April 1, 1941. A. MARLAND 2,237,259

PROCESS OF GALVANIZING SUBSTANTIALLY CLOSED CONTAINERS

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FIG. I.

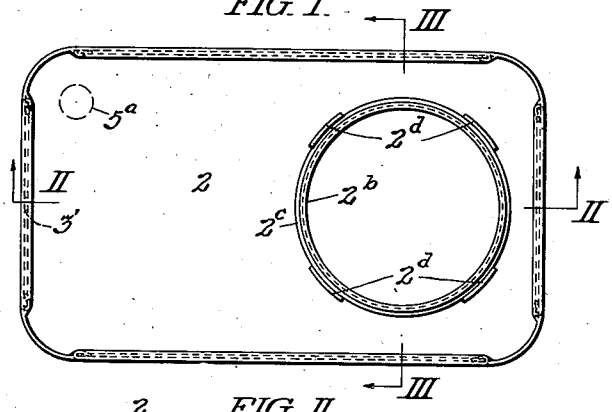


FIG. IV.

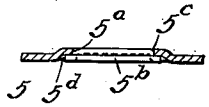


FIG. II.

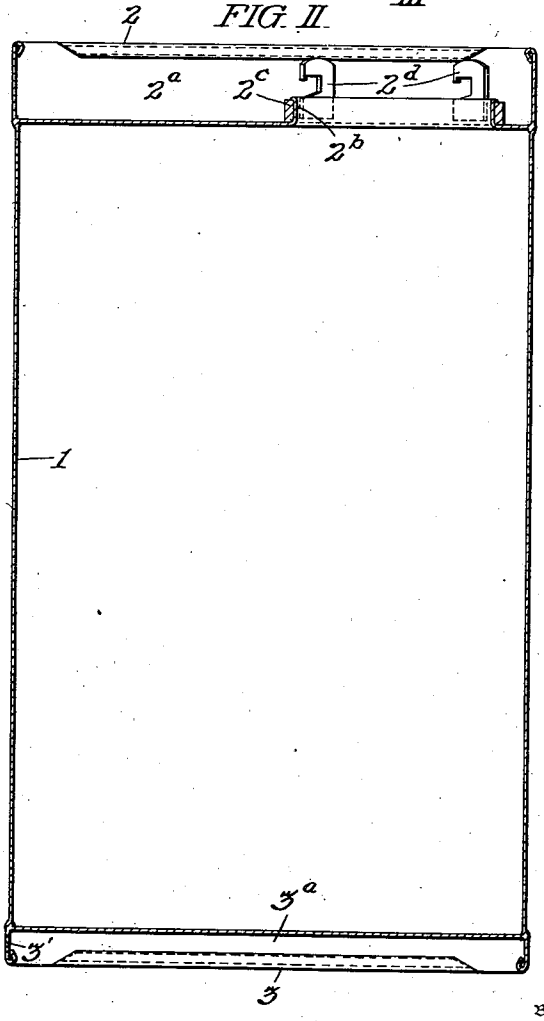
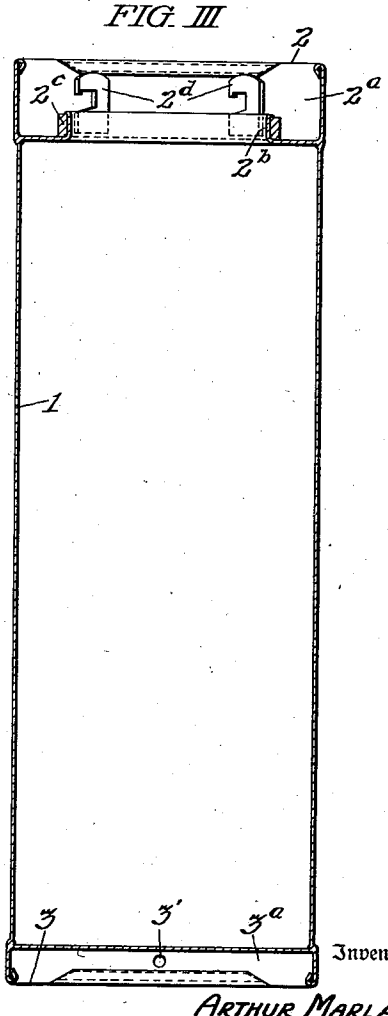


