Oct. 27, 1953 G. W. LEUPOLD 2,656,949

LINED CONTAINER AND WELDED JOINT THEREIN

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FIG. 1.

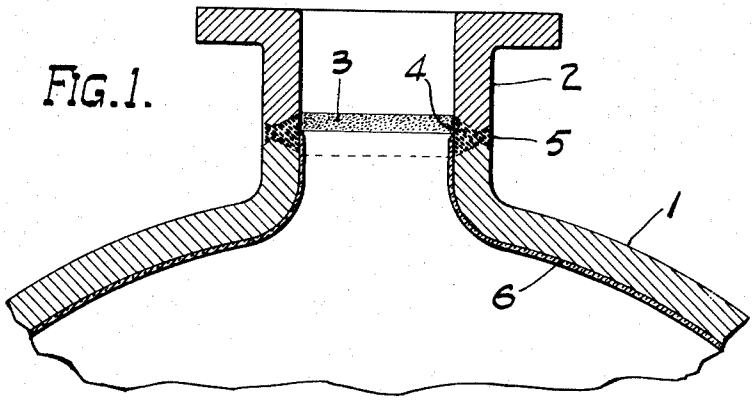


FIG. 2.

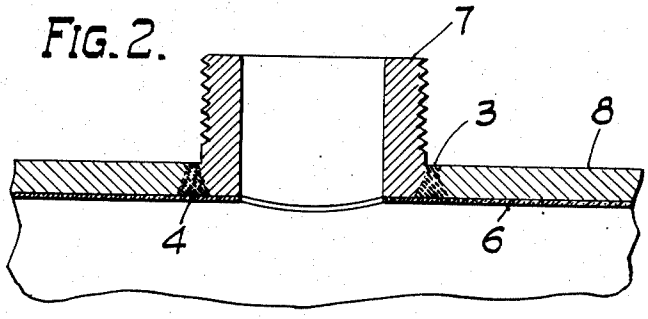
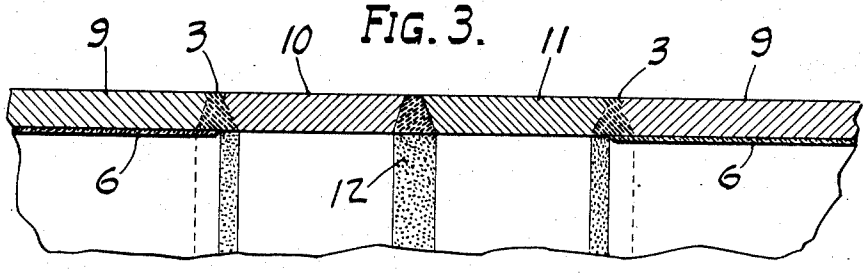


FIG. 3.



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LINED CONTAINER AND WELDED JOINT THEREIN

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1 Claim. (Cl. 220—64)

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This invention relates to a joint between an enamel protected metal member and alloy corrosion-resistant metal of different coefficients of thermal expansion.

The invention is particularly adaptable to joints employed in tanks, vats or containers of varying sizes wherein connection portions such as manways, flanges for various openings and the like, are secured to the body of the tank or vat. If the bearing surfaces of the connection portions are coated with ceramic or vitreous enamel, for instance, any blow or impact to which the connection portions are subjected while in use, may cause the vitreous enamel coating to become chipped or cracked thereby subjecting the metal beneath the chipped or cracked coating to corrosive attack. To remedy this, it has been the practice to make the connection portions of a metal which is resistant to corrosion from the liquid carried or stored in the tank or vat. Frequently the metal employed for this purpose is stainless steel which has a different coefficient of thermal expansion than the metal from which the balance of the structure is fabricated. This in turn has led to the employment of joints of varying forms between the different metals to prevent crazing of the enamel coating generally bonded to the metal which is not corrosion resistant, an example of such metal being low carbon or mild steel.

The principal object of this invention therefore is to provide an improved joint which may be employed in structures having a vitreous enamel protected metal member and an alloy corrosion-resistant metal of different coefficients of thermal expansion.

Another object is to provide a joint between an enamel protected metal member and an alloy corrosion-resistant metal of different coefficients of thermal expansion in which the enamel may extend part way across the joint or, if desired, entirely across the joint.

The discovery that an enamel protected metal member and an alloy of corrosion-resistant metal of different coefficients of thermal expansion may be united by a fusion butt weld in which the enamel coating extends part way across the joint or entirely across the same is a substantial and important contribution to the art.

The invention will be described in connection with a container of the above type for purposes of illustration.

The accompanying drawing illustrates typical embodiments of the invention in which:

Figure 1 is a sectional view taken longitudinally through a portion of a container and its flanged connection;

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Fig. 2 is a sectional view of a portion of a container having a threaded fitting and illustrating another embodiment of the invention; and

Fig. 3 is a longitudinal sectional view of a portion of a wall of a large container such as a tank in which an alloy band is employed around the circumstance of the tank to join the tank sections together.

