Oct. 22, 1929. C. A. DAVIS 1,732,504

METHOD AND APPARATUS FOR COATING

Filed Feb. 12, 1925

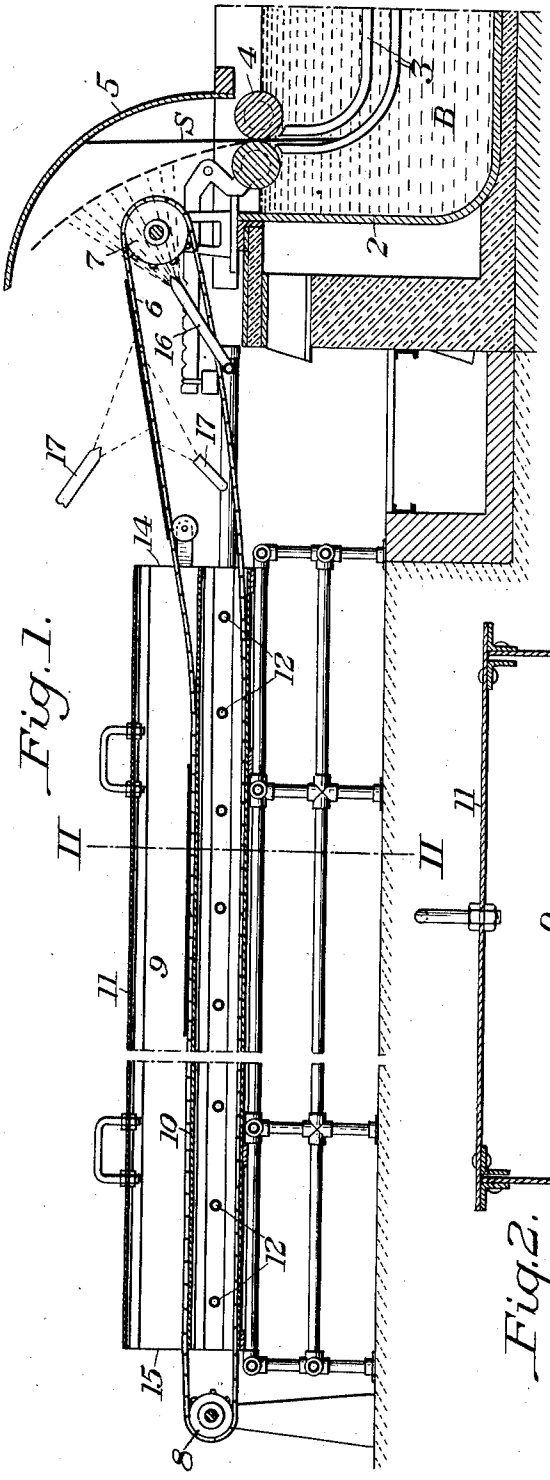


Fig. 1.

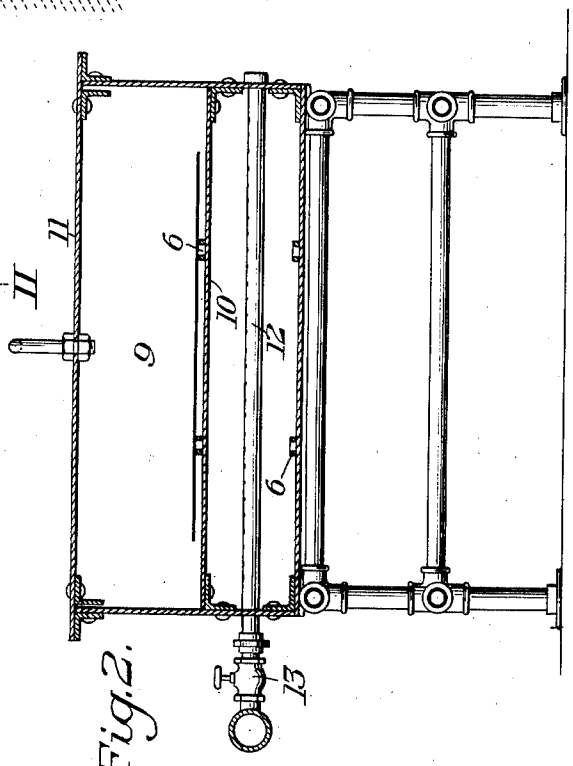


Fig. 2.

