

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Method and Apparatus for Applying a Particulate Material to an Object

We, RHEEM INTERNATIONAL INC., a Corporation of the State of Delaware, United States of America, of 400 Park Avenue, New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to a method and apparatus for applying a particulate material, such as a powdered resin or a metallic powder, to a metallic object, so as to form a substantially uniform coating on 15 said object. More particularly, it relates to a method and apparatus for coating the internal surfaces of the head and the bottom of a metal shipping container.

20 Metal shipping containers, such as black steel drums and pails, are used extensively for transporting and storing a wide variety of products, but their use has been limited in that it is often not possible or practical to use such black steel drums and pails for 25 transporting or storing products having high acid activity qualities, or products producing corrosive activities or strong chemical reactions, all of which act upon the black steel to perforate the container or 30 dilute or impair products carried by the container.

35 Herebefore, when it was desired to carry such products in metal shipping containers, excessively expensive containers, such as stainless steel drums, have had to be utilized, or relatively expensive coatings have had to be applied to the interior of the containers by such methods as painting or dipping. It has been found that such coating operations have not only been time-consuming, but also they have been inefficient in that it has been difficult to apply the coatings with any marked degree of consistency

of thickness; in that voids created by air bubbles often result; in that incomplete coverage is frequently encountered; and in that coatings so applied often become brittle and break away from the coated surfaces in use.

More recently, methods and apparatus for applying particulate materials to the interior surfaces of drum and pail bodies have been devised, and by these methods and apparatus a substantially uniform, complete coating of 50 corrosive-resistant material on black steel container bodies has been attained. Obviously, however, if the desired results are to be accomplished, it is necessary to provide an equally effective coating for the interior surfaces of the heads and the 60 bottoms of the containers, and it is an object of the present invention to provide means and apparatus for efficiently and effectively coating such heads and bottoms with the same materials, with adequate provision for coating at the joiners of the heads and the bottoms with the container bodies, as well as on the normal exposed surfaces, so that complete interior container coating is accomplished. 70

It is another object of the invention to provide apparatus for coating the heads and the bottoms of metal containers with a particulate material, which apparatus is simple and inexpensive to construct and operate, 75 and which is readily adaptable for use in association with modern, high-speed steel container production lines.

According to the present invention there is provided apparatus for applying a particulate material to a heated body so as to form a substantially uniform coating on one surface of the body, which apparatus comprises: a bench; a hopper mounted on the bench and adapted to receive and discharge 85 a quantity of a particulate material; an

open-ended drum mounted on the bench adjacent to the hopper; clamping means mounted on the drum adjacent to the lower open end of the drum, said clamping means being disposed so as to clamp a heated body at said lower open end of the drum and close said end; means for conveying particulate material from the hopper to the interior of the drum and depositing the particulate material on the heated body; and means within the drum for spreading the particulate material substantially uniformly over the exposed surface of the heated body.

Further, according to the present invention there is provided a method for applying a particulate material to one surface of a flat body which comprises the steps of; heating the flat body to a temperature of approximately 375° Fahrenheit; clamping the heated body to the lower end of an open-ended drum so as to expose one surface of the heated body within the drum and close the drum; depositing a quantity of particulate material on the exposed surface of the heated body; spreading the particulate material over the exposed surface of the heated body; and retaining the spread particulate material in contact with the exposed surface of the heated body for a time sufficient to create adhesion of particulate material to the said surface.

One embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:—

Fig. 1 is a side elevational view of the apparatus of the present invention;

Fig. 2 is a top plan view of the apparatus illustrated in Fig. 1;

Fig. 3 is an enlarged sectional view of the applicator drum of the apparatus; and

Fig. 4 is a further enlarged, fragmentary view showing details of a portion of the apparatus within the applicator drum illustrated in Fig. 3.

Referring to Fig. 1 of the drawings, a frame or bench 10 is provided. Mounted adjacent one end of the bench 10 is a hopper 12 which is disposed so as to receive a quantity of particulate material, such as powdered resin or a metallic powder, and to feed the particulate material into the apparatus in the manner hereinafter described.

A vibrator 14 and a feeder 16, driven by a power drive, such as a motor 18, are mounted on the bench 10 adjacent to the hopper 12, and are disposed so as to vibrate and feed particulate material discharged by gravity from the hopper 12. Connected to the feeder 16 is a cylindrical housing 20 which, as best shown in Figs. 2 and 3, extends laterally from the feeder 16 into an applicator drum, hereinafter described in detail, and has an open discharge end 22 dis-

posed within said applicator drum. Within the housing 20, as shown in Fig. 3, is a worm drive 24 disposed so as to receive particulate material discharged from the hopper 12 into the feeder 16, to drive it through the open end 22 of the housing 20, and to discharge it into the applicator drum.

