This invention relates to improvements in tank and flume construction, and has particular reference to a novel form of end closure and substructure therefor.

The subject matter of the invention pertains to certain modifications and improvements in the construction of tanks or flumes such as are required for transportation, storage or purification of domestic or industrial water supplies, or the purification of sewage, or for analogous uses. Certain novel features of this improved type of flume make it particularly adaptable for such uses in many parts of the country, where the construction of large canals or conventional types of storage tanks would be impracticable, or where economy in construction is a necessary expedient. The inventive concept contemplates the utilization of wood for the construction of tanks and flumes that have heretofore required concrete or steel for their construction, and which have also required expensive foundation structures to maintain them. A structure embodying the present invention may be set on mud sills or on piling or on soft ground, as desired, a particular advantage of its construction being that distortion of its substructure will not rupture the flume, as would be the case in the conventional concrete construction.

It is a primary object of this invention to provide a tank or flume which will make possible the economical storage or transportation of large bodies of water or similar liquids.

A further object of the invention is to provide an end closure for large tanks of semi-circular cross section which will withstand the tremendous pressure exerted by the stored water.

A further object of the invention is to provide a novel form of end closure for large semi-circular tanks which will not require the use of steel tie rods or other tension means to withstand longitudinal stresses.

A further object of the invention is to provide a substructure for large tanks or flumes which will effectively withstand the transverse horizontal stresses of the flume walls without the necessity of employing a multiplicity of crossbars or supporting cradles.

A further object of the invention is to provide a tank or flume of great capacity and subject to tremendous internal pressures which will be economical to build and maintain, and which may be set upon mud sills, piling or soft ground, as desired.

A further object of the invention is to provide a tank or flume which may be suspended from a pair of horizontal supports in such manner that distortion of the substructure will not rupture the trough, and which will permit immediate repair of leaks without draining or emptying the flume or tank.

With these and other advantages and objects in view, the invention resides in the novel construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and set forth in the appended claims; it being understood that various changes in form, proportion, size and details of construction within the scope of the claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

Figure I is an end elevation of a tank embodying the principles of my invention, a portion of the end closure being broken away to more clearly illustrate the trough supporting members.

Figure II is a side elevation of the tank illustrated in Figure I, a portion thereof being illustrated in section.

Figure III is a sectional top plan view of the apparatus illustrated in Figure II.

Preliminary to a more detailed description of the illustrated embodiment of the invention, it may be stated in brief that it comprises a semi-circular tank or flume, the construction of which preferably is of wood, the trough being formed of staves 1 assembled to form a trough of semi-circular cross section. Each of the staves is provided with a groove on one of its abutting edges and a bead on the other to simulate tongue and groove construction. The trough is suspended between a pair of longitudinally disposed beams 2 by means of suspension rods 3, the upper ends of which extend directly through said beams 2 and are held in place by means of nuts 4 and washers 5. A croze 6 is formed on the underside of each of the beams 2 into which is fitted the upper edge of the staves 1a, which constitute the rim of the trough, to retain the upper edge of the trough in position and to insure a watertight connection between the trough and the supporting beams.

The supporting structure for the flume comprises a series of spaced cradles, each comprising a foundation sill 7, a plurality of timbers 8 disposed vertically on said foundation sill, and a plurality of timbers 9 disposed horizontally on said foundation sill intermediate said vertical timbers and intermediate the trough and the foundation. Vertical and horizontal bolts 10 pass directly through said cradle timbers to maintain same as a rigid unit. The central portion of each of said cradles is patterned to conform to the outer periphery of said trough so as to maintain same in semi-circular shape under load. The foundation sill 7 may rest upon mud sills or upon piling or upon soft earth, as necessity requires, the illustrated construction utilizing a plurality of foot boards 11 disposed transversely beneath the foundation sill 7 to more effectively...
spread the weight of the flume and substructure over a wide area.

One of the upright or vertical timbers, indicated at 8a, extends the full height of the flume on either side thereof, a portion of the upper end of said upright timber 8a being cut away to form a shelf or abutment for the trough supporting timbers. Mounted upon said shelf is a joint extending longitudinally of the flume, on either side of the trough and positioned to form a continuous bearing for the trough supporting beams 2.

