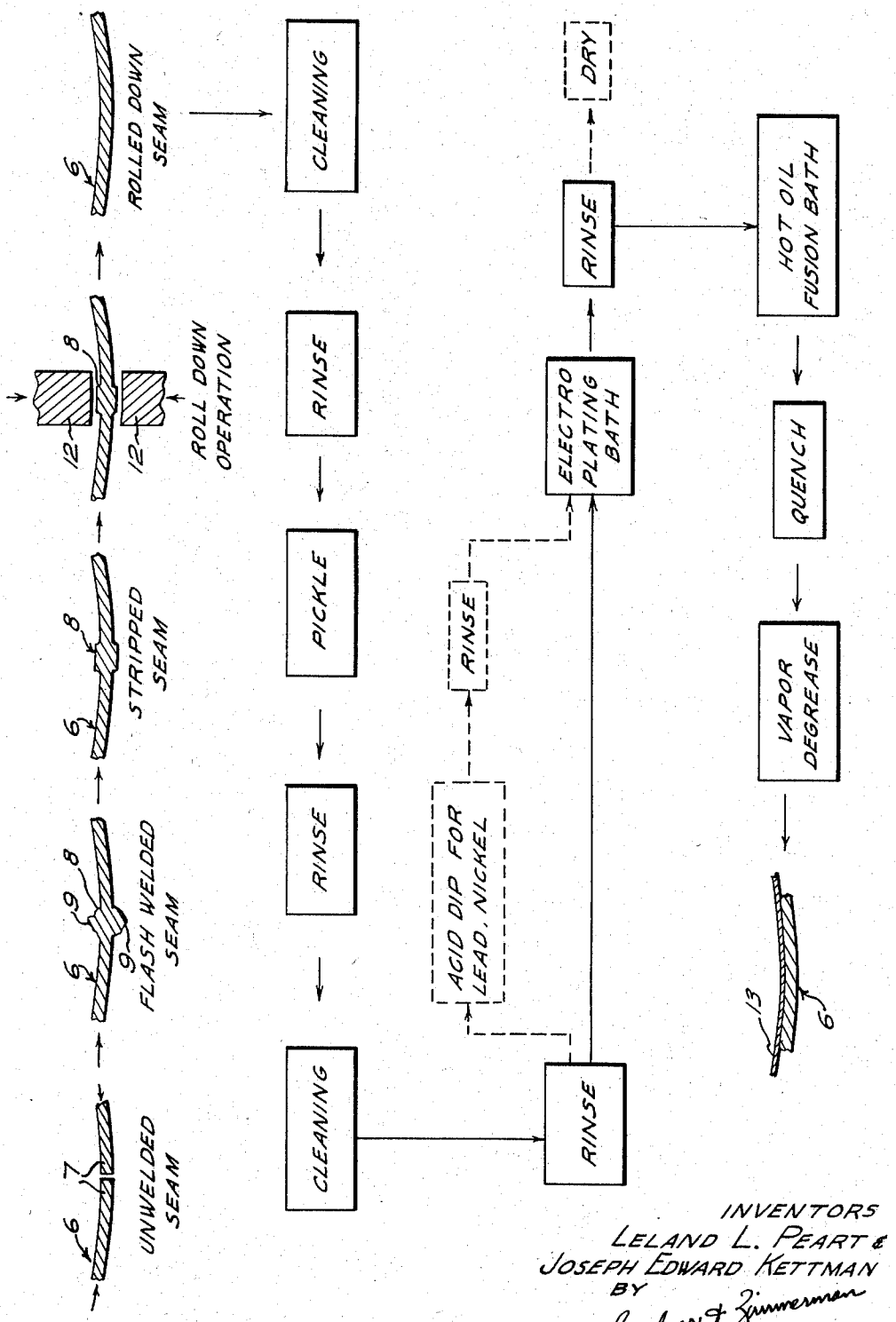
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METHOD OF PRODUCING ELECTROPLATED CONTAINERS

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METHOD OF PRODUCING ELECTROPLATED CONTAINERS

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This invention generally relates to methods and apparatus for electroplating metal surfaces with tin, lead, lead-tin alloys, nickel or the like, and is more particularly directed towards such a method and apparatus for electroplating metal surfaces having a welded seam therein, such as the side seam of a metal drum or similar container.