The applicator drum, generally designated 30, is an open-ended cylindrical drum which is rotatably mounted on the bench 10, the body of the drum 30 being disposed on the bench 10 laterally of the feeder 16 so that the housing 20 enters one side of the drum 30 at substantially the longitudinal axis of the drum 30, the drum 30 being rotatable about the housing 20. The housing 20 terminates at its open end 22 short of the vertical axis of the drum 30.

Handles 32, shown in Figs. 1 and 2 of the drawings, are mounted on the drum 30 in position so that they may be grasped to rotate the drum 30 on the bench 10. It will be readily understood that, in lieu of said handles 32, other means to rotate the drum 30, such as power means, may be provided.

The sides of the drum 30 are flanged inwardly at the open ends of the drum 30, as best shown in Fig. 3, so as to define shoulders 34. Adjustably externally mounted on the shoulders 34 are adaptor rings 36 disposed so as to receive the chimes of container heads and bottoms of various diameters to be coated. The internal ends of the rings 36 and the shoulders 34 are bevelled in alignment so that particulate material within the drum 30 may enter the said chimes in the manner hereinafter described.

As best shown in Figs. 3 and 4 of the drawings, a container head or bottom 40 to be coated is disposed in an open end of the drum 30 within the shoulder 34 at that end of the drum 30, with the inner surface of the head or bottom 40 exposed to the interior of the drum 30. A chime 42, of the head or bottom 40 is fitted over the ring 36. Mounted on the shoulder 34 adjacent the ring 36, are suitable clamps, such as the clamp 44, disposed so as to clamp the chime 42 on the ring 36 and removably support the head or bottom 40 in the coating position hereinabove described. A plurality of clamps 44 may be interconnected by mechanical means for hand or power operation as a unit.

A tubular housing 50 is mounted on the bench 10. The housing 50 extends into the drum 30, entering the drum 30 on the side of the drum 30 opposite the entry of the housing 20, the housing 50 being disposed substantially in axial alignment with the housing 20, and the drum 30 being rotatable about the housing 50. Axially disposed within the housing 50 is a shaft 52, shown in Fig. 3. One end 54 of the shaft 52 protrudes beyond the housing 50, and power

means, such as a motor 56 mounted on the bench 10 and a chain and sprocket drive 58, shown in Figs. 1 and 2, rotatably drive the shaft 52. As shown in Fig. 3, at the inner end of the shaft 52 there is mounted a bevelled gear 60 which meshes with a bevelled gear 62 mounted on a vertical shaft 64 disposed in a housing 66, the shaft 64 being along the vertical axis of the drum 30.

The vertical shaft 64 protrudes beyond both ends of the housing 66, and radially mounted on the ends of the shaft 64 externally of the housing 66 are vertically disposed blades 70, which extend over a substantial portion of the interior of the drum 30. The blades 70 are spaced from the open ends of the drum 30.

Mounted on the free ends of the blades 70 are outwardly directed paddles 72 which are disposed adjacent to the aligned bevelled edges of the rings 36 and the shoulders 34.

If desired, a timing light 80 may also be mounted on the bench 10, the purpose of the timing light 80 being to indicate the elapsed time of the coating operation within the applicator drum 30. In lieu of providing the timing light 80, automatic timing devices may be utilised.

In operation of the apparatus of the present invention, the drum 30 is positioned as shown in Fig. 1, with an open end thereof upward. A head or bottom 40 to be coated is heated, preferably to a metal temperature of approximately 375° Fahrenheit which, in use, has proven to be an acceptable temperature, although the stated temperature is not to be deemed a limitation. The preheated head or bottom 40 is then placed at said open end and clamped into position, as hereinabove described. The drum 30 is then rotated 180°.

Meanwhile, the hopper 12 has been charged with a quantity of particulate material. The vibrator 14 and the feeder 16 will then be activated, and the worm drive 24 will deliver a quantity of the particulate material to the inside of the applicator drum 30, where it will fall by gravity from the open end 22 of the housing 20 to the head or bottom 40 clamped at the lower end of the drum 30.

The rotation of the blades 70 within the drum 30 will spread the particulate material over the entire exposed surface of the head or bottom 40, and the paddles 72 will replenish material in difficult adhesion areas and fill voids, particularly in the chime area.

During the coating operation on the first head or bottom 40, a second heated head or bottom 40 is clamped into position at the upper end of the drum 30. The applicator drum 30 is left in the position described for a time sufficient to produce satisfactory coating results, dependent on materials utilised.

The timing light 80 is set so as to flash upon completion of the chosen time cycle, or the automatic timing means are set to operate upon completion of said time cycle.

