature of the material used, and the form which necessity indicates as the most convenient for a barrel or cask, these vessels, when made of wood, are composed of a number of narrow staves, placed side by side. Hence, of necessity, the sum of the lengths of all the joints must be considerable, in an ordinary barrel, composed of twenty staves, being over fifty feet. The more these joints are multiplied, the greater the chances of leakage; and, on the contrary, the fewer joints, the less chance of loss. If it were practicable to make such a vessel of a single stave, with a single joint, or without any, the chances of loss from this cause would be proportionately reduced, or entirely removed.

Most of the plans proposed for preventing the leakage of the contents of such vessels through the joints have not had for their object the lessening of the number of joints, but rather to fill them up, or cover them with a lining of cloth, paper, or other suitable fabric or material, glued or otherwise firmly cemented to the whole inner surface of the vessel, and thus forming an integral part of the same. The defects of this method are, that in consequence of rough usage, such as a heavy fall, rolling over rough ground, or in the ordinary way of starting the bung, some of the staves are liable to be sprung or driven inward, so that their edges will project beyond those of the staves contiguous to them, which action or motion must consequently tend to break, tear, or rupture the firmly-glued lining along these edges, and this will be repeated every time that such forces are applied to the exterior surface.

Now, one part of my invention consists in forming, substantially or mainly from paper-pulp, paper in sheets, paper or straw-board, or vegetable parchment of any suitable kind or quality, a cylindrical conical frustum or barrel-shaped closed vessel, supported internally by end hoops or a wooden shell, and so constructed as to be composed practically, and, as it were, of a single stave, without any joint corresponding to those between ordinary wooden staves, through which the contents of the vessel can escape; and where such vessels are intended for liquids, I coat, size, or cement the continuous inner surface, or permeate the whole fibre of the paper vessel, with any known varnish, or other substance or compound insoluble in and suited to effectually resist the action and prevent the leakage of the particular liquid the vessel is prepared to contain, and, when desirable, I make the vessel so formed amply strong enough to sustain, without any change of form, leak, or break, its full capacity of liquid.

As the handling and transportation of heavy paper vessels necessarily wears and abrades the exposed parts, it becomes desirable to use some method of protecting them, which, while effectual and lasting, shall be as economical as possible. This I effect by another part of my invention, which consists in surrounding the paper vessel with a stout but roughly-made wooden cask, barrel, or tank, as the case may be, so fitted to the outer surface of the paper vessel, that, while the latter cannot move within the wooden envelope, it shall be independent of the casing along the edges or joints of its staves, so that whenever any one stave shall be sprung inwards beyond the next one, the interior paper vessel shall yield freely, without injury to itself, or the loss of any of its contents.

As a cylinder presents the simplest practicable form of vessel for holding liquids in general, I will explain how I apply my invention to this form.

Upon a mandrel of wood or metal, of the diameter and length of the cylinder required, a continuous sheet of paper or straw-board, of a selected texture and quality, and of a width equal to the length of the mandrel, is closely wound, the successive layers being firmly glued or otherwise cemented together. The thickness of the sides of the paper cylinder will depend upon the manner in which it is proposed to protect and support it by the surrounding vessel. If, as in fig. 1, by a barrel, of the usual form, and as there arranged, a thickness of one-fourth of an inch may be necessary; but if by a vessel with a straight stave, $x x'$, as in fig. 1^a, one-eighth of an inch, or even less, will be sufficient. The mandrel is now removed, and the cylinder allowed to dry. Strips of paper, four or five inches wide, are now cemented to the inner surface of the cylinder at each end, so that they shall project an inch or two beyond the edges, to form the laps. In some cases, where great strength and nicety are required, it may be well to turn off or otherwise make a slight bevel at $v v'$, fig. 2, and thus take the laps from the heads, without increasing the thickness or the diameter of the cylinder at this point, but ordinarily this will not be necessary.

