

SPECIFICATION

Method of and apparatus for painting a multiplicity of parts together

The present invention relates to a method of and an apparatus for painting a multiplicity of parts together.

Spray painting has been used to paint relatively small metallic parts such as slide fastener sliders and end stops, which are hung down from a hanger. Such practice is advantageous in that the parts can have a neat coating, but requires undesirable expenditure of time and labor in attaching the parts one by one to the hanger.

Another painting process has been known in which a batch of parts and paint are put together in a rotating barrel to coat the parts with the paint. A problem with such adherent paint coating is that relatively complicated parts such as slide fastener sliders cannot have an even coating thereon, and tend to suffer from malfunctioning due to the paint clogged in the parts.

According to one aspect of the invention there is provided a method of painting a multiplicity of parts together in a barrel, comprising the steps of:

- (a) placing the parts in the barrel;
- (b) rotating the barrel;
- (c) spraying paint onto the parts in the barrel being rotated while excessive paint is allowed to escape from the barrel while the barrel is being rotated, thereby forming a coating of paint on the parts which is thinner than a desired thickness;
- (d) baking the coated paint on the parts in the barrel;
- (e) cooling the baked paint on the parts; and
- (f) repeating at least the steps (b) to (e) in the order named until the parts have thereon a coating of paint of said desired thickness.

According to another aspect of the invention there is provided an apparatus for painting a multiplicity of parts together, comprising:

- (a) a frame;
- (b) a turntable rotatably mounted on said frame;
- (c) a plurality of barrels rotatably supported on said turntable, each receptive of the parts therein, each barrel being adapted to allow excessive paint to escape therefrom while rotating;
- (d) painting means on said frame for sequentially spraying paint onto, heating, and cooling the parts in each of said barrels at respective positions angularly spaced around said turntable;
- (e) first drive means on said frame for intermittently rotating said turntable, whereby said barrels are successively moved to said angularly spaced positions; and
- (f) second drive means on said frame for rotating said barrels at said angularly spaced positions.

The invention will be described by way of example with reference to the accompanying drawings, wherein:—

Figure 1 is a plan view, partly cut away, of a

painting apparatus embodying the present invention;

Figure 2 is a front elevational view, partly cut away, of the painting apparatus shown in Figure 1;

Figure 3 is an end elevational view of a parts separator that is part of the painting apparatus;

Figure 4 is a side elevational view of the parts separator shown in Figure 3;

Figure 5 is an elevational view of the portion of the painting apparatus from which the painted parts are discharged; and

Figures 6 and 7 are enlarged perspective views of parts to be painted.

The present invention is particularly useful when embodied in a painting apparatus such as shown in Figures 1 and 2, generally indicated by the numeral 10.

The painting apparatus 10 comprises a frame 11, and a substantially horizontal indexing turntable 12 rotatably mounted on the frame 11 by a vertical drive shaft 13 coupled with a stepper motor 14 supported on the frame 11. A plurality of barrels 15 of wire mesh, each having a radially outwardly opening end 16, are rotatably mounted on the turntable 12 by a plurality of corresponding shafts 17 each connected concentrically to the other end of one of the barrels 15 and including a universal joint 18. Each of the shafts 17 is journaled in a bearing 19 on the turntable 12. The barrels 15 are located in angularly spaced relation around the turntable 12 and are inclined upwardly with large-diameter portions 20 of the shafts 17 rollingly riding on an annular land or rail 21 disposed on the frame 11 in surrounding relation to the turntable 12.

The shafts 17 are connected at ends projecting beyond the bearings 19 to a plurality of respective driven gears 22 each partly projecting downwardly through a respective slot (not shown) in the turntable 12. A plurality of angularly spaced motors 23 are supported on the frame 11 and include a plurality of horizontal shafts 24, respectively, each journaled in a bearing 25 on the frame 11 and having a drive gear 26 held in driving mesh with one of the gears 22.

When the stepper motor 14 is energized, the indexing turntable 12 rotates intermittently to cause the barrels 15 angularly move with the turntable 12. The barrels 15 are rotated in response to the meshing of the gears 22 with the gears 26 being rotated while turntable 12 is at rest between its intermittent movements.

