Feb. 1, 1938. E. L. CHAPPELL 2,106,828

METHOD OF MAKING A LINED CONTAINER

Filed March 11, 1935

Fig. 1.

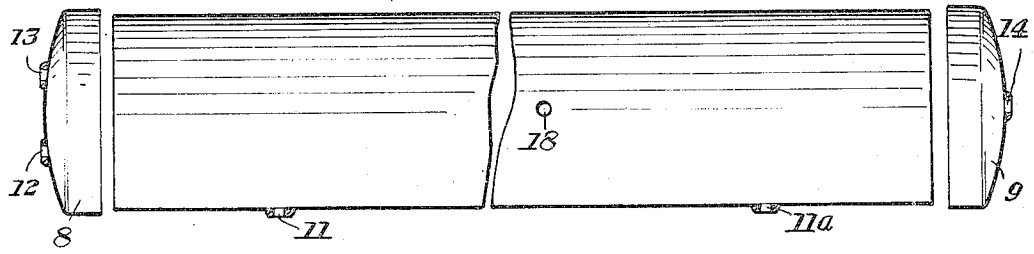


Fig. 2.

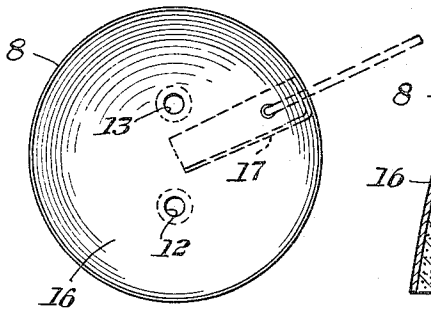


Fig. 3.

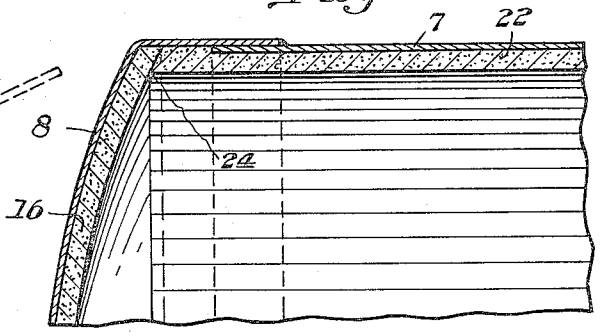


Fig. 4.

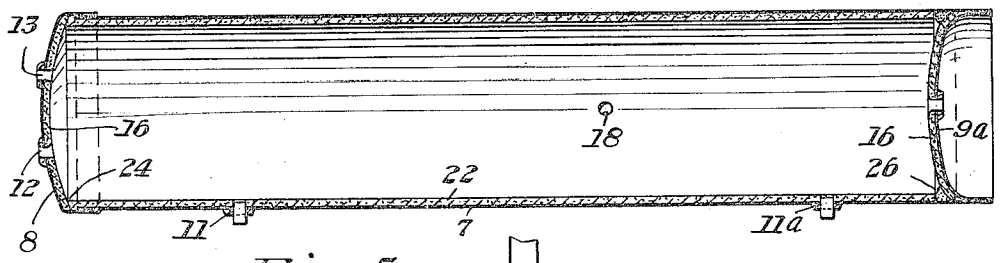


Fig 5.

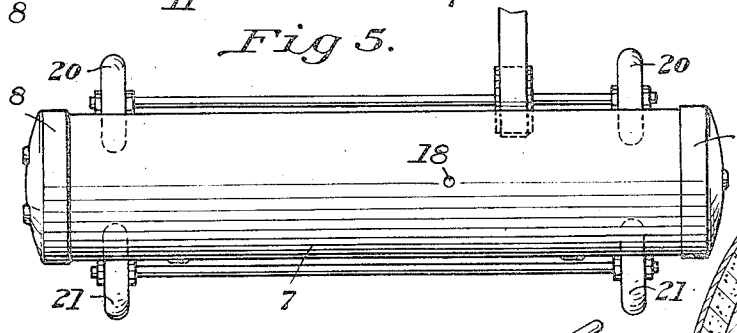


Fig. 7.

