

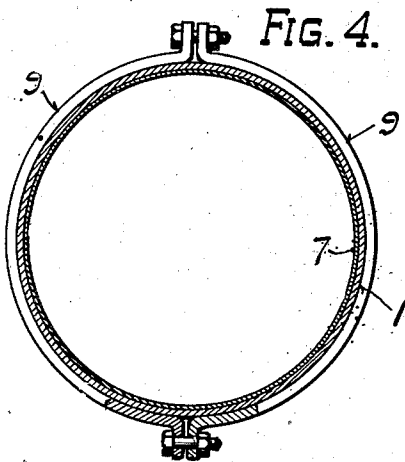
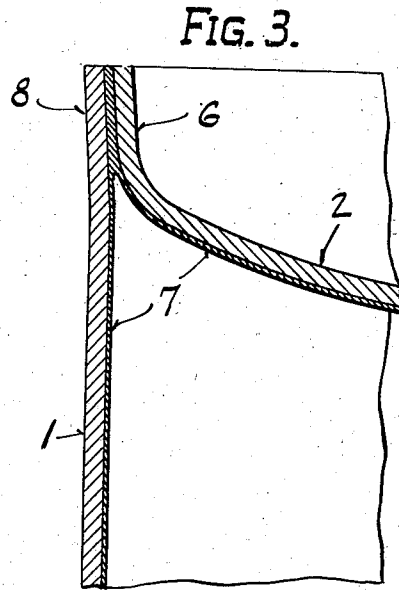
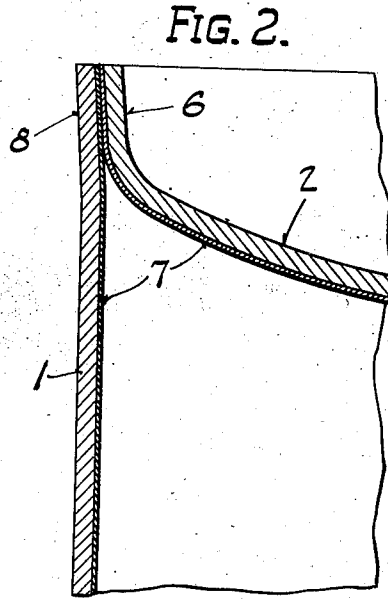
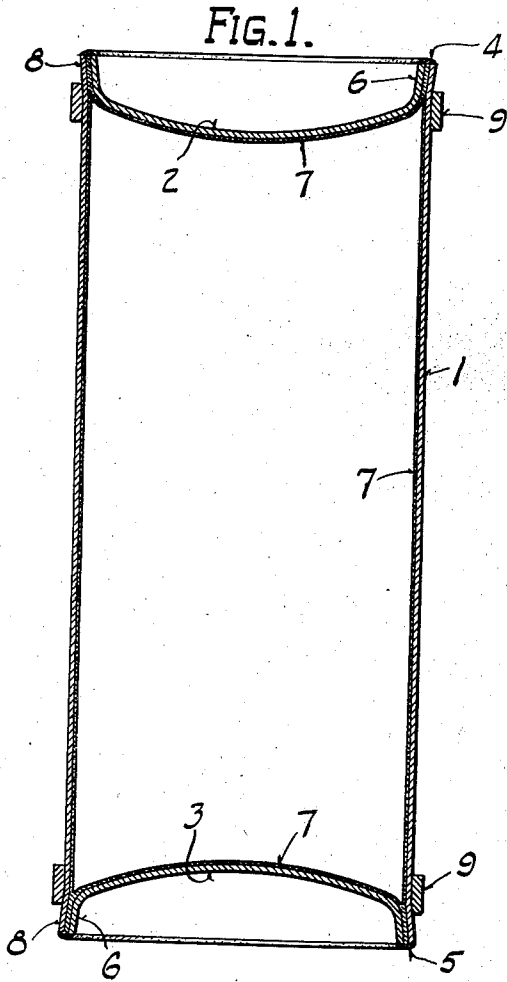
May 28, 1946.

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2,401,231

HOT WATER TANK AND METHOD OF MAKING THE SAME

Filed May 18, 1942



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2,401,231

HOT-WATER TANK AND METHOD OF
MAKING THE SAME

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Application May 18, 1942, Serial No. 443,438

3 Claims. (Cl. 220-64)

This invention relates to ceramic or vitreous enamel lined hot water storage tanks and has particularly found employment in joining the head and shell of an enameled tank under conditions of heat and pressure that provide a liquidtight joint therebetween.

One object of the present invention is to provide a hot water storage tank in which the enamel material of the overlapping contacting surfaces of the head and shell of the tank are sealed together to prevent leakage of fluid through the joint.