A spray gun 28 comprises a tank 29 of paint and a spray nozzle 30 connected with the tank 29 and directed toward the open end 16 of one of the barrels 15 which is rotating but is held at one of the angular positions of the turntable 12. The spray nozzle 30 sprays an atomized mist of paint into such one of the barrels 15 to spray deposit the paint on the parts in the barrel 15. A blower pipe 37 located adjacent to the spray gun 28 is also directed toward the barrel open end 16 for blowing air into the barrel 15 to set the coated paint on the parts.

A hot-air blower 31 is angularly spaced from the spray gun 28, and includes a compressor 32 with a heater and a blower pipe 33 coupled with the compressor 32 for directing hot air into another angularly spaced barrel 15 to bake the coated paint on the parts therein.

A cool-air blower 34 includes a compressor 35 and a blower pipe 36 coupled therewith for introducing cool air into still another barrel 15 that is held at rest while rotating.

A plurality of horizontal support wings 38, 39, 40 project radially outwardly from the frame 11 in angularly spaced positions corresponding respectively to the spray gun 28, the hot-air blower 31, and the cool-air blower 34. A box-like cover 41 is fixedly mounted on the support wing 38, and has a pair of openings 42, 43 for the passage of the barrels 15 therethrough into and out of the cover 41 and a slot 44 extending between the openings 42, 43 for allowing the shafts 17 to move therethrough.

The support wing 39 supports thereon a tiltable box-like cover 45 that is downwardly open and is pivotally coupled to a cover base 46 fixed to the wing 39. The cover 45 is pivotable upwardly by the actuation of a fluid actuator 47 through a link 48 connected between the cover 45 and the piston rod of the fluid actuator 47. When one of the barrels 15 is angularly moved until it is located under the cover 45 that is uplifted, the cover 45 is lowered to shield the barrel 15 for maximum utilization of heat and for protecting the operator against suffering burning that might otherwise result from the hot air blown into the barrel 15. The cover 45 has a vertical slot 49 receptive of the shaft 17 of the barrel 15 being covered.

Another box-like shield cover 50 is fixedly mounted on the support wing 40, and has a pair of openings 51, 52 through which the barrels 15 can move into and out of the cover 50, and a slot 53 extending between the openings 51, 52 for the passage therethrough of the barrel shafts 17.

As best shown in Figure 5, the wing 40 has a discharge opening 54 through which one of the barrels 15 at a time can move from the upwardly tilted position to a downwardly tilted position for discharging the painted parts out of the barrel 15. More specifically, the annular rail 21 includes a separated segmental portion 55 secured to the distal end of the piston rod of a fluid actuator 56 mounted on the frame 11; the portion 55 corresponding to the opening 54 in radial direction and being vertically retractable out of the rest of the annular rail 21. After the cooling of the parts in the barrel 15 in the cover 50 has finished, the fluid actuator 56 is actuated to retract the piston rod, and the segmental portion 55 is moved downwardly to allow the large-diameter shaft portion 20 resting thereon to be lowered until the barrel 15 is moved through the opening 54 to its downwardly tilted position. The parts in the barrel 15 are then thrown out through the open end 16 and a guide 57 onto a horizontal belt conveyor 58 for storage or additional

processing such as parts separation as will be described below.

In Figures 1 and 2, the parts to be spray-painted are (a) loaded through the open end 16 into one of the barrels 15 that is empty in a position between the wings 40 and 38. The turntable 12 is angularly moved to bring the parts-loaded barrel 15 into the cover 41 and then is temporarily stopped for spray-painting operation. The barrel 15 is (b) rotated by one of the motors 23 located below the wing 38 through the chain of the shaft 24, gear 26, gear 22, and shaft 17. Paint is (c) sprayed from the spray nozzle 30 onto the parts in the barrel 15 being rotated, the amount of paint coated in one spraying operation being such that it will form a layer of paint on the parts which is much thinner than a finished layer having a desired thickness. Excessive paint that is discharged but not sprayed onto the parts will escape through the wire mesh of the barrel 15, thereby permitting the parts to be coated with an even layer of paint against irregular paint deposition thereon.

Upon spray deposition of paint on the parts, air is blown from the blower pipe 37 into the barrel 15 being rotated to set the coated paint on the parts.