Upon completion of the time cycle, the drum 30 is again rotated 180°, and the coating operation will then continue on the second head or bottom 40, while the previously coated head or bottom 40 is removed from the apparatus and replaced with another preheated head or bottom 40 to be subsequently coated.

It has also been found advantageous to post-heat the coated parts, which may be accomplished by placing the coated heads or bottoms 40 in an oven and maintaining a metal temperature of approximately 390° Fahrenheit for about fourteen minutes, and then removing the parts from the oven and allowing them to cool. Although post-heating may not be essential, in certain coating operations, it is recommended to ensure an evenly coated surface.

WHAT WE CLAIM IS:—

1. Apparatus for applying a particulate material to a heated body so as to form a substantially uniform coating on one surface of the body, which apparatus comprises: a bench; a hopper mounted on the bench and adapted to receive and discharge a quantity of a particulate material; an open-ended drum mounted on the bench adjacent to the hopper; clamping means mounted on the drum adjacent to the lower open end of the drum, said clamping means being disposed so as to clamp a heated body at said lower open end of the drum and close said end; means for conveying particulate material from the hopper to the interior of the drum, and depositing the particulate material on the heated body; and means within the drum for spreading the particulate material substantially uniformly over the exposed surface of the heated body.

2. Apparatus as defined in Claim 1, wherein the means for spreading the particulate material comprises: rotatably mounted blades.

3. Apparatus for applying a particulate material to a heated body so as to form a substantially uniform coating on one surface of the body, which apparatus comprises: a bench; a hopper mounted on the bench and adapted to receive and discharge a quantity of a particulate material; a drum rotatably mounted on the bench adjacent to the hopper, said drum having upper and lower open ends; clamping means mounted on the open ends of the drum, said clamping means being disposed so as to clamp heated bodies to the open ends of the drum and close said ends; means for conveying particulate material from the hopper to the interior of the drum and depositing the particulate material by gravity on the heated body

clamped to the lower open end of the drum; means within the drum for spreading the particulate material over the surface of the heated body clamped to the lower end of the drum; and means for rotating the drum 180° so as to reverse the positions of the open ends of the drum.

4. Apparatus for applying a particulate material to a heated, chimed head for a metallic container so as to form a substantially uniform coating on one surface of the chimed head, which apparatus comprises: a bench; a hopper mounted on the bench and adapted to receive and discharge a quantity of a particulate material; an open-ended drum mounted on the bench adjacent to the hopper; clamping means mounted on the drum adjacent to the lower, open end of the drum, said clamping means being disposed so as to clamp a heated, chimed head for a metallic container at said lower end of the drum and close said end, with the flat surface of the head and a portion of the chime internally exposed in the drum; means for conveying particulate material from the hopper to the interior of the drum and depositing the particulate material on the heated head; and means within the drum for spreading the particulate material over the exposed flat surface and the exposed portion of the chime of the head.

5. Apparatus as defined in Claim 4, wherein the means within the drum for spreading the particulate material over the exposed flat surface and the exposed portion of the chime of the head comprises: vertically disposed blades rotatably mounted within the drum, said blades being adjacent to the exposed flat surface of the head in contact with the particulate material deposited thereon; and paddles mounted on the free end of the blades, said paddles being adjacent to the exposed portion of the chime and in contact with the particulate material.

6. The method for applying a particulate material to one surface of a flat body which comprises the steps of: heating the flat body to a temperature of approximately 375° Fahrenheit; clamping the heated body to the

lower end of an open-ended drum so as to expose one surface of the heated body within the drum and close the drum; depositing a quantity of particulate material on the exposed surface of the heated body; spreading the particulate material over the exposed surface of the heated body; and retaining the spread particulate material in contact with the exposed surface of the heated body for a time sufficient to create adhesion of particulate material to the said surface.

7. The method of Claim 6, including the step of rotating the drum after contact of the particulate material with the exposed surface of the heated body.

8. The method of Claim 6, including the steps of removing the heated body from the drum and post-heating the body at a temperature of approximately 390° Fahrenheit for approximately fourteen minutes.

9. The method of applying a particulate material in one operation to surfaces of two flat, heated objects which comprises the steps of: heating the objects; clamping the heated objects to opposite ends of an open-ended drum so as to expose one surface of each of the heated objects within the drum and close the drum; disposing the drum so that one of said heated objects defines the bottom of the drum and the other of said heated objects defines the top of said drum; depositing a quantity of particulate material within the drum and upon the exposed surface of the heated object defining the bottom of the drum; spreading the particulate material over said exposed surface so as to form a coating thereon; rotating the drum so as to reverse the positions of the heated objects; spreading the particulate material over the exposed surface of the heated object formerly defining the top of the drum so as to form a coating thereon; removing the heated object formerly defining the bottom of the drum; rotating the drum; and removing the heated object formerly defining the top of the drum.

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