FIG. III



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PROCESS OF GALVANIZING SUBSTANTIALLY CLOSED CONTAINERS

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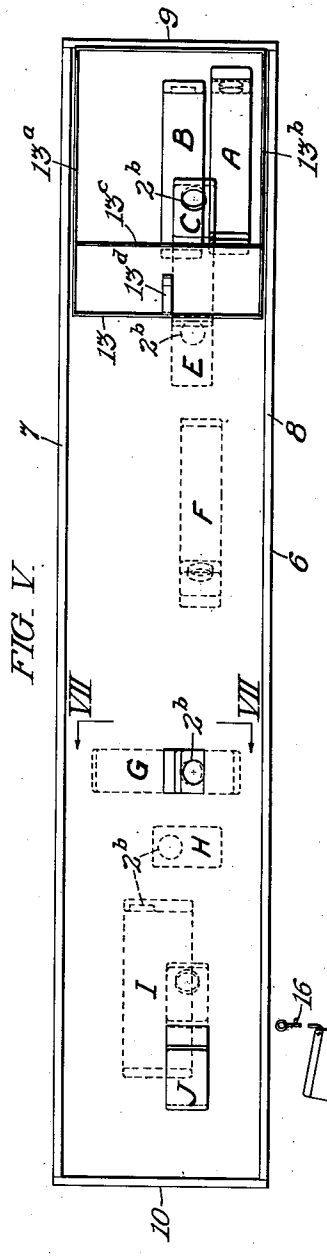


FIG. V.

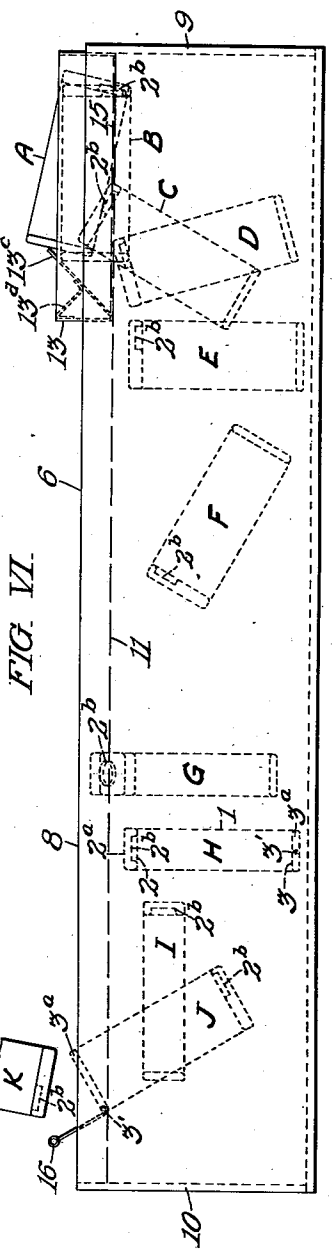


FIG. VI.

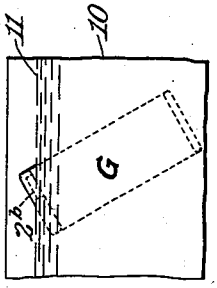


FIG. VIII.

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PROCESS OF GALVANIZING SUBSTANTIALLY CLOSED CONTAINERS

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6 Claims. (Cl. 91—70.2)

Strictly speaking, galvanizing is a process of electrodeposition. However, what is at present thus termed in the art, and contemplated herein, is the mechanical coating of metal with an alloy of zinc and lead known as spelter, by dipping the article to be coated therewith into a molten bath of spelter.

