VARIABLE DEPTH COATING APPARATUS


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References Cited
UNITED STATES PATENTS
3,439,649 4/1969 Probst et al. ......................... 118/634
3,014,811 12/1961 Storck ......................... 117/8

2,653,566 9/1953 Worden ................................ 118/63
2,135,406 11/1938 MacDonald ...................... 91/59

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ABSTRACT
Apparatus for coating a body with a variable depth coating by means disposed externally of the body. In one form, the means comprises means for delivering a nonuniform cloud of coating particles to the body for deposit thereon to define a preselected nonuniform coating. In another form, the means comprises means for providing a uniform cloud of coating particles to the body and means for removing at least a portion of the deposited particles. The removing means comprises in one form means for blowing off deposited particles and in another form means for brushing off deposited particles. Electrostatic means may be employed for releasably retaining the deposited particles.

2 Claims, 3 Drawing Figures
1. Field of the Invention
This invention relates to coating apparatus and in particular to apparatus for providing a variable depth deposit of coating particles.

2. Description of the Prior Art
In one improved form of coating apparatus, means are provided for producing a superjacent cloud from a fluidized bed of coating particles. The body to be coated is disposed in contact with the cloud. Electrostatic means may be employed for causing retention of particles deposited on the body from the cloud so as to provide a desired coat of the particles on the body. It has been found that a variation in the depth of the coating so provided may occur such as due to the configuration of the body being coated. Thus, for example, where the body comprises a bowling pin body rotated about its longitudinal axis in the upper portion of the cloud, a greater depth of the coating tends to occur at the belly and head portions of the pin. While such variable depth coating provides improved coating characteristics, it has been found that such variable depth coating does not necessarily correspond to the requirements of the particular article being coated. Further, it has been desirable to provide further control of the coating depth even in those cases where the coating varies to some extent in the desired manner.

SUMMARY OF THE INVENTION
The present invention comprehends an improved apparatus providing accurate selective control over such depth of coating in a novel and simple manner.

Thus, the present invention comprehends an improved apparatus for coating a body wherein the coating particles are caused to move from a supply to the body to form a coating thereon. Means are provided in the apparatus disposed externally of the body for causing a difference in the depth of the coating on preselected different portions of the body. In one conceptualistic embodiment, the means for causing the difference in the depth of the coating comprises means for providing substantially uniform cloud of coating particles. The apparatus further includes means for removing selectively from different portions of the body at least a portion of the particles deposited thereon. In one illustrative specific embodiment, the means for removing the particles comprises means for blowing off the particles and in a second illustrative specific embodiment, the means comprises brush means.

The invention comprehends that the apparatus may provide a combination of the nonuniformity means and selective removal means as desired.

The deposited particles may be retained on the body by suitable means such as electrostatic means. As discussed above, the cloud means may cause some variation in the depth of coating and the means of the present invention may be utilized either cumulatively with the electrostatic variable coating depth effect or in opposition thereto depending on the desired coating depth variations.

BRIEF DESCRIPTION OF THE DRAWINGS
Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a vertical schematic section of an apparatus embodying the invention;

FIG. 2 is a vertical schematic section of a modified form of apparatus embodying the invention; and

FIG. 3 is a still further modified form of apparatus embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS
In the exemplary embodiment of the invention as disclosed in FIG. 1, of the drawing, an apparatus generally designated 10 for coating a body illustratively comprising a bowling pin body 11 includes means for forming a fluidized bed 12 of coating particles 13. A portion of the particles is caused to be delivered upwardly from the upper surface 14 of the bed 12 to define a cloud 15. The body to be coated is carried on a suitable support 16 to be contacted by the particles 13 in the cloud 15 and resulting a coating 17 of the particles formed on the outer surface thereof. Support 16 may comprise a rotative support permitting rotation of the bowling pin body 11 about its longitudinal axis so as to effect a coating of the pin fully circumferentially thereabout. The particles of coating 17 may be effectively retained on the body 11 by suitable electrostatic charging means 18 providing a suitable high potential between the pin 11 and the particles 13.