The turntable 12 is again rotated stepwise until the barrel 15 with the paint-sprayed parts therein is positioned under the raised cover 45. The cover 45 is then lowered to cover the barrel 15, and (d) hot-air is blown into the barrel 15 to heat the parts for the baking finish of the paint coating on the parts. Upon baking of the paint, the cover 45 is lifted and the turntable 12 is angularly moved again to place the barrel 15 containing the parts coated with the baked paint into the cover 50. Cool air is introduced from the pipe 36 into the barrel 15 to (e) cool the baked paint on the parts.

The barrels 15, upon arrival at the paint-spraying, baking, and cooling stations, are automatically rotated by meshing engagement of the gears 22 with the motor-driven gears 26.

One cycle of operation of painting the parts together is thus completed. The sequence of the steps (b) to (e) is repeated until the layer of coated paint on the parts has a desired thickness.

With this arrangement, a batch of parts are simultaneously painted together. Furthermore, the parts will have a glossy, even coating of paint, and a possibility of the parts getting stuck together due to paint adhesion is substantially eliminated.

To ensure complete separation of the painted parts, a parts separator 60 (Figures 3 and 4) may be provided. The parts separator 60 comprises an upright framework 61 positioned at one end of the belt conveyor 58, and a vertically movable bucket 62 carried on a chain 63 trained around a pair of upper and lower sprockets 64, 65 mounted on the framework 61. The bucket 62 has a pinion 66 rotatable attached by a pin 67 to a bracket 68 fixed to the chain 63. The framework 61 supports on its upper portion a vertical rack 69 positioned adjacent to the chain 63.

The parts separator 60 further comprises a hopper 70 adjacent to the rack 69, and a horizontally slidable selector 71 movable by a fluid actuator 59 and including a pair of downwardly diverging chutes 72, 73. A hopper 74 is located downwardly of one of the chutes 72 and upwardly of a horizontal parts feeder 75 actuated by a vibrator 76. A vertical blower duct 77 extends downwardly from the parts feeder 75 and includes a plurality of nozzles 78 directed downwardly. A hopper 79 is disposed downwardly of the blower duct 77 and has a discharge opening 84 opening toward the bucket 62 at its lowermost position.

A batch of parts 80 (Figure 4) coated with paint in one of the barrels 15 is discharged from the barrel 15 onto the belt conveyor 58, which is driven in a direction opposite to that in which finished parts are transferred for storage or assembling. The parts 80 are thrown into the bucket 62, which is then moved upwardly by the chain 63. The upward movement of the bucket 62 causes the pinion 66 to mesh with the rack 69, whereby the bucket 62 is pivoted clockwise as shown in Figure 3 to unload the parts 80 from the bucket 62 into the hopper 70. The parts 80 are discharged from the hopper 70 into the chute 72 with the selector 71 shifted in the position illustrated in Figure 4. The chute 72 directs the parts 80 into the hopper 74 and then down the blower duct 77, in which the parts 80 are accelerated downwardly by air blow from the nozzles 78.

The parts 80 impinge on an inclined wall 85 of the hopper 79 that is located in the way of falling movement of the parts 80, and any parts 80 that may have adhered together are separated from each other upon impact. The parts 80 are discharged out of the opening 84 into the bucket 62, which is again moved upwardly in order to repeat the cycle of parts-separating operation until the parts 80 are separated completely.

Then, the selector 71 is slid by the actuator 59 to the left in Figure 4 to allow the parts 80 to go from the hopper 70 down the chute 73 into a hopper 81 and thence into one of the barrels 15 (which may or may not be the same one as before) that is held at temporary rest between the cooling and paint-spraying stations and is ready for another cycle of parts painting operation.

Figure 6 shows an end stop 82 for slide fasteners, which is an example of the part 80. A slide fastener slider 83 illustrated in Figure 7 represents another example that can be painted on the painting apparatus 10.

Although various minor modifications may be suggested by those in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon, all such embodiments as reasonably and properly come within the scope of our contribution to the art.