INVENTOR
Charles A. Davis,
by
Byrnes, Stubbs & Parmelee
his Attys.

Patented Oct. 22, 1929 1,732,504

UNITED STATES PATENT OFFICE

CHARLES A. DAVIS, OF YOUNGSTOWN, OHIO

METHOD AND APPARATUS FOR COATING

Application filed February 12, 1925. Serial No. 8,683.

The present invention relates broadly to the art of coating, and method of producing the same, and more particularly to this art as applicable to the production of galvanized articles or bodies.

This invention may be utilized, not only in connection with sheets, bars, special shapes and the like, but in connection with any articles on which the particular coating produced by my invention is desired. Throughout the specification and claims therefore I use the term "articles" in its generic sense as definitive of the wide variety of shapes and articles to which galvanizing may be applicable.

At the present time it is customary to galvanize by employing a bath of zinc and tin; zinc, lead and tin; zinc, lead, tin and aluminum or zinc, tin and aluminum, or any other desired combination of metals capable of producing the type of coating desired. My invention may be used with coating baths having any of these different characteristics, and it will therefore be understood that the term "coating" is used in its generic sense as definitive of a protective layer or body without regard specifically to the combination thereof.

Heretofore, in the art to which the present invention relates, when it has been desired to produce dull finished coated articles, such as sheets, it has been customary to pass the same through a bath having its temperature increased from the usual point of 800° to 850° F. to a higher range of from 1000° to 1050° F. This, however, has involved many difficulties, and has not resulted in a highly satisfactory or uniform product.

In the first place, the high temperature referred to tends to cause the formation of dross in the bath, and the suspension of such dross. This necessarily impairs the character of the coating produced. Also, the temperature conditions are very destructive to the apparatus, thereby materially shortening its life.

An additional difficulty encountered in this type of operation has been that of obtaining a uniform product of high quality. Frequently, so called "freak" sheets have been produced having a non-uniform coating. This has been due partly to the dross referred to, but largely to the wiping action of the rolls which have been loaded or otherwise held together to tightly engage the sheet or other article. The result has been a varying pressure at different parts of the sheet, this usually being greatest in the center and least at the edges, resulting in a sheet having a central portion of dark color approximating that of the base metal, and edge portions with a gradually thickening coat.

As the coated article has left the bath, usually by passage between a pair of exit rolls where it has been a sheet, or by suitable conveyors or the like where it has other characteristics, it has been subjected to the cooling action of the atmosphere, or to a blast of cooling air. I have found that the result of such cooling is to cause the sheet to spangle, this being due to crystallization or the formation of crystals before a proper bond has been effected between the coating and the base metal.

I have found that the difficulties and objections to the methods as heretofore practiced for the production of a dull galvanized finish may be entirely overcome and obviated by the present invention. At the same time, there may be produced an article having a heavier weight of tight coating per unit of area together with increased ductility without fear of checking or peeling, and these constitute certain of the objects of the present invention.

In the accompanying drawings I have shown for purposes of illustration only certain preferred embodiments of the present invention, particularly as applicable to the art of galvanizing sheets, it being understood however that the drawings do not define the limits of my invention as changes in the construction of the apparatus and the operation, as adaptable to the different shapes or articles being handled, may be made without departing either from the spirit of the invention or scope of my broader claims.

In the drawings:

Figure 1 is a longitudinal sectional view

through a portion of one form of apparatus embodying the present invention; and

Figure 2 is a transverse sectional view, on an enlarged scale, on the line II—II of Figure 1.

In carrying out the present invention there may be utilized a suitable form of pot or galvanizing tank 2 of any desired construction suitable for the type of bath and type of material being coated. In the illustrated embodiment of the invention, I have shown a pot especially adaptable to the coating of sheets, and for this reason it is shown as provided with guides 3 adapted to deliver the sheets successively to a pair of exit rolls 4 located adjacent the surface of the bath B within the pot.