Next, hoops $h h$, figs. 1 and 2, about one inch by one-half inch in section, are sprung into the ends of the cylinder, their outer edge at a distance from each end equal to the thickness of the lined head $r r$, figs. 1 and 2. They are set in glue or other cementing substance, and secured in place by heavy tacks, driven from the outside, but not through.

The head, in which the bung is to be inserted, is now prepared, by lining a circle of straw-board or thin wood, of the proper size, with paper, as shown in fig. 2. A suitable opening being made for the screw-plug, the cup-like cavity $o o'$, at the bottom of the plug $P P'$, fig. 7, is filled with the resisting substance or composition intended to be used as a coating for the inner surface of the paper vessel, the plug firmly pressed in place, and temporarily held there by the nut $w w'$, fig. 7.

The head, being next closely fitted in place, is bedded on the hoop with the resisting material. The lap $v' v''$, fig. 2, of the cylinder, is neatly and closely cemented down, and the whole head is then covered with paper, made to lap over the edges of the cylinder, as shown at $v v'$, fig. 2.

The interior of the vessel is now ready to be coated with the copal, shellac, common glue, marine glue, or other substance or composition selected to form the inner resisting-surface to the liquid to be contained therein. It having been satisfactorily ascertained that the joint about the bung is perfect, the head to close the other end of the cylinder is next prepared, by lining a suitable circle of thin wood or straw-board with paper, as before, or this head may be made wholly of paper. It is then carefully fitted to its position, coated on its inner surface, and bedded in place with the resisting substance or composition, and covered, as has already been described for the other head. An opening having been made in the head of the enclosing barrel for the reception of the plug, the latter is passed through it; the head made perfectly concentric with the cylinder-head, and the plug secured in place. The closed cylinder is now ready for setting up the rough barrel around it.

To do this, a band of wood, (fig. 1,) made up of three or four pieces, cut from the solid, is firmly glued or otherwise cemented to the exterior of the paper vessel, in the position indicated in fig. 1. In making the rough barrel or cask, care must be taken that the diameter of its inner surface bears such a relation to that of the cylinder, that when set up about the latter, it shall fit tight along the surfaces of the short cylinders $y y^1 y^2 y^3$ and that of the band of wood, the friction of the surfaces preventing the inner vessel from turning within the

outer one. I insure this further, if thought desirable, by passing a short thick wood-screw through every alternate or every third stave into the band of wood about the paper vessel, but not through it. Where it is desirable to have additional security in this respect at the ends of the vessels, the outer faces of the ends of the inner vessel may be attached to the inner faces of the ends of the enveloping barrel by narrow strips or patches of gluing or cementing, as far removed from the joints as possible, so that no ordinary blow transmitted through them can affect the integrity of the paper vessel beneath. Where a barrel with a straight stave, as in fig. 1^a, is used, the relation between the diameters of the paper and wooden vessel must be such that the former shall fit tightly within the latter, and thus be prevented from turning. To afford additional security against turning, and thus causing leakage about the metallic bung, detached portions of the outer surface of the inner vessel may be attached, by glue or other connecting substance, to corresponding portions of the inner surface of the enveloping barrel, in narrow strips, parallel to the joints of the staves, and occurring on every alternate or every third or fourth stave, as may be found sufficient, but of such a width, and so placed, that in no case shall any motion of the edges of the staves on each other injuriously affect the paper beneath, which must invariably have freedom of motion inwards along these joints. The ends may be treated, if desirable, as described for those of the wooden barrel in fig. 1.