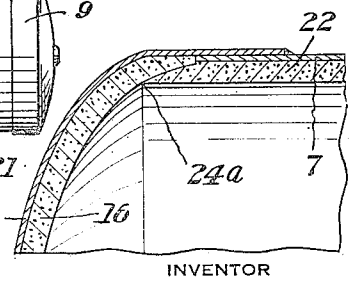
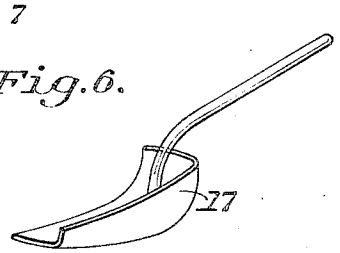


Fig. 6.



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METHOD OF MAKING A LINED CONTAINER

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Application March 11, 1935, Serial No. 10,539

7 Claims. (Cl. 18—59)

This invention relates to a method of making a lined receptacle or container, such as a tank.

Hydraulic cements, of which Portland cement is an example, make a cheap and effective lining for steel or cast iron conduits; and such cement linings have been successfully applied not only to new pipe but also to pipe already installed. It would appear obvious to line receptacles of various kinds with a protective lining of this character in order to cheapen the cost and extend the life of such containers; and in fact many attempts have been made to line receptacles with a wide variety of protective coatings. Where the tank is large enough so that a man may go inside and apply the lining over the entire interior of the tank, satisfactory results have, in some instances, been obtained. It has been a troublesome problem, however, to furnish containers with substantial and corrosion resistant linings where the container will not admit a workman to line the complete container.

It has been proposed to introduce the lining material into the completed container and distribute it within the same in various ways, generally by a pouring or tumbling action such as may be used to apply pitch to the interiors of a barrel. Linings so applied tend to be thin, rough and non-uniform in thickness. It is entirely possible to line a cylindrical article such as a pipe by centrifugal action; but centrifugal action, which is able to bring about suitable lining of the cylindrical walls, has a deleterious effect upon the ends of a tank or the like so that a proper lining of the ends is not obtained. It is an object of my invention to provide a practical method of coating or lining receptacles or containers which overcomes these and other difficulties.

In accordance with my invention, I do not line the entire interior of the container with protective material at once; but line a portion of the interior, and then line another portion thereof. In the case of hydraulic cements, which are the most important protective material for container interiors from the point of view of my invention, the first portion of the lining is permitted to set before the next portion is applied, so that a joint between the two portions results, which is characteristic of cement linings for containers as produced according to my invention.

I prefer to start with a sectional receptacle and line or coat sections of the same before they have been assembled, leaving the cylindrical section for lining after assembling a lined section or sections therewith. In this manner the bordering edge of the newly applied lining or coating forms a tight joint with the lining applied before assembly with the end section. The cylindrical section can, therefore, be lined centrifugally or by other appropriate means, and a uniformly protective lining or coating is formed throughout the interior of the container or receptacle.

In the drawings which illustrate my invention,

Fig. 1 is an exploded view of a tank, for instance a range boiler, before the sections have been assembled;

Fig. 2 shows in plan the interior of a lined end section;

Fig. 3 is a detail sectional view showing a typical joint between the lining applied to the end section before assembling and the lining applied to the cylindrical section after assembly;

Fig. 4 illustrates a modified procedure for lining tanks, according to which the cylindrical portion and one end of a tank are lined or coated, and a lined or coated end section then secured thereto with a tight joint;

Fig. 5 shows diagrammatically mechanism for applying centrifugally the lining material;

Fig. 6 shows a special trowel or form which can be employed in spreading the lining material in an end section;

Fig. 7 is a detail sectional view similar to Fig. 3 but showing a modification of the joint between the linings.

For purposes of illustration my invention is shown and will be described herein, as applied to a tank such as a range boiler. The tank comprises a cylindrical shell 7 and dished ends or heads 8 and 9. The tank will be provided with suitable inlets and/or outlets such as the connections 11 and 11a in the shell and the inlet and outlet connections 12 and 13 in the end section or head 8. A drain connection 14 may also be provided in the end section 9, if this is to be the lower end of the boiler.

In lining the tank, I use a plastic adherent protective material such as air curing rubber, phenol-formaldehyde or other synthetic resins, or a suitable mineral cement. Hydraulic cement is preferable, one suitable for this purpose being described in my prior Patent No. 1,916,157, dated June 27, 1933.

