July 5, 1949. W. H. SPOWERS, JR 2,475,360

ART OF GALVANIZING

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Fig. 1

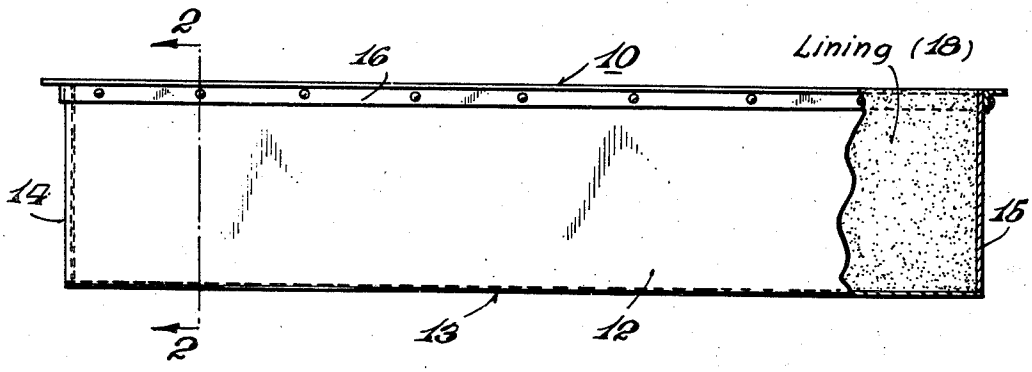
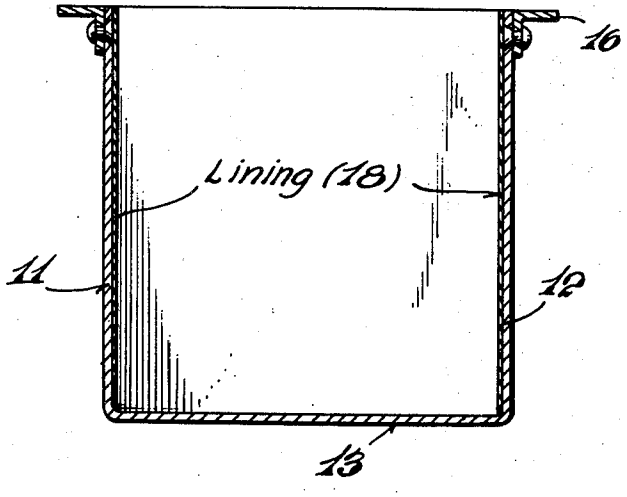


Fig. 2



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ART OF GALVANIZING

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10 Claims. (Cl. 220—63)

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This invention relates to improvements in the art of galvanizing and is more particularly concerned with the prevention of deterioration of steel galvanizing kettles caused by the dissolving away of the inner surfaces of the kettle wall under the action of molten zinc, and with the consequent reduction of dross losses resulting therefrom.

It has long been recognized that the formation of dross, i. e., zinc contaminated with about four percent iron, originates to a substantial degree in the molten zinc container or kettle itself which is usually made from steel plate, this being due to the fact that the application of heat to one side of a steel plate in contact with molten zinc on its other side results in the steel slowly but surely going into solution with the zinc to form large quantities of dross. The use of steel galvanizing kettles is, moreover, disadvantageous for another reason, namely, because the use of steel as a kettle material substantially restricts the temperature range at which the equipment may be operated, deterioration charts of steel galvanizing kettles showing that continued operation above 875° F. results in rapid failure of the kettle.

Nevertheless, the use of steel galvanizing kettles has persisted, despite the drawbacks thereof, largely because no other satisfactory material has been developed, and such attempts as have been made to prevent deterioration thereof under the action of the molten zinc have been based on improved kettle design, the application of heat to the top of the kettle side plates only, and, finally, on the provision of a refractory lining of a special grade of boro-silicate which is fused on to the inner surface of the steel kettle. While the advent of the refractory lined kettle has eliminated substantially the formation of dross originating in the kettle itself, its construction is expensive as the fusing on of the refractory lining involves laborious and time consuming operations adding substantially to the cost of manufacture. Moreover, although laboratory results indicated otherwise, the refractory lined kettle has not increased the temperature range at which the kettle can be operated without failure, and the refractory lining thereof, while possessing a relatively high degree of toughness and pliability, is nevertheless subject to being cracked and chipped in the normal rough usage of a galvanizing kettle. Hence, the refractory lined kettle has not proved itself in actual commercial practice, and its use has been accordingly limited.