Claims

1. A method of painting a multiplicity of parts together in a barrel, comprising the steps of:

- (a) placing the parts in the barrel;
 - (b) rotating the barrel;
 - (c) spraying paint onto the parts in the barrel being rotated while excessive paint is allowed to escape from the barrel while the barrel is being rotated, thereby forming a coating of paint on the parts which is thinner than a desired thickness;
 - (d) baking the coated paint on the parts in the barrel;
 - (e) cooling the baked paint on the parts; and
 - (f) repeating at least the steps (b) to (e) in the order named until the parts have thereon a coating of paint of said desired thickness.
2. A method according to claim 1, including the step of setting the coated paint on the parts between the steps (c) and (d).
3. A method according to claim 1 or 2, including the step of separating the painted parts from each other between the steps (e) and (b).
4. A method according to claim 3, the separation of the painted parts being effected by forcibly striking them apart.
5. A method according to any preceding claim, said cooling step being effected by blowing air onto the parts in the barrel being rotated.
6. A method according to any preceding claim, wherein the barrel moves in a closed path from one position where step (c) is carried out to another position where step (d) is carried out and to a further position where step (e) is carried out and back to said one location where step (c) is repeated.
7. An apparatus for painting a multiplicity of parts together, comprising:
- (a) a frame;
 - (b) a turntable rotatably mounted on said frame;
 - (c) a plurality of barrels rotatably supported on said turntable, each receptive of the parts therein, each barrel being adapted to allow excessive paint to escape therefrom while rotating;
 - (d) painting means on said frame for sequentially spraying paint onto, heating, and cooling the parts in each of said barrels at respective positions angularly spaced around said turntable;
 - (e) first drive means on said frame for intermittently rotating said turntable, whereby said barrels are successively moved to said angularly spaced positions; and
 - (f) second drive means on said frame for rotating said said barrels at said angularly spaced positions.
8. An apparatus according to claim 7, said barrels being angularly spaced around said turntable and each having a shaft rotatably mounted on said turntable.
9. An apparatus according to claim 8, said turntable extending substantially horizontally, said shafts being inclined with respect to said turntable and connected to one end of one of said barrels in concentric relation.
10. An apparatus according to claim 9, the other end of said barrel being open for the loading and discharging of the parts therethrough.



The parts separator 60 further comprises a hopper 70 adjacent to the rack 69, and a horizontally slidable selector 71 movable by a fluid actuator 59 and including a pair of downwardly diverging chutes 72, 73. A hopper 74 is located downwardly of one of the chutes 72 and upwardly of a horizontal parts feeder 75 actuated by a vibrator 76. A vertical blower duct 77 extends downwardly from the parts feeder 75 and includes a plurality of nozzles 78 directed downwardly. A hopper 79 is disposed downwardly of the blower duct 77 and has a discharge opening 84 opening toward the bucket 62 at its lowermost position.

A batch of parts 80 (Figure 4) coated with paint in one of the barrels 15 is discharged from the barrel 15 onto the belt conveyor 58, which is driven in a direction opposite to that in which finished parts are transferred for storage or assembling. The parts 80 are thrown into the bucket 62, which is then moved upwardly by the chain 63. The upward movement of the bucket 62 causes the pinion 66 to mesh with the rack 69, whereby the bucket 62 is pivoted clockwise as shown in Figure 3 to unload the parts 80 from the bucket 62 into the hopper 70. The parts 80 are discharged from the hopper 70 into the chute 72 with the selector 71 shifted in the position illustrated in Figure 4. The chute 72 directs the parts 80 into the hopper 74 and then down the blower duct 77, in which the parts 80 are accelerated downwardly by air blow from the nozzles 78.

The parts 80 impinge on an inclined wall 85 of the hopper 79 that is located in the way of falling movement of the parts 80, and any parts 80 that may have adhered together are separated from each other upon impact. The parts 80 are discharged out of the opening 84 into the bucket 62, which is again moved upwardly in order to repeat the cycle of parts-separating operation until the parts 80 are separated completely.

Then, the selector 71 is slid by the actuator 59 to the left in Figure 4 to allow the parts 80 to go from the hopper 70 down the chute 73 into a hopper 81 and thence into one of the barrels 15 (which may or may not be the same one as before) that is held at temporary rest between the cooling and paint-spraying stations and is ready for another cycle of parts painting operation.

Figure 6 shows an end stop 82 for slide fasteners, which is an example of the part 80. A slide fastener slider 83 illustrated in Figure 7 represents another example that can be painted on the painting apparatus 10.

Although various minor modifications may be suggested by those in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon, all such embodiments as reasonably and properly come within the scope of our contribution to the art.

