June 27, 1939. A. J. MOSES ET AL 2,164,074

PROTECTIVE LINER FOR DRUMS

Filed Dec. 11, 1935

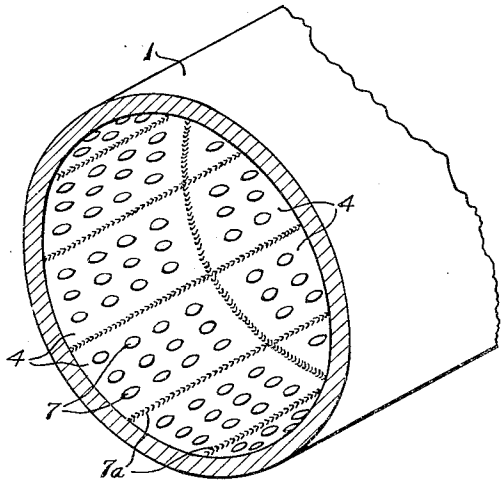


Fig. 1

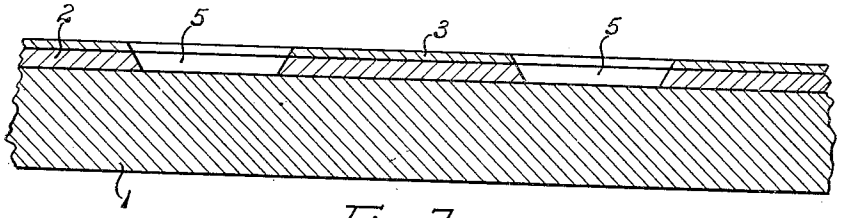


Fig. 2

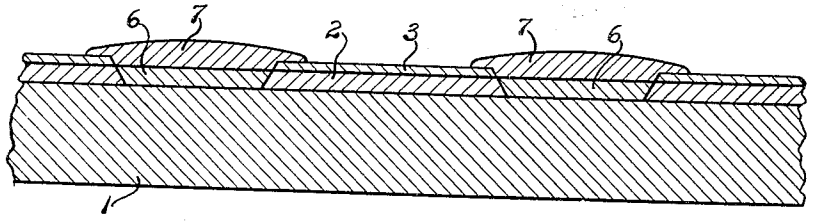


Fig. 3

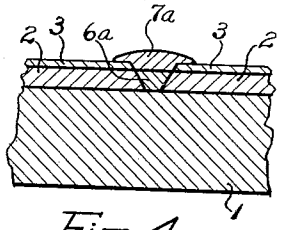


Fig. 4

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Patented June 27, 1939

2,164,074

UNITED STATES PATENT OFFICE

2,164,074

PROTECTIVE LINER FOR DRUMS

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Application December 11, 1935, Serial No. 53,838

7 Claims. (Cl. 29—162)

The present invention relates to the problem of protecting metallic sheets against corrosion and particularly to protecting such sheets by covering them with a liner of material of a higher resistance to corrosion than the sheet itself possesses.

An ordinary situation in which this problem arises is that of drums used in chemical processes or in oil distillation. These drums are often subject to great internal pressure and must be made of correspondingly heavy material. Instead of making them of material capable of resisting the corrosion, which material is relatively very expensive, they may, in accordance with prior practice, be made of carbon steel, which is cheaper, and lined with a corrosion-resisting liner. It is this general type of apparatus to which the present invention relates.