The principal objects of the present invention,

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stated broadly, are the provision of a galvanizing kettle which, while constructed from steel plate, nevertheless constitutes no source of dross loss, which can be manufactured at a substantially lesser cost than the refractory lined kettle while at the same time overcoming the objections to the latter of being subject to cracking and chipping, and which, moreover, substantially increases the temperature range at which the galvanizing equipment can be operated. More specifically, the invention contemplates and provides a galvanizing kettle which may be constructed of steel plate according to the prior practice but which is interiorly lined with a suitable facing alloy having a high melting point and which is capable of bonding itself or of being readily bonded to the steel plate and which, moreover, possesses the property of being resistant to the action of molten zinc. Instead of being interiorly lined throughout, a galvanizing kettle according to the invention preferably has only the inner faces of its side walls lined with the alloy as aforesaid, actual practice having demonstrated that with the high-fired kettles of improved design wherein the larger proportion of the heat is applied to the top half of the side plates only, no substantial deterioration of the kettle bottom and end walls occurs, and hence there appears to exist no requirement for the lining thereof as herein proposed.

The invention also proposes various methods and/or procedures for lining the kettle or the side plates thereof as in the foregoing. According to one proposed method of the invention, the alloy is sprayed on to the inside of the kettle or on to the side plates thereof after construction, or to the steel plate from which the side plates are to be formed. According to another method herein proposed, the steel plate from which the kettle or its side plates is to be formed is sheeted or clad with the alloy applied for example as by tack welding a sheet of the alloy on to the plate and thereupon rolling, or by cladding the plate with the alloy applied thereto as a weld metal.

Other objects will be in part obvious and in part hereinafter pointed out in connection with the following analysis of the invention.

In the drawings:

Fig. 1 is a broken away side elevation of a conventional welded type galvanizing kettle, the inner faces of the side walls thereof being lined according to the present invention; and

Fig. 2 is a transverse section of the kettle illustrated in Fig. 1.

Referring to the drawings, reference character

10 indicates generally a galvanizing kettle of conventional welded construction made from boiled plate or firebox steel throughout and of which the side walls 11, 12 and the bottom wall 13 are formed of one plate. End walls 14, 15 are secured as by welding to the end edges of the bottom and side plates, and steel angles 16 may be secured as by riveting to the sides and ends along their top edges to provide flanges assisting in the mounting of the kettle on its setting. It will be understood that the particular kettle construction illustrated is to be regarded as typical only, and that the invention is not limited to such construction but, on the other hand, can be applied to galvanizing kettles of other standard or known types.

According to the invention, the inner faces of at least the kettle side plates 11 and 12 are lined or faced with one of the suitable high melting point alloys which have been found to possess the ability to resist the action of molten zinc at the galvanizing temperatures. Among the alloys which satisfactorily achieve the objects of the invention are certain of the alloys whose major and predominating component elements are chromium and a metal of the iron group, for example cobalt or nickel.

One of the chromium-cobalt alloys particularly suited to the invention is commercially known as "Stellite," which has been widely marketed for use in high speed cutting tools and as a hard facing, corrosion resistant and non-abrasive material. Moreover, the use of Stellite in the galvanizing arts is already known, this material having been used to provide a wear-resistant surface on sinker bars which are employed to hold wire being galvanized submerged in its passage through the molten zinc. Although its exact composition varies with the makers thereof and its intended uses, it is knwon that this alloy consists in the following elements in the approximate proportions:

	Percent
Chromium	20 to 35
Cobalt	40 to 80
Tungsten	0 to 25
Carbon	.75 to 2.5
Other elements	Remainder

As an example of a chromium-nickel alloy which provides a satisfactory lining for galvanizing kettles according to the invention, reference is made to the alloy commercially known as "Colmonoy," which consists of the following elements in the approximate proportions enumerated:

	Percent
Chromium	10 to 30
Nickel	50 to 80
Boron	1 to 7
Titanium	1 to 4
Other elements	Remainder

In applying kettle linings according to the invention, the selected alloy supplied in powdered or wire form, for example, may be sprayed by conventional metal spray equipment on to the inner face of the kettle side plates following the construction of the kettle, or it may be sprayed on to the plate or plates from which the kettle side plates or walls are to be fashioned. Or the plate or plates which ultimately form the kettle side plates may be clad or sheeted with the selected alloy which for this type of application is supplied in sheet form, the sheets being tack welded to the steel plate, for example, and then rolled

on to securely bond with the plate by any conventional rolling apparatus. It is also possible to clad the steel plates with the selected alloy by applying the alloy as a weld metal over the surface of the plate.