A further object is to provide a hot water storage tank which has a fluidtight joint between the head and shell of sufficient strength to effectually resist the pressure of the contents of the tank without rupture or other injury.

Other objects will appear from the following description of an embodiment of the invention shown in the accompanying drawing.

In the drawing:

Figure 1 is a longitudinal section through a hot water storage tank that has been made by the method of the invention;

Fig. 2 is an enlarged section through a joint between the upper head and shell of a tank prior to the re-fusing of the overlapping linings of the head and shell;

Fig. 3 is a similar section after the re-fusing operation but before the tension bands have been applied; and

Fig. 4 is a sectional view of the hot water tank after tension bands have been applied.

The basic embodiment of the invention is carried out by sealing together the overlapping enamel linings of a head and shell of a hot water storage tank by subjecting the overlapping portions of these members to a reheating operation when the head and shell are held tightly together under pressure. Under these conditions the overlapping linings of the head and shell are bonded together. After inter-fusion of the enamel linings is completed, tension bands are applied on the outside of the tank in the region of the joints of the tank to strengthen the joints and provide sufficient inwardly directed pressure to resist the pressure of the contents of the tank.

Referring to the drawing there is illustrated a hot water storage tank having a generally cylindrical shell 1 and an upper head 2 and lower head 3.

The shell and heads are fabricated from suitable metal and the respective heads are secured to the opposite ends of the shell by the circum-

ferential welds 4 and 5 when assembly is completed.

In manufacturing the hot water tank illustrated in accordance with the invention, the shell 1 is formed from suitable sheet metal rolled into a generally cylindrical shape and then welded along its longitudinally extending seam. The sheet metal heads 2 and 3 are formed into a substantially concave shape with the flanges 6 extending outwardly in the same direction as the respective ends of the wall of the shell 1.

The interior surfaces of the heads and shell are thereafter sandblasted and then sprayed with a ceramic or vitreous enameling material. The material is fired under high temperatures, such as 1600° F., to provide the enamel lining 7 which serves to protect the metal of the tank from corrosion in service. The flanges 6 of the heads are covered with the enamel as well as the end portions 8 of the shell, these respective linings of the heads and shell being later assembled in overlapping relation with each other. The enamel lining 7 ordinarily has the same thickness at the flanges 6 and end portions 8 as it does in other parts of the heads and shell. The lining 7 is somewhat exaggerated in thickness in the drawing to more clearly illustrate the invention.

Since the joints 4 and 5 are similar, it is sufficient to confine the description at this point to only the joint 4 and the assembly of the head 2 with the shell 1.

In assembling the head with the shell 1 the shell is preferably heated to a sufficient temperature to effect an expansion of its diameter under conditions such as those described in the application filed by the same inventor on April 2, 1942, Serial No. 437,353, and entitled "Method of joining lined tubular members." The head 2 is then advanced a predetermined distance within the end portion of the hot shell 1 and maintained in this position by a suitable fixture until the shell cools to the same temperature as the head to shrink the shell onto the flange of the head and bring their linings into tight overlapping engagement. The head under these conditions has a residual compressive stress and the end portion of the shell a residual tensile stress.

The same prestressing of the head and shell can also be obtained by subjecting the head to a sufficient low temperature to contract its diameter rather than heating the shell to expand the same. Similar results also occur if the shell is heated and the head cooled.

The flange 6 of the head may extend equidistant with the end portion 8 or the flange may project a slight distance axially outwardly from the edge of the end portions 8 to provide a seat for the circumferential weld 4. In any event, however, the enamel lining 7 of the shell overlaps the enamel lining 7 of the head for a substantial distance in the area of the joint between the head 2 and shell 1.

While the head and shell are thus held together under pressure from the residual stress therein they are heated to a softening temperature for the enamel under a re-fusing method similar to that described in the application of Waldo W. Higgins, Serial No. 441,201, filed April 30, 1942, entitled "Joinder of porcelain enameled products" and assigned to a common assignee with this invention.

The temperature utilized is substantially lower, such as 200° F. lower than the firing temperature to which the head and shell are originally heated in firing the enamel to the interior surfaces of these members to provide the lining 7. The heating of the enamel in this manner softens it but does not melt it in any substantial manner. The prestressing of the members effecting a pressure contact between the enamel coatings facilitates the interfusing of the latter when heated.

The softening of the enamel lining 7 in this manner should be sufficient to seal or bond the respective overlapping linings of the head 2 and shell 1 together into one integral lining under the pressure created by the compressive and tensile stress in the members. Although it is preferred that the entire structure be heated to accomplish the re-fusing of the enamel, this is not necessary as local heating of the flange 6 of the head and end portion 8 of the shell, such as by a frequency induction coil or other means, will accomplish the desired re-fusing or interfusion of the ceramic enamel lining.