Among materials that have been used in the past for lining vessels in this way are steel with high chromium content, i. e. containing 12 to 18% chromium; and steel containing both chromium and nickel, the former making up about 18% and the latter about 8% of the total. The material is secured to the inside of the finished drum by placing into the drum edge to edge separate sheets bent to proper radius and welding them to the drum through perforations in the sheets, the sheets further being welded together and to the shell along the abutting edges. Considerable trouble has resulted in such vessels from the fact that the plug welds through the holes and at times the seam welds break. The reason for this difficulty is probably as follows: When such a weld is made between either high chromium steel or stainless steel of the 18–8 composition and carbon steel a fusion zone of doubtful ductility results, this zone extending from a region of zero chromium content adjacent to the carbon steel to a region of maximum chromium content adjacent to the high chromium or stainless steel liner. Steel containing chromium is very air hardening in the ranges of chrome content here involved and this property is intensified by the presence of carbon. While these steels usually contain carbon in only minute quantities, this content is increased in the weld metal by pick-up from the carbon steel plate. This results in a material which is very brittle in the "as welded" condition. Cracks are apt to appear in this brittle material during the cooling process which no amount of subsequent annealing can rectify. These cracks may extend into the material of the shell itself, which of course is a serious matter.

These difficulties are obviated by our invention which will now be described in connection with the accompanying drawing. In this drawing Fig. 1 shows a projected view of a drum with our invention applied, portions being broken away; Fig. 2 shows a fragmentary sectional view through the shell with the liner used by us in place but not yet secured to the shell; Fig. 3 shows a view similar to that of Fig. 2 with the liner secured to the shell; and Fig. 4 shows a fragmentary sectional view illustrating a seam weld.

The shell 1 to be protected from corrosion is, for example, made of carbon steel. The liner used by us to protect this shell against the corroding influence of gases, liquids or other materials placed in the shell is a compound or clad sheet consisting of a thin carbon steel layer 2 clad with a thin layer 3 of corrosion resisting metal, for example chrome steel containing in the neighborhood of 18% chromium, the two layers having been united by means of known processes resulting in a continuous intimate permanent bond between the two. This protective clad sheet is, just as in prior practice, preferably made up of individual pieces 4—4 which are bent to shape and placed edge to edge as the liner is installed. The sheets 4 are perforated as at 5, the perforations being preferably tapered as indicated, with the smaller diameter adjacent to the carbon steel shell. The perforations are preferably circular, although some other shape may, if desired, be used. After one of the sections 4 has been put in place it is secured to the shell by first filling the holes 5 with a fused layer of carbon steel 6, this steel being preferably of the same chemical composition as the shell 1 or approximately so. A welded junction is thereby produced between the carbon steel of the liner and the shell. This weld will be sound and of good strength and heat conductivity without being brittle, and, in any event, capable of being annealed to remove any brittle characteristic. As indicated in Fig. 3, the weld metal 6 is kept in depth about equal to the carbon steel component of the liner. Above it is next fused a layer 7 of corrosion resisting metal preferably somewhat higher in its corrosion resisting alloy content, chrome in the present instance, than the remaining surface metal 3 of the liner, this excess of the chrome serving to compensate for dilution by the carbon steel and resulting in a composition of the weld metal 7 approximately the same as that of the protective layer 3. The surface coat 7 may be applied in one or more layers and is preferably raised somewhat above the remaining surface

metal and allowed to extend laterally on all sides a little beyond the metal 6.

The number and spacing of the holes 5 is determined by conditions existing in each case and upon the service to which the finished vessel is to be put. Each of the holes is treated as described above.

Along abutting edges of adjacent sheets the carbon steel 2 of each is connected to the other and to the shell 1 by means of fused carbon steel and the weld 7a of chrome steel is filled in above the carbon steel weld metal 6a and extended laterally a little beyond it on both sides.

We have found the above method of protecting a carbon steel drum eminently satisfactory and have found particularly that the welds are very reliable and do not readily break.

While in the illustrative example just described the cladding is assumed to be a chrome steel, the method applies equally well to a liner made up of carbon steel clad with steel of the 18–8 composition, that is containing 18% of chromium and 8% of nickel. The required changes in the method are obvious, the main one being that in applying the weld metal 7 an alloy rod approximating the 18–8 alloy of the cladding is used.

The cladding might, moreover, be non-ferrous, e. g. nickel, the same method being followed with obvious required changes.