It is an object and effect of this invention to efficiently coat the interior of a ferric metal container with molten metal, of any composition which will prevent corrosion of the ferric metal, and to effect such coating despite the fact that the container has but a single comparatively small opening at one end thereof to permit the ingress of the molten metal and the egress of the excess of such metal, but leave the interior of the box entirely coated with congealed metal.

My invention is particularly applicable to a gun powder box which, in accordance with the specification requirements of the United States Government, is rectangular in shape and 9.75 by 16.25 by 28.775 inches in outside dimensions, having a 2.344 inches deep flange surrounding one end closure, and a 1.094 inches deep flange surrounding the opposite end closure; the end of the box having the deeper flange being the top and having a single circular opening 6.053 inches in diameter near one of the narrow ends of that end closure; which opening is surrounded by a circular flange with cam slots to receive projections from a spider locking cap which has at its center a screw threaded stud with a handle for forming a tight closure.

In view of representations by previous manufacturers of such boxes, that it was impossible to completely coat the interior thereof with molten metal with but one opening into the box; heretofore, said Government specifications have permitted an opening one and one-half inches in diameter in the bottom closure of such a box, to be left open during the process of galvanizing the box but subsequently closed by what is termed a "penny" which is in fact a circular metal disk which is used to cover the one and one-half inch opening by soldering it both inside and outside the bottom wall of the box. The purpose of that one and one-half inch opening in the bottom of the box is to prevent the galvanizing bath of molten spelter into which the box is dipped from trapping air in it, and permit the spelter to quickly fill the box and to drain out of the box as it is lifted from the molten spelter.

Despite permission of the United States Government for competing manufacturers to make such powder boxes with the two openings aforesaid; tests of such boxes furnished to the Government, by experts of the War Department, have heretofore resulted in an average of seven per cent of the boxes being rejected as defective, mostly because of leaks of the seams around the "penny"; necessitating a Government charge of forty-eight cents to remedy that defect, in any one box.

My present invention is the result of long experimentation with the object and effect of devising a process of introducing and withdrawing the ferric metal container with respect to the molten spelter bath, with the result that the container is thoroughly coated both inside and outside with an imperforate layer of spelter protecting the ferric metal from corrosion.

Of course, my invention effects a material reduction in the cost of such powder boxes to the Government by the elimination of the steps of forming the one and one-half inch opening, forming the "penny" closure therefor, soldering the inside joint between the box and "penny," soldering the outside joint between the box and "penny," and testing those joints. Moreover, as demonstrated by commercial use, my invention is so efficacious in the provision of imperforate coatings upon such substantially closed containers as to reduce to less than one-half of one per cent such powder boxes which do not meet the test requirements of the Government.

My invention includes the various novel features of operation hereinafter more definitely specified.

In said drawings: Fig. I is a plan view of the top end of such a U. S. Government powder box.

Fig. II is a longitudinal sectional view of such a U. S. Government powder box, taken through the 16.25 inches width of the box on the line II, II in Fig. I.

Fig. III is a longitudinal sectional view taken through the 9.75 inches width of the box, in diametrical relation with the 6.053 inches opening, on the line III, III in Fig. I.

Fig. IV is a fragmentary vertical sectional view of a portion of the bottom of a powder box having the one and one-half inch opening and soldered "penny" closure aforesaid.

Fig. V is a plan view of a tank containing a bath of molten spelter and showing successive positions of such a box container as shown in Figs. I to III inclusive, as it is introduced to said bath, progressed therein, and withdrawn therefrom.

Fig. VI is a longitudinal elevation of said tank

showing the successive positions of said container represented in Fig. V.

Fig. VII is a fragmentary vertical sectional view taken on the line VII, VII in Fig. V, showing the angle of inclination of the container and the relation of the single opening therein at the top thereof to the top level of the galvanizing bath in the sixth successive position of the container in its progression through the bath.