The plating process is a well developed art, and from the more basic hot dip method, electroplating has come into widespread commercial use. While hot dipping gives excellent results, it has the primary disadvantage of using excessive quantities of tin or other plating material. Electroplating is somewhat more complicated, but it possesses the advantage of controlling the thickness of the plating to any desired amount. Accordingly, for most large production jobs, economy dictates the use of electroplating, rather than the hot dip method where the plating material is relatively costly, such as in the case of tin, nickel, and the like.

No particular problems are encountered where a smooth surface is involved, but where a welded seam is present, it has heretofore been found difficult, if not impossible, to electroplate over the weld area and provide a plating equivalent to that produced remote from the weld area. This inferior plating results from the fact that following the welding, the base metal surface is pitted, i.e., has recesses, pockets and cracks, some being clearly visible to the naked eye, and others being of microscopic character. In any event, during the plating operation, the current tends to take the paths of least resistance, and consequently the plating will flow to the high areas surrounding such pockets or cracks rather than fill the same. The foregoing situation further results from the difficulty in cleaning the smaller cracks, and the filling of the pockets with gas formed during the electroplating, which further interferes with the plating flowing therein. Thus, examination of electroplated containers manufactured with conventional methods revealed excessive plating porosity in the zone of the side seam weld.

It is therefore an object of the present invention to provide a method of electroplating a metal surface having a weld area therein in which the plating or coating material may be kept at a minimum thickness while still insuring substantial freedom from porosity in the weld area.

Another object of this invention is to provide a method of electroplating the interior surface of a metal container having a welded side seam in which the weld is compacted and smoothed out so as to eliminate the larger cracks, pockets, and the like; the surface is electroplated; and then the deposited coating is subjected to a fusing operation which results in the filling or covering of the smaller cracks, etc. with plating material.

A further object of the invention is to provide a method of the character described in which an improved oil bath is provided for the fusing operation, such bath incorporating a desired fluxing action which removes any

microscopic oxide film and serves to protect the surface against further oxidation, as well as having a sufficiently high flash point to eliminate fire hazards, and which possesses other features of advantage.

A still further object of this invention is to provide a method of electroplating a metal container in which the container shell side seam is flash welded, the excessive weld metal is broached, the weld seam is compacted, and the welded shell is then subjected to a generally conventional electroplating operation.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred method of the invention which is diagrammatically illustrated in the drawing accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawing:

The figure is a diagrammatic representation of the major steps performed during the carrying out of the method of the present invention.

As hereinabove discussed, the method presently to be described is particularly well adapted for the electroplating of metal containers having a welded side seam, and the process will be primarily described in connection with tin plating wherein a coating of tin approximately .0002 inch in thickness is electrodeposited over the entire inner surface of the container, including the weld area. However, it will be later discussed how this same process may be utilized with other plating materials.

As will be understood, in the manufacture of metal containers, the steel or other base metal from which the body or shell is fabricated is rolled into generally cylindrical form and then provided with a longitudinally extending weld, usually referred to as a side seam. Conventionally, the weld is of the lap joint type, but as will be later explained, while this type of joint is possible, it possesses certain disadvantages from a plating standpoint. Accordingly, in the manufacture of the container **6**, as will be seen in the drawing, the ends **7** are first placed in butting relationship, and such ends are flash welded together. As is well known, flash welding is accomplished by passing sufficient electric current through the butting pieces to melt and fuse them together, while at the same time applying pressure in the direction of the arrows to insure a strong joint of compressed fused material.