More generally yet, a vessel made of some material other than carbon steel can be protected by a clad sheet whose one component is a material like that of the vessel wall, and whose other layer is of the protective composition desired. In each case the bond between the sheet and the similar layer of the clad sheet is made by fusion metal of the same general composition as these two after which a layer of fusion metal is added of the same general composition as the protective cladding, this layer covering the plug and extending slightly beyond it at all points.

What we claim is:

1. The method of protecting a carbon steel sheet comprising the steps of perforating a carbon steel sheet clad with corrosion resisting steel, placing the clad sheet against the carbon steel sheet with its carbon steel component adjacent to the carbon steel sheet, connecting the carbon steel layer of the clad sheet to the carbon steel sheet by adding a layer of carbon steel which completely covers the bottom of the perforation and is fused to the carbon steel sheet and to the edge of the carbon steel layer of the clad sheet encompassing the perforation, and covering the added layer of carbon steel by fusing a layer of weld steel of at least approximately the same chemical composition as the cladding to it and to the cladding, said covering layer extending laterally at all points beyond the perforation and being fused to the cladding.

2. The method of protecting a carbon steel sheet comprising the steps of perforating a carbon steel sheet clad with corrosion resisting metal, placing the clad sheet against the carbon steel sheet with its carbon steel component adjacent to the carbon steel sheet, connecting the carbon steel layer of the clad sheet to the carbon steel sheet by adding a layer of carbon steel completely covering the bottom of the perforation and fused to the carbon steel sheet and to the edge of the carbon steel layer of the clad sheet encompassing the perforation, and covering the added layer of steel by fusing a layer of corrosion resisting metal of at least approximately the same chemical material as the cladding to it and to the cladding, said covering layer extending laterally at all points beyond the perforation and being fused to the cladding.

3. The method of protecting a relatively thick metallic sheet against corrosion, comprising the steps of perforating a relatively thin protective sheet of substantially the same chemical composition as the thick sheet and clad with a layer of metal of more highly corrosion resistant properties, placing the clad thin sheet against the thick sheet with the cladding facing away from the thick sheet, connecting the layer of the thin protective sheet which is of substantially the same composition as the thick sheet to the thick sheet by adding weld metal of substantially like composition as the thick sheet and fused to the bottoms and sides of the perforations, and covering the added weld metal by fusing a layer of corrosion resisting metal of approximately the same chemical material as the cladding to it and the cladding, said last named layer extending laterally beyond the first named fused metal at all points around the perforation and being fused to the cladding.

4. The method of securing a thin perforated clad sheet to a thick sheet comprising placing the thin sheet against the thick sheet with the cladding facing away from the thick sheet, and filling the perforation with a composite plug the inner layer of which is of substantially the same composition as the thick sheet and is fused to the thick sheet at the bottom of the perforation and to the thin sheet along the side of the perforation, and the outer layer of which is fused to the cladding and is of substantially the same composition as the cladding.

5. The method of securing together a thick sheet and a thin perforated sheet of substantially the same composition clad with a layer of corrosion resistant metal, comprising placing the two in contact with the cladding facing away from the thick sheet, and filling the perforation with a composite plug the inner layer of which is of the same composition as the thick sheet and is fused to it and to the thin sheet and the outer layer of which is fused to the cladding and is of substantially the same composition as the cladding.

6. The method of protecting a carbon steel sheet according to claim 1, the clad sheet having a plurality of perforations and each perforation being welded in accordance with claim 1.

7. The method of affixing to a carbon steel sheet a protective carbon steel liner clad with steel having an ingredient rendering it resistant to corrosion, comprising the steps of forming perforations through the clad carbon steel liner, placing it against the carbon steel sheet with the cladding facing away from the carbon steel sheet, uniting the liner with the sheet by adding weld material of substantially the same composition as the sheet fused to the entire bottom of each perforation and to the surrounding carbon steel edge of the liner, and covering the said added weld material by means of arc welding using in this operation a rod containing a somewhat higher percentage of the ingredient rendering the material resistant to corrosion than the cladding contains, whereby the resultant covering is of substantially the same composition as the cladding, extending said covering layer laterally at all points beyond the perforation and fusing it to the cladding.

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