Referring to Figs. I to III; the rectangular body 1 of the box has the top closure 2 welded thereon and forming the 2.344 inches flange 2^a and with the 6.053 inches circular opening 2^b surrounded with the circular flange 2^c having the cam slot lugs 2^d thereon. The bottom closure 3 of said box is welded thereon to form the 1.094 inches flange 3^a.

The 9.75 inches side of said flange 3^a opposite to that side of the box which has the opening 2^b at the other end is provided with a small aperture 3' for engaging a hook implement 16 as hereinafter described.

In accordance with my invention, said bottom closure 3 is imperforate. However, as shown in Fig. IV, the bottom closure 5 has a one and one-half inch opening 5^a therein provided with the closure "penny" 5^b which is supposed to be sealed thereover by an inside solder joint 5^c and an outside solder joint 5^d.

Referring to Figs. V and VI; the tank 6 has opposite side walls 7 and 8 and opposite end walls 9 and 10 and the molten spelter therein is maintained at the level indicated by the line 11 shown in Fig. VI.

Adjoining the end wall 9 of said tank and in rigid relation therewith is the flux box 13 conveniently formed of a metal plate bent to rectangular configuration and having its opposite side walls 13^a and 13^b in spaced relation with the side walls 7 and 8 of said tank. The left hand end of said flux box has in rigid relation therewith the inclined deflecting plate 13^c connected with the left hand end wall of said box by the brace 13^d. The purpose and effect of said box 13 is to confine to its area a layer of molten flux 15 upon the top surface of the molten spelter 11, which flux is preferably borax, and which coats both the outer and inner surfaces of the container as the latter is thrust below the top level 11 of the spelter bath as hereinafter described.

Referring to Figs. V, VI, and VII; the eleven successive positions of the container with reference to the baths of flux and spelter are respectively indicated by the letters A to K inclusive.

As indicated at A; the container is introduced through the flux bath and into the spelter bath with its wider plane side walls in vertical position and with its narrower plane side walls at an inclusive angle of approximately twelve and one-half degrees to the horizontal top level line 11 of the spelter bath, and with the single opening 2^b at the lower corner; thus permitting both the flux and the spelter to flow through said opening into the interior of the container while the opposite bottom, then high, end of the container is depressed until the opposite narrower plane sides of the container reach the horizontal position indicated at B. The container is then turned downward at its bottom end, until its assumes the position C, in which its longitudinal axis is inclined upward toward position A, at substantially sixty degrees to the surface line 11, while its upper end opening 2^b continues receiving the molten flux and spelter. When the container has received as much of the molten material as will flow into it in the position C; it is depressed and tilted with its opposite wider side walls in vertical planes until it assumes the position D, with its axis upwardly inclined away, from position C, at an angle of substantially seventy degrees to line 11, in which position the molten material will flow into the uppermost corner of the interior space of the container. The container is then moved to position E in which all of its side walls are in upright position and the opening 2^b submerged below the top level 11 of the spelter so that the upper flanges 2^a and 2^d of the box and its opening are thoroughly coated with the molten spelter. The container is maintained with its opposite wider side walls in vertical planes while it is moved to the position F in which its axis is upwardly inclined away from position E at an angle of substantially thirty degrees to line 11. It is then progressed and turned substantially ninety degrees to position G, with its axis at substantially sixty degrees to surface 11.

It is to be noted with reference to Figs. V, VI, and VII, that in the position G the container opening 2^b is only partly below the surface level 11 of the spelter bath, so that the molten material may flow in and air out. In that position, any surplus flux in the contents of the container floats to the top of the spelter and escapes upon the top surface of the spelter in the tank. It is well-known in the art that oxides and dross collect on the top of a molten spelter bath and that such oxides and dross, unless removed, will deleteriously affect the resultant galvanized coating on a container. Therefore, I find it convenient to remove such oxides and dross, by any convenient means, from the surface of the molten metal in the interior of said container, when the container is in the position G with its opening 2^b only partially below the surface level 11 of the spelter bath.