Following the flash welding operation, due to the resulting boiling out of the metal, the welded seam **8** will include a protrusion **9** of metal extending generally radially inwardly and outwardly of the shell surfaces. The next step is the removal of these protrusions, and this is preferably effected by a stripping or broaching operation. This may be accomplished by using a series of cutter blades, each successive blade removing a thin layer of the protuding metal **9** until the side seam has a cross-sectional form such as that illustrated in the sketch entitled stripped seam. The stripping operation must be carefully performed as it is necessary to finish up with a seam of substantially uniform thickness without tears or the like appearing therein.

After the seam has been properly stripped, the seam is rolled with a pair of pressure rolls **12** or the like. The width of the rolls is substantially greater than the width of the stripped seam, and the peripheral surfaces of the respective rolls are of complementary form, that is, the inner roll has a convex surface and the outer roll has a concave surface, each surface having a curvature substantially equal to that of the container itself. The action of these pressure rolls **12** on the cold seam area is to

smooth out any small ridges resulting from the stripping operation, and more important, to compact the metal in the seam area. By compacting the metal, any microscopic pores or tears will be closed, and there will be insured a density of steel at least equivalent to the cold rolled surface on the remaining portions of the drum **6**.

The foregoing description deals with the preferred manner of side seaming to place the container body in optimum condition for electroplating, since the recesses, pockets, cracks, etc. resulting from conventional welding practices and which would materially interfere with proper plating, have been substantially eliminated. However, it should be made clear that while the flash welding procedure may be preferable, tests have indicated that acceptable plating may be obtained where the welded seam is of the lap joint type. However, here again, it is particularly necessary that the seam be pressure rolled to eliminate the large recess along the line of overlap of the joint. Here, the upper or inner roll down roll may have the convex surface such as that previously described while the lower or outer concave roll is provided with a recess into which the compressed metal may flow. Notwithstanding such an operation even when the rolls **12** follow the welding dies and act while the steel is still hot, it has been ascertained that the surface is pitted, i.e., that cracks, etc. still remain which present the previously discussed problems during plating.

Returning now to the further processing of the container shell **6** whose welded side seam has been compacted and/or smoothed out in one of the foregoing manners, the shell is now ready for plating, and preferably a generally conventional plating operation is performed. This includes placing the shell in an alkaline electro cleaner to remove surface dirt, oil and other foreign objects and then subjecting the shell to a cold water rinse. Preferably, a pickling operation is then performed which includes dipping the shell in a sulfuric acid pickling bath so as to remove any scale from the side seam weld as well as rust or oxidation from other surfaces of the shell. Another cold water rinse follows, and again the shell is dipped in an alkaline electro cleaner to remove any smut picked up during the pickling operation, followed by a cold water rinse.

Where tin is the plating material, the shell is then placed directly in the electroplating bath. However, for plating materials such as lead or nickel, the shell should first be dipped into a dilute acid bath, such as a 5% hydrochloric acid solution by volume which serves to remove oxide and neutralize the shell surface. This is followed by a cold water rinse.

Thus, the shell is now in a conventional plating bath with the tin, lead, nickel or other plating material forming the anode, and the shell comprising the cathode. In accordance with conventional practice, after the electroplating bath, the plated material is merely rinsed and dried. This would be adequate for the inner shell surfaces remote from the weld seam, but at the seam, notwithstanding the compacting operation performed thereon, there remains microscopic openings into which the plating material will not flow. In many instances, this would not be a deterrent to use of the container. However, where the container is to be used for certain chemicals or foods, it is essential that the porosity of the plating on the weld area meet the general standards required for general tin plating or the like.

Accordingly, as an important feature of the invention, following the electroplating and conventional rinsing, a flow brightening or fusing operation is performed on the plating, particularly where the plating is tin. This fusion results in a melting of the plate coating and the molten metal flows along a generally level path and will serve to fill any recesses or cracks in the base metal which remain even after the weld compacting operation.