Claims

1. A method of painting a multiplicity of parts together in a barrel, comprising the steps of:

- (a) placing the parts in the barrel;
- (b) rotating the barrel;
- (c) spraying paint onto the parts in the barrel being rotated while excessive paint is allowed to escape from the barrel while the barrel is being rotated, thereby forming a coating of paint on the parts which is thinner than a desired thickness;
- (d) baking the coated paint on the parts in the barrel;
- (e) cooling the baked paint on the parts; and
- (f) repeating at least the steps (b) to (e) in the order named until the parts have thereon a coating of paint of said desired thickness.

2. A method according to claim 1, including the step of setting the coated paint on the parts between the steps (c) and (d).

3. A method according to claim 1 or 2, including the step of separating the painted parts from each other between the steps (e) and (b).

4. A method according to claim 3, the separation of the painted parts being effected by forcibly striking them apart.

5. A method according to any preceding claim, said cooling step being effected by blowing air onto the parts in the barrel being rotated.

6. A method according to any preceding claim, wherein the barrel moves in a closed path from one position where step (c) is carried out to another position where step (d) is carried out and to a further position where step (e) is carried out and back to said one location where step (c) is repeated.

7. An apparatus for painting a multiplicity of parts together, comprising:

- (a) a frame;
- (b) a turntable rotatably mounted on said frame;
- (c) a plurality of barrels rotatably supported on said turntable, each receptive of the parts therein, each barrel being adapted to allow excessive paint to escape therefrom while rotating;
- (d) painting means on said frame for sequentially spraying paint onto, heating, and cooling the parts in each of said barrels at respective positions angularly spaced around said turntable;
- (e) first drive means on said frame for intermittently rotating said turntable, whereby said barrels are successively moved to said angularly spaced positions; and
- (f) second drive means on said frame for rotating said said barrels at said angularly spaced positions.

8. An apparatus according to claim 7, said barrels being angularly spaced around said turntable and each having a shaft rotatably mounted on said turntable.

9. An apparatus according to claim 8, said turntable extending substantially horizontally, said shafts being inclined with respect to said turntable and connected to one end of one of said barrels in concentric relation.

10. An apparatus according to claim 9, the other end of said barrel being open for the loading and discharging of the parts therethrough.



11. An apparatus according to claim 9 or 10, said turntable having an annular rail on which said shaft rollingly rests.

12. An apparatus according to claim 11, said annular rail including a segmental portion displaceable for moving one of said barrels in a direction transverse of said annular rail.

13. An apparatus according to claim 7, said painting means comprising a spray nozzle, a hot-air blower, and a cool-air blower located respectively at said angularly spaced positions and directed toward said barrels at said positions.

14. An apparatus according to claim 7, each of said barrels having a shaft journaled in a bearing mounted on said turntable and having a driven gear, said second drive means comprising a plurality of motors supported on said turntable and located in said angularly spaced positions, and a plurality of drive gears connected respectively to the motor shafts, each of said driven gears being in mesh with one of said drive gears when said barrels are held in said angularly spaced positions, respectively.

15. An apparatus according to claim 7, said barrels being made of wire mesh.

16. An apparatus according to claim 7, said turntable including a plurality of support wings extending radially outwardly therefrom at said respective angularly spaced positions, including a plurality of box-like covers mounted respectively on said support wings for covering said barrels.

17. An apparatus according to claim 7,

including means for separating the paint-coated parts from each other after the cooling of the parts, and conveyor means for transporting the parts from one of said barrels to said separating means.

18. An apparatus according to claim 17, said separating means comprising an upright framework, a bucket vertically movable along said framework for carrying the parts, means on said framework for elevating said bucket, passage means on said framework for receiving the parts from the elevated bucket and guiding them, a blower duct mounted on said framework below said passage means for accelerating the parts downwardly therethrough, and a chute disposed below said blower duct for the passage therethrough of the parts, said chute having a wall in the way of movement of the parts, whereby the parts accelerated can impinge on said wall for their separation upon impact.

19. A method according to claim 3 or 4, including the step of removing the parts from the barrel prior to and replacing the parts in a barrel subsequent to the separating step.

20. A method according to claim 19 wherein the barrel in which the parts are replaced is the same as that from which they have been removed.

21. A method according to claim 19 wherein the barrel in which the parts are replaced is different from that from which they have been removed.