June 3, 1952 E. L. CHAPPELL 2,598,972

METHOD OF MAKING A COMPOSITE HOLLOW INTERNALLY CEMENT-LINED INTERNALLY GENERALLY CYLINDRICAL OBJECT

Filed Feb. 19, 1948

Fig. 1.

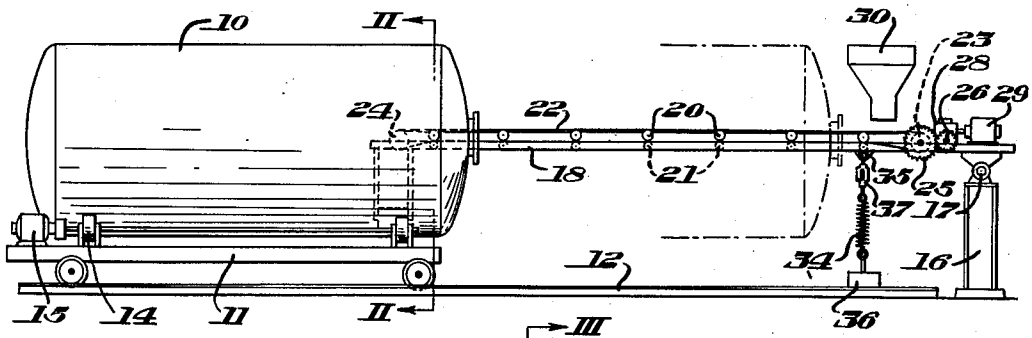


Fig. 2.

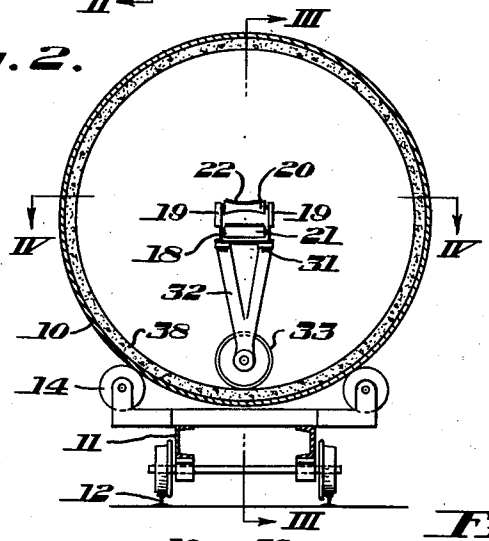


Fig. 4.

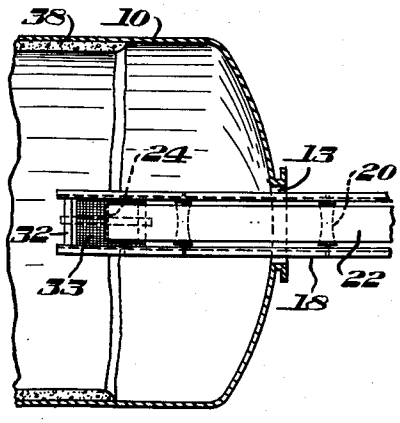
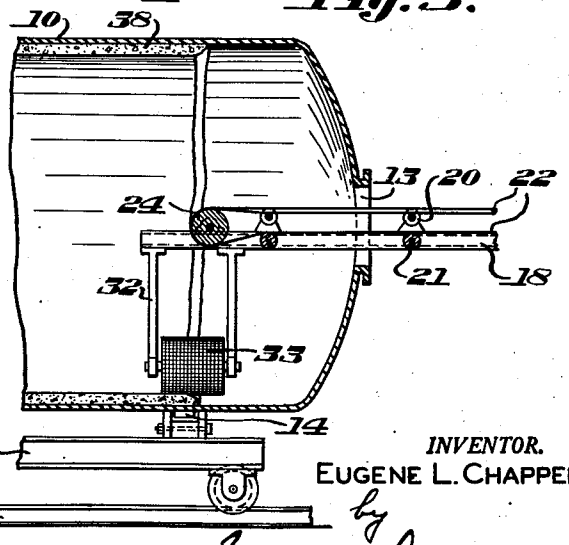


Fig. 3.