In lining the tank according to the preferred embodiment of my invention, I line an end section, preferably both end sections 8 and 9, before they are assembled with the shell 7. Such a lined end section is shown in Fig. 2, the lining being indicated at 16. This lining may be placed

in the end section in any suitable fashion; for instance, it may be spread by hand with a trowel while the end section is in general horizontal, giving a circular movement to the trowel relative to the end sections. A special trowel 17 or form, as shown in Fig. 6, can be used for the purpose. The end section or sections is or are assembled with the shell 7, being secured thereto by riveting, lap-welding or butt-welding, or in other suitable fashion. The protective material, such as a cement, is then introduced into the assembled tank through one of the openings. Plugs are then inserted in the inlets 11 and 11*a*, making sure that the inner end of each plug extends approximately to, but short of, the interior wall of the finished lining. If an opening such as shown at 18 is left for the regulating thermostat, this opening is also plugged. The plastic protective material is applied to the unlined section 7 in a manner suitable to the coating material being used.

In Fig. 5 is illustrated diagrammatically mechanisms for centrifugally lining a tank. This mechanism causes the lining material to be applied to the walls of the shell 7 by the centrifugal force arising from the spinning of the tank on its long axis. The lining material is forcibly driven against the walls of the shell 7; but does not find its way out of openings in the head unless they are approximately at the periphery, and therefore in general they need not be closed. The tank is supported on two sets 20 and 21 of wheels opposed to each other. These wheels may have pneumatic rubber tires to prevent slippage of the tank. A cap or the like (not shown) is generally applied over the top of the rotated tank to prevent its jumping out from between the two sets of wheels. Either or both sets may be driven so as to rotate the tank at a relatively high speed. For a tank 12 inches in diameter, a speed of 500 to 600 R. P. M. has been found satisfactory.

The thickness of the lining is determined by the quantity of lining material inserted. A desirable lining thickness when using hydraulic cement in tanks of a diameter of about 12 inches is one-quarter of an inch. The figures given above are by way of example only. It will be understood that the thickness may be increased or decreased; and that the speed of revolution may be varied over rather wide limits, depending upon the diameter of the tank, the fluidity of the lining material, and the time which it is desired to allow for applying the lining. The lining should be at least thicker than one-eighth of an inch with hydraulic cements.

Corrosion at the overlapping joint between the shell 7 and the ends or heads 8 and 9 is very objectionable. Increased thickness of the lining adjacent this joint is an advantageous feature of my invention. It will be apparent from Fig. 3 that due to the centrifugal application of the lining material, there is increased thickness of the lining from the overlap to the end or head 8 or 9.

The centrifugally applied lining 22 forms a tight joint 24 with the lining 16 applied to the head 8 previous to assembly with the shell 7. A desirable joint is formed if, as shown in Fig. 3, the lining 16 is extended to the upturned flange of the end or head 8, but is not prolonged up this flange. The exact character of the joint between the two linings depends for the most part on the shaping of the lining 16; and the same may, if desired, be squared off, undercut, or extended along the flange of the head 8 and tapered, as shown in Fig. 7. In the latter case, the lining 22 will overlie the tapered border of the lining 16, as shown at 24*a*. In any case, the centrifugally applied lining material takes from one end thereof to the other a uniform level, so that it is formed against the periphery of the end lining 16 but does not extend inwardly over the same toward the axis of the tank. When hydraulic cement is used, the lining 16 will be aged sufficiently to take on a preliminary set before the head 8 is assembled with the shell 7 and the lining 22 applied thereto.

It may under some circumstances be found desirable to assemble some section of the tank after the application of the lining to the shell 7. This variation of the processes is shown in Fig. 4. According to this modified procedure, an end section 8 is lined and assembled with the shell 7. The lining 22 is then applied to the shell 7 in some suitable manner. For instance, the cement may be applied by troweling. A head 9 is prepared with its lining or coating; and after the lining 22 has been applied to the shell 7, the head 9 is secured in place. This method applies for instance to a construction, such as shown in Fig. 4, where one head of the container is to be concave and the other head convex. The lining 16 is, as above described, first applied, and the lined head 8 is secured, as by lap-welding, to the end of the shell 7. The lining 22 is then applied to the shell 7 so as to form a tight joint 24 with the lining 16. An end 9*a* which has been previously coated or lined is then fitted in the remaining end of the container. If found necessary or desirable, extra lining material or sealing compound may be applied so as to form a joint, as indicated at 26.