In order to apply my invention to a barrel or cask of the usual form, I take a block-form built up in the same manner as an ordinary hat-block, and of a size such that the paper shell made upon it will when completed just fill the barrel or cask. Recesses are turned on each end of the solid form, corresponding to the hoops *h h*, figs. 1 and 2, in which hoops of wood of suitable size are fitted. Sheets of paper, cut in the pattern shown in fig. 8, are then laid on in a form corresponding to the staves of a barrel, each layer breaking joints with the one below it. The first sheets are dampened and fitted to the form of the block, the remainder are firmly glued or otherwise cemented to this layer and to each other. The hoops *h h* are then sprung in place and fastened, as already described. A suitable head, made as already shown, and properly fitted on one end of the block, is then secured in place by means of the resisting material used and the laps. The forming-block is now removed, the inner surface coated, the head with the plug put in place, and the enveloping barrel or cask set up, as heretofore set forth for the cylindrical paper vessel. Precisely the same means are used in this case to prevent the turning of the paper vessel with its envelope as have hereinbefore been explained at length for the barrels represented in figs. 1 and 1^a.

If it is considered necessary to test the tightness of the joint at the bung before closing the paper vessel, then, upon the completion of the sides, as shown, the block is to be removed, the lining-strips at each end for the laps, and the hoops put in place, and the two heads placed in position in the order and in the manner already described for the cylindrical paper vessel.

Where a larger vessel is wanted, of the ordinary cask-form, I take a light barrel of suitable dimensions, of which the staves are made as thin as possible, say three-eighths or one-half inch thick, as shown on the inner barrel, figs. 3 and 4, and secured only at each end by a thin iron hoop, *h h*, fig. 4, and proceed as follows:

Taking the head of the inside barrel, I cover it with as many layers of suitable paper as I think necessary, allowing them to project an inch or two beyond the edge of the head to make the lap. I line the inside of the head, at the point where the plug enters, with two or three disks of paper for the edges of the cup *o o'* of the plug *P P'*, fig. 7, to rest upon. I then set the plug in place, as has been described, secured temporarily by the screw, and then put the head in position; the other end of the light barrel being covered with paper, as described, for the plug end. The laps from the heads on to the staves are made as shown in fig. 4. The staves are then covered with paper, cut after the manner shown in fig. 8, each successive layer breaking joints with that beneath; or the paper may be wound on diagonally in strips of from three to five inches wide. The successive layers are attached to each other by means of the substance or composition selected to resist the contained fluid, and, if desirable, each layer may be permeated and saturated with it. The shell of paper is to be made of a thickness depending on the size of the vessel and the amount of pressure to be resisted, but ordinarily one-sixteenth to one-eighth of an inch will be sufficient. It may be desirable to coat the interior of the inner barrel with the substance or composition used as a resistant. The barrel is now ready for its wooden enveloping cask. The method of setting this up and of preventing the turning of the inner vessel, without having the paper vessel adhere to the outer cask along or near the edges of its staves, is the same as that explained in detail hereinbefore for the barrels shown in figs. 1, 1^a.

Barrels may also be lined, as shown in figs. 5 and 6, without the use of a mandrel, by first lining the bottom with paper, and turning up the laps against the inner sides, and then lining the sides with sheets cut as shown in fig. 8. If a layer of paper be put on the bottom, and then one on the sides, the laps at the edges will alternate, and a solid joint at the junction of the bottom with the sides will be obtained. The first sheets laid on are not attached to the wood, so that any shrinkage of the staves will not affect the paper vessel, or they may be glued or otherwise cemented to the inner face of every alternate or every third or fourth stave, in strips, say, one-half an inch wide, parallel to and away from the joints of the staves, so that the exterior surface of the paper lining shall be entirely free along these joints. Previous to the lining being completed and coated, with a view of putting in the head, the upper end of the barrel is terminated on its interior surface by a short cylinder, as shown in fig. 5, the lower edge of the cylinder terminating in the croze, which is lowered, say, one-half to three-fourths of an inch, sufficiently to admit of a stout head-lining being sprung in over the head. The head is then dropped from its original position, 1' 1" to 2' 2", fig. 6, and in some cases the old heads may have to be replaced by new ones of a slightly larger diameter. The head being lined and coated, as shown, fig. 6, and the paper lining of the barrel being cut off at a proper distance below the croze to receive the lining of the head closely, the latter is fixed in place, bedded in the resisting material used, the head-lining sprung into place, set in the resisting-composition, if desirable, and firmly secured by screws or nails.