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METHOD OF MAKING A COMPOSITE HOLLOW INTERNALLY CEMENT-LINED INTERNALLY GENERALLY CYLINDRICAL OBJECT

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4 Claims. (Cl. 25—154)

1

This invention relates to the coating or lining of metallic pipe or containers such as tanks with a layer of a plastic mix of liquid and solids such as hydraulic cement.

The centrifugal method of applying a cement lining has proved quite satisfactory for small pipe and tanks, i. e., those having a diameter not greater than 18" or 2'. The centrifugal force compacts the cement against the metal and segregates excess water so it may be easily drained off. The centrifugal method is not suitable, however, for lining large tanks or pipe. In the first place, their size makes it difficult and expensive to spin them about their axis at the necessary speed. They are not always truly cylindrical, furthermore, and slight departures from precise shape will cause variations in the thickness of the lining, the inner surface of which is a true cylinder having the axis of rotation for its axis. In larger tanks, lack of concentricity between the tank wall and its lining is more serious than in small tanks since the lining thickness is not much greater in large tanks than in small ones. For these reasons it has been the usual practice to line large tanks by hand plastering. This is slow and expensive.

I have invented a novel method for lining large pipe and tanks which overcome the above difficulties. In a preferred embodiment and practice I deliver a fluid mixture of liquid and solids such as a cement mix, onto the surface of the member to be coated or lined, progressively form it in place, and simultaneously eliminate excess liquid by applying a permeable surface to the formed layer under pressure. The method may conveniently be carried out by moving the surface to be coated past a rotary screen to which a layer of cement is delivered and pressing the rotary screen against the surface to lay the cement on the surface and press it thereagainst. This converts the mix from a plastic, non-adherent semi-fluid to a condition of density and moisture content such that it forms a compacted, adherent lining. The apparatus preferably includes, in addition to the screen, means for moving the article being lined, means for supporting the screen in operative position, and means for supplying cement to the screen and collecting excess liquid extracted by the screen. The apparatus is so constructed as to be insertable into a tank through the usual manhole. The preferred form includes a beam extending axially into the tank or pipe to be lined and means carried thereby for supporting the rotary screen.

A complete understanding of the invention

2

may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating the preferred embodiment and practice. In the drawings,

Figure 1 is a diagrammatic side elevation showing a portion of the apparatus and a tank in the process of being lined;

Figure 2 is a transverse section taken along the plane of line II—II of Figure 1;

Figure 3 is a partial longitudinal section taken along the plane of line III—III of Figure 2 with parts in elevation; and

Figure 4 is a partial horizontal section taken along the plane of line IV—IV of Figure 2.

Referring in detail to the drawings, a tank 10 to be lined is disposed on a wheeled car 11 traveling on rails 12. The tank has a manhole 13 in one end. The car 11 has rollers 14 mounted on shafts journaled thereon supporting the tank for rotation. A motor reducer 15 is mounted on the car for driving one of the shafts on which the rollers 14 are mounted, thereby causing rotation of the tank 10 about its own axis.

For the purpose of lining the tank with cement as it is rotated I provide mechanism now to be described. A pedestal 16 has pivoted thereto at 17 a beam designated generally by reference numeral 18 and which comprises opposed portions 19 in which are journaled for free rotation an upper set of longitudinally spaced rollers 20 and a lower set of longitudinally spaced rollers 21. The rollers 20 are of concave shape while the rollers 21 are cylindrical. An endless belt 22 has its upper reach supported by the rollers 20 and its lower reach supported by the rollers 21. The belt 22 passes about a pulley 23 at the outer end of the beam 18 and a pulley 24 at the inner end of the beam. The shaft of the pulley 23 carries a gear 25 which meshes with a pinion 26 carried by a shaft 27 of a gear reducer 28 driven by an electric motor 29, the gear reducer and motor being mounted on the outer end of the beam 18. The motor is shown as mounted substantially directly above the pivot 17 with the gear reducer closely adjacent so that most of the weight of the motor and gear reducer is taken directly by the pedestal. The motor through the mechanism described causes travel of the endless belt 22. When the apparatus is in use the upper reach of the belt moves toward the left, viewing Figures 1, 3 and 4, and the lower reach of the belt moves toward the right viewing those figures.