For lining tanks with hydraulic cement, I prefer to follow the procedure first set forth, according to which the sections of the tank are all assembled before the lining 22 is applied to the section 7. The hydraulic cement linings of any or all of the sections can be set merely by permitting them to age; and in the claims the step of hardening or setting the lining is to be taken in its broad sense as including either passively permitting this to take place by the passage of time or by active treatment thereof. For instance, after the cement has lined the entire interior of the tank and has taken a preliminary set, the final set or hardening may be hastened by subjecting the lining to treatment with water or steam.

Among the numerous advantages adherent in my method of lining receptacles or containers and the product obtained, many of which will be apparent from the above description, I wish to refer particularly to the evenness of the coating or lining resulting in uniformity of protection against corrosion throughout the interior of the container. The procedure is well within the skill of artisans used to doing this kind of work; and satisfactory results are not hit or miss but can be depended upon in regular production. The ends are lined with as excellent a lining or coating as the body or cylindrical shell portion, a feature which is not to be expected from procedures heretofore followed according to which the lining or coating material is applied by a pouring or tumbling action. The process has particular advantage because a centrifugal application of the lining material to the walls parallel to the axis of the tank is made possible without the drawback of defective application of lining to the ends.

The feature of increased thickness of the lining adjacent the joint between the shell and an end is of particular importance at the top of a hot water tank. There the water is the hottest and the most corrosion is apt to take place. The construction which I have devised enables the manufacturer to protect this vulnerable part of the tank without the expense of a thick lining throughout the interior of the tank.

The term "mineral cement" is used herein to distinguish from an organic material such as the air curing rubber or the synthetic resins mentioned above. As the term "hydraulic cement" is used herein, it is used in its broad sense of a cement which requires water in hardening or setting, and which in general is capable of hardening under water.

While I have illustrated and described certain embodiments of my invention and have pointed out the practice which I at present find to be preferable, it will be understood that the invention may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. In a method of making a lined container or receptacle, the steps consisting in providing sections of the receptacle including a body portion and an end section, applying a coating or lining of plastic hardenable mineral cement to the end section while apart and free from the body portion, at least partially hardening said cement, assembling the lined section and the body portion, and applying said cement to the body portion while forming the edges thereof against the hardened cement lining of the end section.

2. In a method of making a lined receptacle, the steps consisting in providing sections of the receptacle including a cylindrical body portion and end sections, applying a lining of plastic protective material to the end sections, assembling the lined sections and the body portion to form a closed receptacle, and applying said protective material centrifugally to the unlined body portion of the receptacle.

3. In a method of making a lined container, the steps consisting in providing metal sections capable of being assembled into a closed container for fluids under pressure, partially lining the interior walls of said container with flowable lining material before assembling of the container, assembling said sections into a closed container, introducing such lining material within the assembled container, and completing the lining of the interior walls thereof by applying said material to the unlined portions of said walls by centrifugal action.

4. In a method of making a lined container or receptacle, the steps consisting in providing sections of the receptacle including an end section, applying a coating or lining of plastic protective material to said end section, assembling the lined section and an unlined section, and applying said protective material centrifugally to the unlined section and forming the edge thereof against the lining of the lined end section.

5. In a method of making a lined container or receptacle, the steps consisting in providing sections of the receptacle including a cylindrical body portion and opposite end sections, lining the end sections with hydraulic cement, assembling the lined sections and the cylindrical body portion, centrifugally lining the body portion with hydraulic cement, and permitting setting of the cement lining of the receptacle.

6. In a method of making a lined cylindrical container, the steps consisting in providing a container in sections including opposite end sections, lining the end sections with hardenable mineral cement, assembling the lined ends and an intermediate unlined section, introducing mineral cement within the assembled sections, applying said cement to the unlined section by centrifugal action by rotating the container or its axis, and permitting hardening of the cement lining of the container.

7. In a method of making a lined cylindrical tank, the steps consisting in providing sections of the tank including a cylindrical body portion and end sections, lining said end sections with plastic mineral cement, assembling the unlined body portion and said end sections so that the end sections overlap the body portion at the edges of the body portion, and applying a lining of such cement to the cylindrical walls of said body portion and forming the edge thereof against the lining of a lined end section.

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