Other methods known in the art of applying facing alloys of the type enumerated above to steel plate or which would be apparent to one skilled in the field of uniting dissimilar metals are of course intended to be included within the scope and purview of the present invention.

Referring to Fig. 2, it will be observed that the kettle side walls 11 and 12 are each faced on their inner side with a lining 18 of the selected alloy applied either by the spray method or by the cladding procedure outlined above. Due to the properties of alloys such as "Stellite" and "Colmonoy" in resisting the deteriorating effect of molten zinc, the steel side walls of the kettle are protected by the lining 18 against the action of the molten zinc, even though heat is applied to the outer faces of the kettle side walls as is usual. Accordingly, the invention provides a kettle in which dross losses originating in the kettle itself are substantially eliminated, while at the same time providing a lined kettle whose lining is in effect an integral part of the kettle and hence not subject to chipping or cracking. Moreover, a kettle according to the invention permits operation of the equipment at the relatively high temperatures of 1000°–1100° F., and hence increases the operating range well above the more or less critical temperature of 875° F. characterizing the prior kettles.

Although suggestion is given in the foregoing that only the kettle side plates need be lined, the invention also contemplates the lining of the full interior of the kettle, under conditions or for certain applications making such necessary or advisable. Moreover, in lining welded kettles of the type illustrated it is contemplated that all joints will be welded with the alloy selected for the facing itself, the facing alloy in such instance being employed as the weld metal.

It will be understood that the invention has wider application than the lining of steel kettles used in the galvanizing technique as a container for the molten zinc. On the other hand, the invention contemplates lining with alloys of the type above indicated other articles employed in galvanizing and which are usually constructed from steel and hence subject in service to the deteriorating effect of molten zinc, among which may be mentioned by way of example work baskets as used in the basket method of galvanizing, sinker rolls for maintaining wire being galvanized submerged in the molten zinc, the tools for handling work being galvanized and the like.

For convenience in expression, the word "lining" is employed in certain of the appended claims to designate a lining applied either after construction of the kettle or to the steel plates or plate from which the kettle is to be fabricated.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A steel galvanizing kettle having an interior lining of a molten-zinc-resistant alloy whose major elements are chromium and cobalt.

2. A steel galvanizing kettle having an interior

lining of a molten-zinc-resistant alloy whose major elements are chromium and nickel.

3. A steel galvanizing kettle having an interior lining of a molten-zinc-resistant alloy selected from the group consisting of the chromium-cobalt and chromium-nickel alloys and which are characterized by predominating amounts of chromium-cobalt and chromium-nickel, respectively.

4. A galvanizing kettle constructed from steel plate and the inner faces of the side walls thereof being lined with a molten-zinc-resistant alloy whose major elements are chromium and cobalt.

5. A galvanizing kettle constructed from steel plate and the inner faces of the side walls thereof being lined with a molten-zinc-resistant alloy whose major elements are chromium and nickel.

6. A galvanizing kettle constructed from steel plate and the inner faces of the side walls thereof being lined with a molten-zinc-resistant alloy selected from the group consisting of the chromium-cobalt and chromium-nickel alloys and which are characterized by predominating amounts of chromium-cobalt and chromium-nickel, respectively.

7. A galvanizing kettle constructed from steel and having at least its inner side walls interiorly lined with molten-zinc-resistant alloy whose major elements are chromium and cobalt.

8. A galvanizing kettle constructed from steel and having at least its inner side walls interiorly

lined with molten-zinc-resistant alloy whose major elements are chromium and nickel.

9. A steel galvanizing kettle having an interior lining of a molten-zinc-resistant alloy whose major elements are chromium and a metal of the group consisting of cobalt and nickel.

10. A galvanizing kettle constructed from steel plate and the inner faces of the side walls thereof being lined with a molten-zinc-resistant alloy whose major elements are chromium and a metal of the group consisting of cobalt and nickel.

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