Thereupon, the container is moved from the position G to the position H in which it is again entirely submerged in the spelter. The container is then turned from the vertical position H to the horizontal position I with the opening 2^b at the right hand end thereof, such movement causing the molten spelter contents of the container to rewash over the interior surface of the container and assure the complete coating of such surface. The container is then further turned from the horizontal position I to the position J in which the opposite wider sides of the container are in vertical planes and with the opening 2^b at the then lower end of the container, and the container axis upwardly inclined away from position I at an angle of substantially sixty degrees to line 11. In that position, the perforation 3' in the flange 3^a is exposed above the top level 11 of the spelter and I find it convenient to engage the hook implement 16 therein to facilitate the operation of lifting said container from the bath and turning it in a horizontal plane to the position K above the tank, in which its axis is inclined upwardly reversely to its position J. During that movement, the excess molten spelter within the container gravitates through the opening 2^b back into the tank. It may be observed that the tilting of the top closure 2, which is then at the lower end of the container, from the inclined position J to the reversely inclined position K facilitates the discharge of any excess molten spelter from the interior of the container, which excess might other-

wise lodge on said closure 2 and, of course, the surplus spelter drains from what is the upper end of the container in the position J through said perforation 3', and the surplus molten spelter upon the outside of the container gravitates into the tank as the container is raised to the position K; thus leaving the container with a substantially uniform corrosion resisting coating throughout all of its interior and exterior surfaces.

In other words; during the process above described, the container body 1 is turned counter-clockwise, with reference to Fig. VI, from its position A to its position F, through an angle of one hundred sixty-two and one-half degrees. It is then turned, clockwise with reference to Figs. VI and VII, thirty degrees, and turned, clockwise with reference to Fig. V, ninety degrees and raised, from its position F to its position G. It is then turned, clockwise with reference to Fig. VII, thirty degrees and lowered, from its position G to its position H. It is then turned counter-clockwise, with reference to Fig. VI, ninety degrees and raised from its position H to its position I. It is then turned counter-clockwise, with reference to Fig. VII, ninety degress and raised, from its position I to its position J. It is then turned clockwise, with reference to Fig. VI, forty degrees and raised from the position J to the position K, while its molten contents drain out.

Said process is made continuous by introducing containers at the initial end of the tank 6 at the same rate that they are withdrawn from the terminal end of the tank. In other words; a plurality of containers form a progressing series, in which successive containers are simultaneously at respectively different stages in the process. In one plant where progression of the containers is effected manually, under my supervision, such United States Government powder boxes are completely galvanized at the rate of sixty per hour. That rate may be considerably increased by substituting mechanical means for progressing the containers in the tank.

However, I do not desire to limit myself to the precise details of construction, arrangement, or method of operation herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention, as defined in the appended claims. For instance, the liquid body of corrosion resisting coating material may be aluminum paint, or any waterproof varnish, or tin.

I claim:

1. The process of galvanizing the interior and exterior surfaces of a substantially closed container having a single opening at one end thereof, in a body of molten spelter having a layer of molten flux covering a region of its top surface; which consists in inclining the container with its longitudinal axis at an angle of substantially twelve and one-half degrees to said surface with said opening presented laterally at the then lowest end of the container and partly below said region surface, so that both molten flux and metal flow into the container through said opening and air escapes through said opening; then, while keeping said opening only partly submerged below said surface, lowering the opposite end of said container below said surface and turning the container counter-clockwise in a vertical plane through an angle of substantially seventy-two and one-half degrees; then turning said container counter-clockwise substantially forty-five degrees while completely submerging said container below the surface of the molten metal; then, while said container is below the surface of the molten metal, turning said container clockwise substantially fifteen degrees and then counter-clockwise substantially sixty degrees; then turning said container substantially thirty degrees clockwise in said plane, and substantially ninety degrees counter-clockwise in a horizontal plane while raising said container until said opening is partly above and partly below the surface of the molten metal; then removing oxides, by any convenient means, from the surface of the molten metal in the interior of said container; then turning said container clockwise in a vertical plane substantially thirty degrees, to vertical position with its opening upward, and submerging it in the molten metal; then turning said container clockwise in a vertical plane substantially ninety degrees, to horizontal position below the surface of the molten metal; then turning said container counter-clockwise substantially ninety degrees in a vertical plane, transverse to its longitudinal axis, and substantially sixty degrees clockwise in a vertical plane, parallel with its longitudinal axis, with its opening downward; then turning said container clockwise substantially forty degrees in a vertical plane parallel with its longitudinal axis and substantially one hundred eighty degrees in a horizontal plane, transverse to its longitudinal axis, while raising it from the molten metal; thereby draining the excess molten metal from the interior of the container through said opening and discharging excess molten metal from its exterior.

