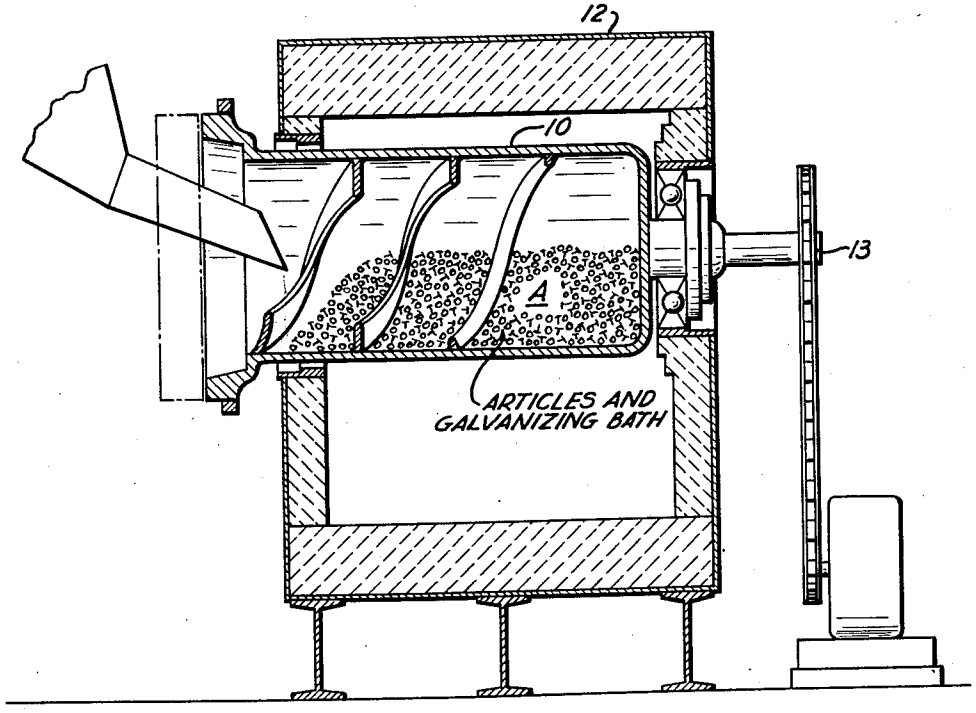
May 28, 1957 H. F. MYERS ET AL 2,793,965

GALVANIZING COMPOSITION AND PROCESS

Filed Oct. 28, 1955



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United States Patent Office 2,793,965 Patented May 28, 1957

2,793,965

GALVANIZING COMPOSITION AND PROCESS

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Application October 28, 1955, Serial No. 543,575

10 Claims. (Cl. 117—109)

This invention relates to an improved method and coating composition for galvanizing small ferrous articles in drums, a procedure sometimes known as "hot rumbling." The present application is a continuation-in-part of our co-pending application Serial No. 353,900, filed May 8, 1953, and now abandoned.

Commonly small ferrous articles, such as nails, are galvanized in batch lots by mixing or rumbling them in a heated drum, which contains a quantity of zinc in molten or flake form along with a flux. The drum is heated to a sufficient temperature and the charge is mixed for a sufficient time for the flux to react with the surfaces of the articles and for molten zinc to flow over these surfaces and coat them. After being coated, the articles are dumped into a quench bath or are spray-cooled to set the coating and wash off excess flux. The washed articles then can be drained, dried and packaged. The fluxes commonly used in such processes are ammonium chloride and zinc ammonium chloride.

The quality of articles galvanized by hot rumbling depends on several factors, such as, (*a*) how well the surface is cleaned before the articles reach the drum, (*b*) the fluxing action, and (*c*) the skill of the operator, who must control the relation between quantity of flux, drum temperature and time of mixing. The prior art has recognized the difficulty of producing smooth, bright coated nails, for example, and has used small additions of tin metal, tin-zinc alloy, lead, or tin pot by-products (skimmings or dross) to increase the fluidity of the zinc and produce brighter and smoother coatings.

An object of the present invention is to provide improved hot rumbling galvanizing methods and coating ingredients which minimize galvanizing defects, such as uncoated spots, and produce smoother and brighter coatings than usual methods.

A further object is to provide improved hot rumbling galvanizing methods and coating ingredients which reduce the quantity of zinc required in the bath to deposit a coating of any given weight on the articles.

A further object is to provide an improved method of preparing article surfaces, which method is an integral part of the galvanizing operation and reduces the resistance to flow of coating material.

The single figure of the drawing is a vertical section of a typical conventional apparatus in which our method can be performed. The apparatus includes a rotatable drum **10**, a suitably fired furnace **12** in which the drum is journaled, and a drive **13** for the drum. A charge of articles A, together with a galvanizing bath constituted in accordance with our invention, are fed into one end of the drum.

According to our invention volatile tin salts are incorporated in the galvanizing charge along with the zinc and the usual flux. Many tin salts which have appreciable vapor pressure near the melting point of zinc can be used, but with chloride fluxes we prefer the tin chlorides or sodium stannate. Both stannous and stannic chlorides are operable, although stannic chloride is less practical

because of excessive fuming. A composition for galvanizing 100 parts by weight of small articles, such as nails, in accordance with our invention consists of the following:

Zinc	4 to 13.5 parts by weight.
Flux	At least 1 part by weight.
Volatile tin salt	Sufficient to furnish a tin content equal to 0.25 to 4.0 percent of the weight of zinc.