The longitudinal trough supporting beams 2 are of a complementary supporting joints 12, which extend longitudinally of the flume, are interconnected with each of the series of supporting cradles by means of a rod 13 which extends transversely across the top of the trough to unite the upper ends of the opposed upright timbers 8a of each of the cradle structures. Each of these rods 13 passes directly through the longitudinal beams 2, a nut 14 and associated washer 14a bearing against the inside edge of each beam 2, and a similar nut 15 and washer 15a bearing against the outer face of each upright timber 8a. It will be appreciated that by turning down the nut 15 the upper end of the upright timber 8a will be compressed tightly against the longitudinal beam 2, but that means other than the nut 15 and washer 15a is necessary to apply tension to the rod intermediate the longitudinal beams 2. For this purpose a turnbuckle 16 (see Figure 1) is positioned on said rod 13 intermediate said beams 2 to adjust the amount of pull exerted by said rod. The longitudinal beams 2 and joints 12 are interconnected at spaced intervals by suitable bolts 17 disposed vertically therebetween. This construction, of course, provides the necessary for a multiplicity of cradle structures or crossbars, the longitudinal beams and supporting joints being held against horizontal distortional forces in a manner presently to be described.

When the flume is under load the horizontal forces are exerted against the walls and tend to push them outwardly, due to the fact that the supporting cradles prevent the flume, when loaded, from assuming a cross-sectional shape approximating a hydrostatic catenary, but maintain it in its original semi-circular shape. In prior constructions of this kind it has been customary to resist these horizontal forces by the use of closely spaced crossbars, one crossbar being customarily placed at each suspension rod. Having reference to Figures I and II it will be noted that in applicant's structure these horizontal stresses are equalized by a series of tie rods extending transversely of the flume and which form a part of each series of cradle structures. These comprise the rod 13 which extends across the top of the flume to unite the upper ends of the upright timbers 8a, the pair of truss rods 10 which extend transversely of the cradle structure beneath the trough, and the anchor rod 19 extending transversely of the flume and directly through the cradle timbers at the bottom of the flume. These tie rods constitute the sole lateral support for the upright timbers 8 of the cradle structure and serve to prevent them being pushed outwardly under the horizontal transverse stresses of the flume walls.

The head or end closure, by means of which sections of flume may be converted into storage tanks or the like, comprises an end beam or cap timber 20 disposed transversely of said flume adjacent one end thereof and extending across the top of the flume in such manner as to form an abutment for the longitudinal forces in the periphery of the trough are a plurality of timbers 21 disposed in stacked relation on their flat sides and lying in the same vertical plane as the cap timber 20 to form a composite tank head. The head timbers 21 comprise broad, relatively thin sections longitudinally of the flume, illustrated, being approximately 2 inches by 14 inches. The dimensions of these head timbers are to be governed by the longitudinal forces to be overcome in each individual case. It has been discovered, however, that timbers of comparatively greater thickness than those used in the present construction tend to warp and twist, and do not lend themselves to be compressed so as to present a water tight end closure for large tanks. It has proven desirable to provide said head timbers 21 with a double tongue and groove construction, preferably being provided with an opposed groove and head adjacent either edge, as indicated at 22, so as to permit each timber to be interlocked with each adjacent timber.

It will be noted that there are no longitudinal tie rods interconnecting the tank heads or end closures. In the ordinary construction of this type of tank, the absence of such longitudinal tie rods for the end closures would necessitate the introduction of large quantities of steel to withstand the longitudinal stresses. In applicant's construction a cross 23 in the staves 1 receives the peripheral edge of the composite head timbers 21, the staves 1 extending a sufficient distance outside of the end closure to form a chine 24 for said cross, and the entire longitudinal thickness of the impounded water is received by this comparatively shallow chine.

To compress said stacked head timbers 21 within the inner periphery of said trough so as to provide a water tight end closure therefor, there is provided a shoe 25, vertical tie rods 26, and peripheral tie rods 29. The shoe 25 is disposed upon the outer periphery of the trough in approximately the same vertical plane as the cap timber 20 and stacked head timber 21 and is patterned to the inner periphery of the trough, the vertical tie rods 26 extend directly through the shoe and through the head timbers 21 and cap timber 20, and are equipped at each end with nuts 28 and washers 28a with which to apply tension thereto. These rods are spaced equally across the width of the flume, and it will be appreciated that by turning down the nuts 28 the head timbers 21 will be compressed between the cap timber 20 and shoe 25 to form a water tight end closure for the tank. The shoe 25 is supported against the outer periphery of said trough solely by the tension of said tie rods 26, no other support being necessary or provided therefor. The staves 1 are compressed against the peripheral ends of the head timbers 21 by means of a plurality of closely spaced tie rods 29 traversing the outer periphery of the trough, the ends of said tie rods 29 extending through the site end portions of the cap timber 28, where tension is applied to the rods by means of nuts 30 which are turned down against suitable washers 21.