Disposed above the exit rolls, and in cooperative relation thereto, in such manner as to engage a sheet *s* as it is delivered by the exit rolls, is a guide or deflector 5 which may be in the form of a heat retaining hood if desired, and adapted to deflect the sheet laterally as indicated in dotted lines in the drawings. Mounted in such manner as to receive a deflected sheet is a conveyor 6 of any desired construction preferably guided by a roll or set of rolls 7 mounted on the pot and passing to a second roll or set of rolls 8 mounted at any desired distance therefrom. Conveniently, these rolls may be in the form of sprockets any or all of which may be driven to effect the desired movement of the conveyor, or additional driving means may be provided as well understood in the art.

Intermediate the ends of the conveyor there is provided means for subjecting the successive sheets to predetermined temperature conditions or zones whereby the rapidity of cooling may be accurately and definitely controlled. Preferably, this operation is obtained by providing a leer or leer tunnel 9 having suitable supporting means 10 therein for the upper run of the conveyor. Conveniently, this supporting means may be in the form of a continuously extending sheet or partition carried by the sides of the leer and adapted to effect a more nearly uniform distribution of heat to the coated articles as will hereafter be more fully pointed out. The upper portion of the leer may be provided with an easily removable cover or closure 11 whereby access to the interior thereof is facilitated.

Mounted at suitable points within the leer, and preferably below the partition 10 is means for producing definite temperature conditions throughout the length of the leer. In accordance with the illustrated embodiment of the invention these temperature conditions may be obtained by utilizing a plurality of transversely extending burners 12, suitably spaced, and each provided with a controlling valve 13 whereby the amount of gas or other combustible material supplied thereto may be effectively controlled. In actual operation, these burners will preferably be so controlled as to provide a gradually decreasing temperature condition from the entering end 14 of the leer to the exit end 15, whereby the temperature of the sheet, or other article, will be gradually brought from its high point to a lower temperature condition without permitting crystallization or spangling to occur.

It will be understood that the heating medium utilized for the leer is immaterial, as is also the type of heater employed, it being possible to use any type of heating means operative either from the standpoint of direct heat transfer, or reflective heat transfer, as desired.

In accordance with the present invention, the bath B is maintained at its normal point of approximately 800° to 850° F. At this temperature, the formation of dross is at a minimum, and it is not suspended in the bath in such manner as to interfere with the production of an effective coating. At this temperature also, the apparatus may be effectively operated, as the conditions are not such as to so influence the same as is the case where higher temperatures, approximately of 1000° F. or over, have heretofore been employed. I have found that where normal temperature conditions are used, there is a tendency for the coating to crystallize as the article leaves the bath due probably to the cooling action either of the atmosphere or air blast before the article and the coating have become firmly united. Obviously, this is objectionable as it permits the coating later to peel or flake away from the article particularly as it is bent or flexed from its normal position. I have found that this condition may be entirely overcome by subjecting the article to such temperature conditions substantially at the time it leaves the bath to prevent such crystallization. These temperature conditions may obviously be obtained in many ways, but I have found that they may expeditiously be created by the use of a burner or burners 16 located adjacent the exit rolls and effective for directing a blast or blasts against the articles after they have left the bath. By properly positioning such burners, burning of the coating does not take place, and the temperature of the article is maintained at a point above that at which crystallization is possible. If desired supplemental burners 17 may be provided intermediate the burners 16 and the leer for the purpose of further controlling the temperature of the coated articles.

A further difficulty, heretofore encountered in the art has been due partly to the action of the conveyors on the coated articles. Ordinarily, the conveyors have been at a materially lower temperature than the articles, and along the lines of contact between the articles and the conveyors there has been such

a chilling action as to materially augment this crystallization. This augmenting has resulted in non-uniformity of the product. By the apparatus disclosed herein, the conveyors are maintained at the desired temperature to obviate this chilling action, not only by the burners 16 and 17 but also, if desired, by returning the lower run of the conveyor through the leer. In actual practice, where the conditions are such that a leer cannot be constructed of such nature as to permit both runs of the conveyor to travel therethrough, I have found that the burners provided, are, if properly controlled, effective for maintaining a temperature such that chilling does not take place.