In accordance with known principles, the quantity of zinc needed within the foregoing range is a function of the total surface area of the articles. Small sized articles which have a large total surface area of course require a greater quantity of zinc than larger articles which have less total surface area. The quantity of zinc actually needed to meet any particular specification is based on experience and weight tests which take into account factors such as heating losses, large size heads and extra length in the case of nails, checkered surfaces, and a safety factor. We have found that the total amount of zinc required to produce a quality product free from uncoated spots and roughness can be reduced as much as 22 percent for certain types of articles by addition of volatile tin salts in accordance with our invention. The zinc reduction is greatest for larger size articles. In a typical operation of galvanizing 7/8 inch x 11 gauge roofing nails, we have reduced the quantity of zinc needed for 200 pounds of nails from about 25 pounds to about 21.5 pounds, a saving of 14 percent, by adding tin in an amount equivalent to 1.25 percent of the weight of zinc.

Specific examples of charge compositions for galvanizing 200 pounds of 7/8 inch x 11 gauge barbed roofing nails are as follows:

Example I

	Pounds
Zinc flake	21.5
Zinc ammonium chloride	2
Stannous chloride (anhydrous)	0.45

Example II

	Pounds
Zinc flake	21.5
Zinc ammonium chloride	2
Stannous chloride ($SnCl_2 \cdot 2H_2O$)	0.51

Example III

	Pounds
Zinc flake	21.5
Ammonium chloride	2
Stannous chloride (anhydrous)	0.45

Example IV

	Pounds
Zinc flake	21.5
Ammonium chloride	2
Stannous chloride ($SnCl_2 \cdot 2H_2O$)	0.51

Example V

	Pounds
Zinc flake	21.5
Zinc ammonium chloride	2
Sodium stannate	0.63

Example VI

	Pounds
Zinc flake	21.5
Ammonium chloride	2
Sodium stannate	0.63

According to our galvanizing method a quantity of clean ferrous articles, for example 200 pounds of nails, is charged into a drum together with the proper proportions of molten or flake zinc, fluxing agent and volatile tin salt. The drum is rotated and heated to an internal temperature between approximately 1200° and 1650° F.

(preferably 1400° to 1500° F.), which melts the flux, tin salt and the zinc. The tumbling action brings the molten ingredients into intimate contact with the surfaces of the articles and coats these surfaces uniformly. After about five minutes of tumbling in the heated drum, the articles are discharged to a quench or spray cooler.

Our method attains the benefits of metallic tin additions to the galvanizing charge and also improves the fluxing or surface preparation of the article. Thus the method minimizes the occurrence of uncoated spots and produces more uniform finishes. Its further advantage of conserving zinc has already been pointed out.

While we have disclosed only certain preferred ways of practicing the invention, it is apparent that other alternatives and equivalents may arise. Therefore we do not wish to be limited by the disclosure set forth, but only by the scope of the appended claims.

We claim:

1. A galvanizing charge which consists of the following:

Zinc	4 to 13.5 parts by weight.
Flux	At least 1 part by weight.
Volatile tin salt	Sufficient to furnish a tin content equal to ¼% to 4% of the weight of zinc, said salt being selected from the group consisting of stannous chloride and sodium stannate.

2. A galvanizing charge as defined in claim 1 in which said volatile tin salt is stannous chloride.

3. A galvanizing charge as defined in claim 1 in which said volatile tin salt is sodium stannate.

4. A method of galvanizing small articles comprising mixing them in a heated revolving drum with zinc and a flux and containing in addition a volatile tin salt in an amount sufficient to furnish a tin content equal to ¼% to 4% of the weight of zinc, said salt being selected from the group consisting of stannous chloride and sodium stannate.

5. A method as defined in claim 4 in which said volatile tin salt is stannous chloride.

6. A method as defined in claim 4 in which said volatile tin salt is sodium stannate.

7. A method of galvanizing small ferrous articles comprising mixing them in a proportion of about 100 parts by weight with a charge which consists of the following:

Zinc	4 to 13.5 parts by weight.
Flux	At least 1 part by weight.
Volatile tin salt	Sufficient to furnish a tin content equal to ¼% to 4% of the weight of zinc.

and heating said articles and charge to a temperature of 1200° to 1650° F. while continuing the mixing for about five minutes until the articles are completely coated with zinc, said salt being selected from the group consisting of stannous chloride and sodium stannate.

8. A method as defined in claim 7 in which said volatile tin salt is stannous chloride.

9. A method as defined in claim 7 in which said volatile tin salt is sodium stannate.

10. A method of galvanizing small ferrous articles comprising mixing them in a drum in a proportion of about 100 parts by weight with a charge which consists of the following:

Zinc	4 to 13.5 parts by weight.
Flux	At least 1 part by weight.
Stannous chloride	Sufficient to furnish a tin content equal to ¼% to 4% of the weight of zinc.

the flux being of the group consisting of zinc ammonium chloride and ammonium chloride, and heating said articles and charge to a temperature of 1200° to 1650° F. while rotating said drum for about five minutes until the articles are completely coated with zinc.

References Cited in the file of this patent

UNITED STATES PATENTS

933,324	Mowry	Sept. 7, 1909
1,029,351	Farnham	June 11, 1912
1,133,628	Field et al.	Mar. 30, 1915
1,939,667	Csanyi	Dec. 19, 1933
2,501,262	Carhart et al.	Mar. 21, 1950

FOREIGN PATENTS

386	Great Britain	of 1857