There is provided a source of cement which is indicated diagrammatically at 30. The cement may be prepared in any suitable way and is de-

livered by any suitable means to the upper reach of the belt 22 adjacent the outer end thereof. The composition and consistency of the cement will be determined by the particular conditions of each lining operation. The method of and means for mixing and delivering the cement to the belt are not limitations upon the present invention.

Fastened to the bottom of the inner end of the beam 18 by screws or bolts 31 are downwardly projecting spaced apart arms 32. Journaled for rotation in the lower ends of the arms 32 is a cylindrical screen 33. The axis of the cylindrical screen 33 is substantially parallel to the axis of the tank 10. The cylindrical screen 33 is positioned so that the cement which is delivered onto the belt 22 through the delivery means 30 is in turn delivered from the inner end of the belt by gravity onto the screen 33.

For pressing the screen 33 downwardly against the bottom of the tank 10 I provide a tension coil spring 34 acting between the beam 18 at 35 and a bracket 36 mounted on the floor. A turnbuckle 37 permits of changing the spring tension.

In the process of lining the side wall of the tank 10, the car 11 is moved along the rails 12 to bring the tank to the position shown in dotted lines in Figure 1. This positions the screen 33 at the end of the tank remote from the manhole. The motor 15 is then started to rotate the tank on the car and the motor 29 is started to drive the belt 22 so that its upper reach moves toward the left, viewing Figures 1, 3 and 4. Cement is delivered from the delivery means 30 onto the belt and is conveyed by the belt into the tank and delivered onto the screen 33. Rotation of the tank causes rotation of the screen and delivery of the cement from the screen to the inner surface of the tank. The screen is pressed against the inner surface of the tank by the unbalanced weight of the beam and the mechanism carried thereby plus the action of the spring 34 whose effectiveness may be controlled by adjustment of the turnbuckle 37. Thus the screen exerts pressure against the cement as it is delivered to the tank wall tending to compact it and progressively form a layer thereof against the tank wall. The screen 33 is of such mesh as to permit excess water to pass freely therethrough without permitting any substantial flow of the solids contained in the cement mix. In the claims the word "permeable" means having the characteristic of permitting the passage of water without permitting substantial passage of solids contained in the cement mix.

The car 11 is moved slowly to the left as viewed in Figure 1 as the lining proceeds whereby a continuous integral lining is applied to the tank in the form of a helix. The travel of the car should be controlled so that the successive turns of the helical layer applied to the interior of the tank will lap properly to form a continuous lining. The screen 33 of course, rotates by reason of its frictional engagement with the lining as it is applied. The water separated from the lining by the rotating screen will tend to drain through the lowest portion thereof. It may be permitted to collect in the tank.

When the operation has proceeded to completion, the lateral wall of the tank will have been covered with a continuous coating of cement of substantial thickness indicated at 38. The coating-applying apparatus may then be removed, i. e., the arms 32 and screen 33, leaving the tank free to move away from the beam 18 for finishing operations such as lining the ends. It will be understood that the apparatus mentioned is of knock-down construction so it can be inserted through the manhole 13, assembled on the interior of the drum and then taken down for removal when the lining operation has been completed.

The fluid cement mix applied to the wall of the tank is converted by separation of a portion of the water contained therein from a plastic semi-fluid lacking sufficient adherence to be retained against the tank wall into a compacted adherent layer which retains its shape and position throughout the setting or chemical hardening of the cement. Excess water in the cement is progressively removed from the cement practically at the instant of its delivery onto the tank wall by pressure of the rotating screen thereagainst.

It will be apparent that the invention provides an improved method of lining large tanks and pipe which avoids the difficulties characteristic of the centrifugal method and hand plastering. By means of the invention a tank may be lined in a much shorter time than required by hand plastering and a more continuous and uniform lining is obtained. At the same time, the tank being lined need not be rotated at high speed since the compacting of the cement layer applied is effected by pressure of the cylindrical rotating screen instead of centrifugal force.