The fusion of the respective linings of the head and shell at the region of the joint seals the latter against circulation or approach of the fluid contents of the tank to the outer line of the joint. Employing a lower temperature in the re-fusion process than the original firing temperature insures that no defects will be developed in the enamel lining.

After the re-fusion described, it is preferred that the circumferential weld 4 be made to increase the strength of the joint to resist the pressure of contained fluid. The weld 4 is made to join the end of the flange 6 to the edge of the end portion 8 of the shell. The weld need not be employed, however, where the members are accurately dimensioned and fit together in tight engagement, as the fusion of the enamel lining of the head and shell together provides a liquid-tight joint of durable quality and sufficient strength to offset and effectively resist the pressure of the contents of the tank.

To further increase the strength of the joint between the head 2 and shell 1 it is preferred that tension bands 9 or other tension device be employed circumferentially around the end portions 8 of the shell 1 at a line slightly removed from the outer edge of the end portion.

The tension device 9 may consist of two semi-circular hoop members or bands as illustrated in Fig. 4 suitably secured together at their meeting ends by bolts or other means. The tension device insures that the ceramic enamel lining seal of the joint between the head 2 and shell 1 will

not be injured or broken by pressure from contained fluid.

The invention entirely eliminates the necessity for the employment of gaskets between the heads and shell of a hot water tank and provides a strong durable joint that is not easily injured by the pressure of contained fluid.

The enamel lining of the tank is utilized not only to protect the metal of the interior of the tank from corrosion but also as a sealing and interfusing agent to secure the heads tightly within the ends of the shell by a liquid tight joint. This is accomplished without the necessity for additional thickness in the enamel in the overlapping areas and without danger of injury to the enamel by refiring thereof.

The tension device described is readily applied and provides a secondary support for the enamel sealed joints between the heads and shell to further insure that no injury befalls the joints in service whereby fluid might escape or cause injury to the metal at the joint.

Various embodiments of the invention may be employed within the scope of the accompanying claims.

The invention is claimed as follows:

1. A hot water storage heater tank and the like, comprising a cylindrical shell lined with ceramic enamel, a flanged head inserted in the end of said shell with its flange extending outwardly and fitting the shell to provide complementary circumferential overlapping portions at the end of the shell, said head being lined with ceramic enamel with the lining extending over the outer surface of the head flange, the enamel coatings of said shell and head being interfused and integral throughout substantially the entire region of said overlapping portions and free from defects produced by refiring of the enamel at firing temperatures therefor, a weld securing the end edges of said shell and head flange together, and a tension band encircling and tightly engaging the shell at the inner end of said overlapping portions and at points inwardly from the inner juncture of the head and shell thereby placing the shell at said points under residual compressive stress to prevent separation of the shell and head at said juncture from internal fluid pressure in said tank tending to cause rupture of the interfused enamel.

2. In the manufacture of hot water storage heater tanks and the like, the steps of forming a cylindrical tank shell and lining the same with ceramic enamel fired and bonded thereto throughout the inner surface, forming a flanged head adapted to set into an end of the shell with its flange extending outwardly and fitting the shell to provide overlapping portions of substantial extent and lining the head and outer surface of the flange with ceramic enamel fired and bonded thereto throughout the surface referred to, assembling said shell and head under conditions of differential thermal expansion and contraction resulting in a radial tightening of said shell upon the flange of said head, and thereafter heating the overlapping portions of said shell and head to a temperature generally about 200° F. below the previous firing temperature for the enamel while utilizing the radial pressure and tightness resulting from said assembly operation to effect the interfusion of the enamel coatings between said overlapping portions, and welding the corresponding ends of the shell and head flange together to complete the closure.

3. In the manufacture of hot water storage

heater tanks and the like, the steps of forming a cylindrical tank shell and lining the same with ceramic enamel fired and bonded thereto throughout the inner surface, forming a flanged head adapted to set into an end of the shell with its flange extending outwardly and fitting the shell to provide overlapping portions of substantial extent and lining the head and outer surface of the flange with ceramic enamel fired and bonded thereto throughout the surface referred to, assembling said shell and head under conditions of differential thermal expansion and contraction resulting in a radial tightening of said shell upon the flange of said head, thereafter heating the overlapping portions of said shell and head to a temperature generally about 200° F.

below the previous firing temperature for the enamel while utilizing the radial pressure and tightness resulting from said assembly operation to effect the interfusion of the enamel coatings between said overlapping portions, welding the corresponding ends of the shell and head flange together to complete the closure, and applying a circumferential tension band to the shell in the region thereof extending inwardly from the inner juncture of the shell and head to initially compress the shell in this region and secure the same against expansion under internal fluid pressure tending to separate the shell and head and rupture the interfused enamel.

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