To apply this invention to wooden tanks or cisterns, I build up with continuous sheets of paper or straw-board, extending entirely around the inner surface, and breaking joints with each other, a solid lining of paper, these layers being alternated with the layers forming the lining for the bottom and top edges, so as to form perfect laps. The sheets next the wood are tacked in place, or they may be glued or otherwise cemented to the inner face of the staves, leaving the paper entirely free along the joints, as already fully described hereinbefore where barrels are used as protecting envelopes, and a few tacks are driven through the succeeding ones into those below and into the wood, to insure the paper shell remaining in place when the tank or cistern is empty. The last two layers are simply attached to those below with the adhesive composition used, no tacks being driven through them. The man-hole may be arranged with a lip and cup, similar to that in the screw-plug, fig. 7.

These closed vessels may also be formed from paper-pulp, pressed into moulds, giving a shell of the form of a truncated cone, or any other surface of revolution, such as to fit one-half or other fractional part of the barrel, cask, or other vessel, intended to surround it; the shells so formed having a scarf or shoulder-scarf, or other suitable joint, at the edges where the parts are to be fitted together. These zones or bands, so formed, having been cemented together at the joints, and one end of the shell closed with a suitable head, as already shown, the interior surface is to be coated with the resisting-composition or material, the other head fitted in place, and the hermetically-closed vessel, so formed, is ready to be surrounded by its protecting envelope as already described.

Or such vessels may be made by pressing paper-pulp, or paper, or straw-board, into moulds such that the resulting form shall present the appearance of a wide stave, suited to fit the interior of a half, quarter, or other fractional section, taken through the long axis of the enclosing-vessel, which section may be joined, superposed on each other, coated, and otherwise treated, so as to form a hermetically-sealed vessel after the manner hereinbefore set forth.

As regards the first part of my invention, it is essential that the paper vessel should be supported internally by end hoops or disks or an extended shell, substantially as hereinbefore described and indicated by figs. 1, 1^a, 2, 3, 4; and by that combination of the internal wooden end pieces or shell with the paper vessel, a closed cylindrical tank-like or barrel-shaped package, having sufficient stiffness and strength to maintain its shape when filled or partly filled with liquid, semi-fluid, or pulverized materials, can be made at a cheaper rate, and with the sides and ends of the paper vessel of less thickness than if the paper vessel were not supported internally. And in respect to the other part of my invention, it is commonly preferable, but not essential, that the paper vessel should be supported by the internal end hoops or shell. But it is indispensable to that part of my invention, that while the paper vessel must be fitted so closely in, or so attached to the outer wooden case as to not turn within the latter by any ordinary handling, transportation, and use of the complete vessel, the paper vessel must be free or separable from or not adhere to the wooden case along the joints of its staves, so that the paper vessel will be less liable to be ruptured or injured by a stave being forced in beyond those next to it, than if the whole outer surface of the paper vessel were firmly glued to the entire inner surface of the wooden case, or if the paper vessel were cemented to the outer one along the joints of the staves.

What I claim as my invention, and desire to secure by Letters Patent, is—

A closed cylindrical tank-like or barrel-shaped vessel, formed essentially or mainly from paper-pulp, paper in sheets, or paper or straw-board, of any suitable quality, and supported internally by disks or hoops at the ends, or an extended wooden shell, substantially as described herein.

I also claim a closed cylindrical tank-like or barrel-shaped vessel, formed essentially or mainly from paper-pulp, paper in sheets, or paper or straw-board, with or without internal end hoops, or an inner wooden shell, substantially as described, in combination with an exterior protecting case formed of wooden staves and heading, and fitted or secured to the paper vessel, substantially as set forth, so that the paper vessel shall not turn within the wooden case, and yet shall be free or separable therefrom along the joints of the staves.

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