While I have described as a preferred embodiment a continuous coating operation, it will be understood that the invention may also be practiced by applying a layer of a hardenable fluid mixture of liquid and solids to an area of the surface to be covered and then engaging the layer with a screen and applying pressure. Alternatively, the heads of a tank such as that shown at 10 may be lined by having a layer of fluid cement spread thereon by hand and then applying a screen shaped to fit under sufficient pressure to separate excess water. The invention may also be applied to flat surfaces as well as curved surfaces such as tank walls and heads.

Various other changes in construction or procedure may be made in the preferred embodiment and practice disclosed herein without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a method of making a composite hollow internally cement-lined internally generally cylindrical object, the steps comprising applying a layer of hydraulic cement to the interior of a hollow internally generally cylindrical object having an internal diameter greater than two feet, disposing a permeable surface within said object, causing a relative bodily turning movement between said object and said permeable surface about the axis of said object to bring said permeable surface successively opposite portions of said object disposed at different locations circumferentially thereof, said turning being effected in such manner as to preclude the development of substantial centrifugal force acting on the hydraulic cement, and pressing said permeable surface against said layer of hydraulic cement and thereby forcing the solids of the hydraulic cement tightly against said portions of the interior of said object and simultaneously expelling water from the hydraulic cement through the permeable surface and thereby bonding the solids of the hydraulic cement together and to the interior of said object to form

thereagainst a tenaciously adherent cement lining.

2. In a method of making a composite hollow internally cement-lined internally generally cylindrical object, the steps comprising applying a layer of hydraulic cement to the interior of a hollow internally generally cylindrical object having an internal diameter greater than two feet, disposing a fine mesh screen within said object, causing a relative bodily turning movement between said object and said fine mesh screen about the axis of said object to bring said fine mesh screen successively opposite portions of said object disposed at different locations circumferentially thereof, said turning being effected in such manner as to preclude the development of substantial centrifugal force acting on the hydraulic cement, and pressing said fine mesh screen against said layer of hydraulic cement and thereby forcing the solids of the hydraulic cement tightly against said portions of the interior of said object and simultaneously expelling water from the hydraulic cement through the fine mesh screen and thereby bonding the solids of the hydraulic cement together and to the interior of said object to form thereagainst a tenaciously adherent cement lining.

3. In a method of making a composite hollow internally cement-lined internally generally cylindrical object, the steps comprising applying a layer of hydraulic cement to the interior of a hollow internally generally cylindrical object having an internal diameter greater than two feet, disposing a permeable clyinder within said object, causing a relative bodily turning movement between said object and said permeable cylinder about the axis of said object to bring said permeable cylinder successively opposite portions of said object disposed at different locations circumferentially thereof, said turning being effected in such manner as to preclude the development of substantial centrifugal force acting on the hydraulic cement, and pressing and rolling said permeable cylinder against said layer of hydraulic cement and thereby forcing the solids of the hydraulic cement tightly against said portions of the interior of said object and simultaneously expelling water from the hydraulic cement through the permeable cylinder and thereby bonding the solids of the hydraulic cement together and to the interior of said object to form thereagainst a tenaciously adherent cement lining.

4. In a method of making a composite hollow internally cement-lined internally generally cylindrical object, the steps comprising disposing a rotatable permeable cylinder within and adjacent the interior surface of a hollow internally generally cylindrical object having an internal diameter greater than two feet and simultaneously turning the object substantially about its axis, relatively shifting axially of the object the object and cylinder, delivering hydraulic cement to the interior of the object at the portion thereof at which the cylinder is disposed, said turning being effected in such manner as to preclude the development of substantial centrifugal force acting on the hydraulic cement, thereby spirally forming a layer of hydraulic cement on the interior of the object, and pressing the cylinder against the layer of hydraulic cement and thereby rotating the cylinder by contact with said layer and forcing the solids of the hydraulic cement tightly against the interior of the object and simultaneously expelling water from the hydraulic cement through the cylinder and thereby progressively spirally bonding the solids of the hydraulic cement together and to the interior of the object to form thereagainst a tenaciously adherent cement lining.

EUGENE L. CHAPPELL.

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