I have found also that certain of the advantages of the present invention are inherent in the application of heat to a coated article irrespective, to some extent, of the possible previous formation of a crystalline or semicrystalline structure, due to the fact that the increased temperature to which the coating is subjected tends to improve the bond between such coating and thereby impart increased ductility irrespective of the fact that crystallization may, to at least some extent, be present.

In actual practice, it has been definitely determined that by this control of temperatures, preferably involving an increase in temperature of the article as it leaves the bath and thereafter a gradual decrease in temperature controllably regulated, the coating is caused to bond firmly to the article without any danger of crystallization. By this process, I am enabled to produce articles having a thicker coating, due partly to the lower bath temperature, and a materially tighter coating due to the control of the temperature conditions of the coated article. Also, successive articles have uniform coatings of the desired thickness and present surfaces not only of uniform color but of uniform characteristics free from spangling and having the desired dull finish characteristics.

Further advantages of my invention are inherent in the coating operation in the bath at a lower temperature. As the temperature increases, with a corresponding increase in the dross formation and suspension the coating in effect is more nearly an oxidation of irregular characteristics and without the desired amount of ductility. By the coating at a lower temperature, and thereafter subjecting the surfaces of the coated article to such temperature conditions that uniformity and ductility is insured, the product is correspondingly improved.

Still further advantages of my invention arise from the provision of the heavier coating, it having heretofore been necessary to decrease the coat thickness in order to produce a dull finish, not only by reason of the higher bath temperature but also by reason of the wiping action of the rolls used in connection therewith.

I claim:

1. In the method of galvanizing, the steps consisting in subjecting an article to the action of a bath of coating material, removing the coated article, subjecting the coated article to sufficient heat in excess of the bath temperature to prevent crystallization, and thereafter gradually cooling the coated article by applied heat, substantially as described.

2. In the method of galvanizing, the steps consisting in subjecting an article at relatively low temperature to the action of a bath of coating material, removing the coated article, increasing the temperature of at least the coating on said article, and thereafter gradually cooling the coated article, substantially as described.

3. In the method of producing dull finished galvanized articles, the steps consisting in coating the articles, removing the coated articles from the coating zone while conserving the heat thereof and increasing the temperature, and thereafter gradually cooling the coated articles, substantially as described.

4. In the method of producing dull finished galvanized articles, the steps consisting in coating an article, removing the article from the coating zone, increasing the temperature at least of the coating to prevent crystallization thereof, and thereafter controllably cooling the coated article, substantially as described.

5. In the method of producing dull finished galvanized articles, the steps consisting in coating an article, removing the article from the coating zone, increasing the temperature at least of the coating to prevent crystallization thereof, and thereafter cooling the article by subjecting the same to gradually decreasing temperature conditions, substantially as described.

6. A coating apparatus, comprising coating means, annealing means providing controlled temperature gradations, and temperature increasing means intermediate said first mentioned means, substantially as described.

7. Coating apparatus, comprising coating means, an annealing leer providing controlled temperature gradations, conveying means for transferring a coated article to the leer, and heat increasing means cooperating with said conveyor, substantially as described.

8. In the method of galvanizing, the steps consisting of passing an article through a bath maintained at such temperature that dross suspension is minimized, thereafter removing said article from the bath and increasing the temperature of the coating, and effecting gradual cooling of the coated article, substantially as described.

9. In the method of galvanizing, the steps consisting of subjecting an article to the

action of a bath of coating material, removing the coated article, increasing the temperature of at least the coating on said article, and thereafter controlling the cooling of the article by predetermined gradations of temperature to produce the desired character and appearance of the coating.

In testimony whereof I have hereunto set my hand.

CHARLES A. DAVIS.