2. A process as in claim 1; wherein a plurality of similar containers are simultaneously progressed, in series relation, in the successive stages described, and are simultaneously at respectively different stages in the process.

3. The process of galvanizing the interior and exterior surfaces of a substantially closed container having a single opening at one end thereof, in a body of molten spelter, having a layer of molten flux covering a region of its top surface at one end thereof; which consists in inclining the container, in a vertical plane, with its longitudinal axis at an angle of substantially twelve and one-half degrees to said surface, with said opening presented laterally at the then lowest end of the container and partly below the surface of said flux region, so that both flux and spelter flow into the container through said opening; then, while keeping said opening only partly submerged below said surface and permitting the molten material to flow in and air out therethrough, lowering the opposite end of said container below said surface, in a vertical plane, until its longitudinal axis is at an angle of substantially sixty degrees to said surface and upwardly inclined toward its first position, and the container is filled with the molten material to the level of said surface; then depressing and tilting said container in the opposite direction, in a vertical plane, until its longitudinal axis is at an angle of substantially seventy-five degrees to said surface and upwardly inclined away from its first position and with its opening submerged and its interior entirely filled with the molten material; then, while it is entirely submerged, turning it, in a vertical plane, until its longitudinal axis is vertical; then turning it, in a vertical plane, until its longitudinal axis is inclined upwardly away from its first position, at an angle of substantially thirty degrees to said surface; then turning it, on its longitudinal axis, ninety

degrees, and progressing it until its longitudinal axis is inclined upwardly, in a transverse vertical plane at an angle of substantially sixty degrees to said surface, and with its opening only partly submerged; then again turning said container to vertical position, and submerging it; then turning it, in a vertical plane, until its longitudinal axis is substantially horizontal, with its opening toward its first position; then turning it, on its longitudinal axis, ninety degrees, and progressing it until its longitudinal axis is upwardly inclined away from its first position, in a vertical plane, at an angle of substantially sixty degrees to said surface, with its opening at its lower end; then turning it substantially forty degrees, in a vertical plane parallel with its longitudinal axis and substantially one hundred eighty degrees in a horizontal plane, transverse to its longitudinal axis, while raising it above said surface, with its longitudinal axis upwardly inclined toward its first position, while all the molten material drains from it.

4. A process as in claim 3; wherein a plurality of similar containers are simultaneously progressed, in series relation, in the successive stages described, and are simultaneously at respectively different stages in the process.

5. The process of coating, with a corrosion resisting material, the interior surfaces of a substantially closed metallic container, having a single opening at one end thereof, while progressing it in a liquid body of the coating material; which includes inclining the container with its opening at its lower end and partly submerged in said liquid; turning the container downward at its other end until it is entirely submerged in said liquid, with its opening uppermost; turning it, on its longitudinal axis, until it is at right angles to its submerged position, while raising it until its opening partly emerges from the liquid; against submerging it and turning it until its opening is again at its lower end; and maintaining its opening downward while raising it from the liquid and draining the excess liquid from it.

6. A process as in claim 5; wherein a plurality of containers are simultaneously progressed, in series relation, in the successive stages described, and are simultaneously at respectively different stages in the process.

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