Tin plate fusion is not basically new, and heretofore, vegetable or animal oils have been utilized as the heat transfer medium. Commercially available oils were found to possess certain disadvantages such as short pot life, imparting of streaked surface to the plate, low flash point, etc. It was determined that an adequate fusing oil must have a sufficiently high flash point, as well as produce a desired fluxing action, and finally a mineral oil possessing the following characteristics was proven satisfactory:

Viscosity at 210° F., SSU	135–414
Neutralization No.	.44–1.18
Iodine No.	32–54
Saponification No.	5–21

The oil has a flash point of 560–580° F. and contains 2.5–15% fatty acid. As tin melts at 450° F., the fusion bath may be maintained at approximately 500° F. without danger, and the weak fatty acid content affords the desired fluxing action.

As a specific example, the following mineral oil was proven satisfactory on tin plate:

Flash point, ° F.	570
6% tallow.	
2% degras.	
Viscosity at 210° F., SSU	135
Neutralization No.	.95
Iodine No.	38
Saponification No.	14

By virtue of the acid fluxing action, any microscopic oxide film is removed and the surface is protected against further oxidation.

As is known, in the electrodeposit of tin, the latter is built up as a crystalline structure. The hot oil removes the crystals, and therefore, following the fusion bath, the shell is promptly quenched in a cold solution of trichlorethylene before the crystals can be reformed. This not only cools the metal, but also serves to remove the major portion of oil which may be adhering to the same. The shell is then vapor degreased by hot trichlorethylene to further clean and remove any residual oil. The container **6** with its plating **13** is then completed and ready for such further manufacturing operations as may be required.

With a combination of side seam treatment and tin plate fusion, a plated container may be provided which meets the most exacting porosity requirements.

What is claimed is:

1. The method of constructing cylindrical metal shells which comprises welding opposite edges of a rolled plate to provide a cylindrical shell having a longitudinally extending side seam, stripping excess weld material from said seam to leave flat raised surfaces of weld material along such seam, applying pressure to said weld seam in a direction generally normal to the plane thereof to compact the weld metal to an extent to be substantially flush and continuous with the inner peripheral surface of said shell adjacent the seam, electrolytically depositing a layer of metal upon the inner surface of said shell, and then fusing said metal by immersing the shell into a hot mineral oil bath containing from 2.5 to 15% of free fatty acid maintained at a temperature above the melting point of the metal.

2. The method of ferrous metal fabrication which comprises welding opposite edges of ferrous metal plate providing a welded seam along such edges, stripping excess weld material from said seam and then applying pressure to said stripped weld seam in a direction generally normal to the plane thereof to compact the weld metal, electrolytically depositing a layer of metal upon the surface of the ferrous metal and upon the seam, and then fusing said plated metal by immersing the ferrous metal fabrication into a hot mineral oil bath containing from 2.5 to 15% of free fatty acid maintained at a temperature above the melting point of the plating metal.

3. The method of constructing cylindrical metal shells which comprises welding opposite edges of a rolled plate to provide a cylindrical shell having a longitudinally extending side seam, stripping excess weld material from said seam and then applying pressure to said strip seam in a direction generally normal to the plane thereof to compact the weld metal and flatten the same, electrolytically depositing a layer of metal upon the inner surface of said shell, and then fusing said metal by immersing the shell into a hot mineral oil bath containing from 2.5 to 15% of free fatty acid maintained at a temperature above the melting point of the metal.

References Cited in the file of this patent

UNITED STATES PATENTS

1,884,467	Windsor	Oct. 25, 1932
1,906,376	Holmes	May 2, 1933
2,276,007	Young et al.	Mar. 10, 1942
2,303,035	Fink	Nov. 24, 1942
2,333,567	Helmore	Nov. 2, 1943
2,533,533	Stoddard	Dec. 12, 1950
2,643,975	Neish	June 30, 1953

FOREIGN PATENTS

457,780	Great Britain	Apr. 29, 1936
458,940	Great Britain	Dec. 30, 1936