With reference to Fig. 1 the wall 1 of the container is of ordinary carbon or mild steel while the flanged connection 2 is of a metal which resists corrosion, such as stainless steel. The wall of the container and the connection are joined by the fusion butt weld 3. The metal of the joint is of particular importance in that it is preferable to use an alloy for the weld which is compatible to metals having different coefficients of expansion.

As an example, one such alloy which has been found to be suitable for fusion welding mild steel to stainless steel comprises substantially the following:

70 to 80% nickel
10 to 18% chromium
9% iron maximum
0.5% copper maximum
Remainder residuals

An alloy of the above composition has a coefficient of thermal expansion substantially the same as that of mild steel while stainless steel has a coefficient of thermal expansion substantially 50 per cent greater.

It has been discovered that the above alloy may be used advantageously to form a fusion butt weld between the different metals. In making such a weld the width of the inner surface 4 of the weld 3 is made considerably greater than the width of the outer surface 5. Across the weld there is a gradation of the composition of the weld deposit which makes possible the carrying over of the vitreous enamel lining onto the weld deposit for a substantial distance, for instance, approximately across half the width of the inner surface of the weld.

It is known in the enameling art that when applying a vitreous enamel to carbon steel a ground coat must first be used before firing the cover coat. It is also known that the ground coat is generally not acid resistant while the cover coat is. Vitreous enamel may be applied

directly to certain alloy steels such as stainless steel.

In the practice of the invention it is preferable to first join the body 1 of the container to the flanged connection 2 by a fusion butt weld 3 having an inner surface 4 of substantial width. The metal of the weld deposit will be diluted by the metals which are being joined so that the weld metal nearest the carbon steel of the body 1 will take on characteristics more nearly those of the carbon steel than will the weld deposit metal at a line adjacent the corrosion-resistant metal of the connection fitting where the characteristics of the weld deposit metal will be more nearly like that of the corrosion resistant metal. The effects of this dilution serve to make the weld deposit metal a buffering agent between two metals possessing substantially different coefficients of expansion and to provide a zone of gradual change from metal of the one coefficient to metal of the other.

A vitreous enamel lining 6 is next applied to the inner surface of the wall 1 of the container. As stated above a ground coat must be used when coating carbon or mild steel with vitreous enamel. In the preferred practice of the invention the ground coat is first applied to the inner surface of the container and also for a short distance across the inner surface 4 of the fusion weld 3. The cover coat is next applied to the ground coat and then fused in any suitable manner.

It has been found that the weld deposit metal extending from approximately the center of the surface 4 to the corrosion-resistant connection fitting 2 is, by virtue of the effects of dilution of the metal of fitting 2 with the metal of the weld deposit, resistant to attack from corrosion. Therefore, it is unnecessary to carry the enamel lining over the entire surface 4 of the joint 3 although this may be done if desired. The latter is illustrated in Fig. 2 wherein a threaded connection 7 is shown as welded to wall 8 of a container by weld 3.

In Fig. 3 there is shown a portion of the wall of a substantially large tank which has been fabricated from two tank sections. Walls 9 of the tank sections are generally of carbon steel and are joined together by circumferentially extending bands 10 and 11 of a suitable corrosion-resistant alloy such as stainless steel which are joined by welds 3 to the respective tank sections according to the above described process and then joined to each other by a fusion weld 12. The metal of the weld deposit 12 is preferably of the same constituency as that of the bands 10 and 11.

The invention provides a joint which may be used for example in a container the body of which is fabricated from a relatively inexpensive metal such as mild or carbon steel. Connection fittings of a corrosion-resistant metal are joined to the body of the container by a fusion butt weld and subsequently the inner surface of the body portion is provided with a vitreous enamel lining to protect the body from corrosion. Heretofore, tapered joints have been utilized in joining connection members to the body of the container and then the inner surface was enamel lined. The invention provides an ordinary fusion butt weld in joining metals of different coefficients of thermal expansion in which the weld deposit metal is an alloy compatible with the metals being joined so that the alloy weld deposit acts as a buffering agent between the metals in that there is a gradation of composition of the weld deposit from one side of the weld to the other.

Various embodiments of this invention may be employed within the scope of the following claim.

I claim:

In a corrosion resistant metallic structure having a fusion weld deposit therein, a carbon steel body having a surface subject to corrosion when unprotected, a body having a corrosion resistant alloy steel surface adjacent said carbon steel surface, a fusion weld deposit between said bodies and presenting a surface zone of substantial width between said surfaces in which there is a gradation of alloy content providing a gradual change in the coefficient of thermal expansion from that of said carbon steel surface to that of said alloy steel surface, and a protective coating of vitreous enamel fused and bonded to said carbon steel surface and extending for at least a substantial distance across said surface zone of said weld deposit, the gradation in coefficient of thermal expansion of the surface zone covered by said vitreous enamel serving to prevent injury to the enamel from thermal expansion differentials, and the alloy content of the exposed surface metal adjacent the edge of said coating being sufficient to substantially resist corrosion without further protection.

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