The construction illustrated and described exemplifies its utilization in large tanks or flumes, although it will be appreciated by those skilled in the art that the structure defined is of economical value in connection with the construction of tanks.
or flumes of any size. The elastic nature of the construction illustrated, as distinguished from the rigid type of non-elastic flume, will permit
5 of the absorption of unusual stresses, such as may be due to settlement or distortion of the foundation structure and which may cause a longitudinal twist in the flume, without causing rupture in the trough proper. However, should such a rupture occur in the trough, the resulting leak may 10 be substantially stopped by further tightening the nuts 4 at either end of the tension rods 3, thereby further compressing the longitudinal staves 1 between the supporting beams 2. This, 15 of course, may be accomplished without draining or emptying the flume or tank.

Having now described my invention and in what manner the same may be used, what I claim as new and desire to protect by Letters Patent is:

1. An apparatus of the character described having a sub-structure comprising a semi-circular trough, a foundation, a timber disposed vertically on said foundation at either side of said trough, a pair of spaced longitudinally disposed supporting members between which said trough is suspended, and a joist disposed longitudinally and exteriorly of said trough on either side thereof and bearing on said timbers to form a bearing for said supporting members.

2. An apparatus of the character described, a sub-structure comprising a semi-circular trough, a foundation, a timber disposed vertically on said foundation at either side of said trough, a pair of spaced longitudinally disposed supporting members between which said trough is suspended, said supporting members being positioned intermediate said vertical timbers, and a joist disposed near the upper end of said timbers and longitudinally and exteriorly of said trough on either side thereof and bearing on said timbers to form a bearing for said supporting members.

3. An apparatus of the character described comprising a semi-circular trough, a pair of spaced longitudinally disposed supporting members between which said trough is suspended, and a joist disposed vertically at either side of said flume to provide a bearing for the trough supporting members, and tension means interconnecting said vertical timbers and engaging under the trough with the ends thereof anchored at a higher level.

4. An apparatus of the character described, comprising a semi-circular trough, a sub-structure comprising a pair of spaced longitudinally disposed supporting members between which said trough is suspended, a foundation, a plurality of timbers disposed vertically on said foundation, at least one of said timbers extending the full height of said trough on either side thereof to provide a bearing for the trough supporting members, at least one other of said vertical timbers being positioned to form a support for the walls of said trough, and tension means interconnecting said outermost timbers and engaging under the trough with the ends thereof anchored at a higher level.

6. In an apparatus of the character described, an end closure for a semi-circular trough, comprising a plurality of relatively wide, thin timbers disposed in stacked relation on their flat sides within the periphery of said trough and adjacent one end thereof, a cap timber for said end closure, a shoe for said end closure, means for compressing said timbers between said cap timber and said shoe, and a rod engaging the ends of said cap timber and engaging said trough to compress said trough against the ends of said stacked timbers.

7. In an apparatus of the character described, an end closure for a semi-circular trough comprising a plurality of relatively wide, thin timbers disposed in stacked relation on their flat sides within the periphery of said trough and adjacent one end thereof, a cap timber for said end closure, a shoe for said end closure, and means disposed vertically directly through said shoe, said timbers and cap timber to compress said stacked timbers between said cap timber and said shoe.

8. In an apparatus of the character described, an end closure for a semi-circular trough, a timber disposed transversely of said trough adjacent one end thereof, a plurality of relatively wide, thin timbers disposed in stacked relation on their flat sides within the periphery of said trough and lying in the same vertical plane for said cap timber, each of said timbers being interlocked with each adjacent timber, a shoe for said end closure, means to compress said timbers between said cap timber and said shoe, and means to compress said trough against the peripheral ends of said stacked timbers.

9. An apparatus of the character described, comprising a semi-circular trough, a pair of spaced longitudinally disposed beams between which said trough is suspended, means for suspending said trough from said beams, a cradle structure for supporting said longitudinal beams, and tension means to equalize the horizontal stresses of the trough under load, said means comprising a tie rod disposed across the top of the trough and interconnecting the upper portion of the cradle structure, a truss rod extending transversely of the cradle structure beneath the trough, and an anchor rod for said cradle structure disposed transversely of said structure at its base.

10. In an apparatus of the character described, a semi-circular trough, a pair of spaced longitudinally disposed supporting members between which said trough is suspended, transverse rods extending beneath said trough for suspending it from said supporting members, and a support for each of said members, said support being positioned at each side of the trough beneath the outer edge of each said member and outside the plane of said rods to permit said member to conform to changes in curvature of the trough walls.

11. A substructure for a semi-circular trough, comprising a foundation, a timber disposed vertically on said foundation at either side of said trough, a multiplicity of timbers disposed intermediate said vertical timbers being patterned to conform to the outer periphery of said trough so as to maintain same in semi-circular shape under load, a tie rod interconnecting said vertical timbers above the level of the trough, a truss rod interconnecting said vertical timbers and engaging under the trough and having its ends anchored at a higher level, and an anchor rod interconnecting said vertical timbers at their base.

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