As indicated briefly above, the invention comprehends the provision in apparatus 10 of a means for controlling the depth of coating 17 at different portions of the body. Illustratively, it is desirable to provide a substantially greater depth of the coating at the belly portion 11a and a substantially smaller depth at the head portion 11b as compared to the remainder of the pin surface. This is effected in apparatus 10 by causing a difference in the rate of delivery of the particles 13 to the different portions of the pin. More specifically, the depth control is effected in apparatus 10 by causing the formation of more dense cloud portions 15a and 15b at the pin portions 11a and 11b respectively.

The variation in cloud density may be effected by suitable means such as selectively controlled fluidizing means generally designated 19. Fluidizing means 19 may include a permeable bottom wall 20 defining the lower boundary of the fluidized bed 12 adapted to pass fluidizing fluid upwardly therethrough. The space below wall 20 may be divided into desired into different portions, such as space portions 21a, 21b, 21c and 21d, by means of suitable walls 22. Fluidizing fluid such as pressurized air is delivered to the space portions 21a-d from a supply manifold 23 and a plurality of discrete means for delivering different amounts of air from the manifold to the different space portions. Herein the air control means comprises adjustable air valves 24a, 24b, 24c and 24d. Thus, control valve 24a regulates the amount of air delivered to space portion 21a and thus the amount of cloud formation about space portion 21a. Valve 24b similarly controls the cloud formation about space portion 21b, valve 24c similarly controls the cloud formation about space portion 21c, and valve 24d similarly controls the cloud formation above space portion 21d.

Thus, where a greater depth of coating is desired on the pin body 11 at portion 11a overlying space portion 21b and pin body portion 11b overlying space portion 21d, valves 24b and 24d are adjusted to provide a greater rate of flow through space portion 21b and space portion 21d than that provided by valves 24a and 24b through space portions 21a and 21c.

Resultingly, as shown in FIG. 1, cloud portions 15a and 15b are caused to be more dense and thereby provide a relatively greater rate of delivery of particles 13 to the pin body portions 11a and 11b. Thus, the depth of coating 17 at body portions 11a and 11b is correspondingly increased thereby to provide desired improved air characteristics of the resultant bowling pin. Adjustment of the depth of coating may be readily effected by suitable adjustment of the control valves 24a, 24b, 24c, and 24d.

The control of coating depth by the adjustable valves permits the operator to effect a variation in the depth substantially as desired and, thus, should it be desirable to provide a greater depth of coating on the body portion above space portions 21a and/or 21c, the valves may be suitably readjusted for
this. Further, the depth of coating of the relatively large depth portions 11a and 11b may be suitably varied by suitable control of the valves 24b and 24d. Thus, for example, a somewhat greater depth of coating may be provided on portion 11a than on portion 11b if so desired.

As will be obvious to those skilled in the art, fine control of the variable depth coating may be provided by increasing the number of separate control valves and space portions. Alternatively, apparatus 10 may be utilized to provide a substantially uniform coating by causing the delivery of air through each of the valves to be similar.

The coating material may comprise any suitable coating material. Illustratively, apparatus 10 is advantageous and adaptable for use in coating plastic material such as cellulose acetate butyrate, ethyl cellulose, etc., onto wooden bowling pin bodies.

Turning now to the embodiment of FIG. 2 a modified form of apparatus generally designated 110 for providing a variable depth coating is shown to comprise an apparatus generally similar to apparatus 10 of FIG. 1, but utilizing different means for controlling. Thus, in apparatus 10 the means 119 for producing a cloud 115 is adapted to provide a uniform cloud which would tend to provide a generally uniform depth of coating on the body 11. Thus, cloud-producing means 119 may be similar to means 19 except that the pressurized air is delivered to a single large space 121 underlying the portions wall 120 so that substantially all portions of the fluidized bed are utilized to produce a substantially uniform cloud thereabout.

In apparatus 110 the depth of coating is controlled by removing at least a portion of the particles 13 deposited on body 11 to form coating 17. The removal of the deposited particles may be effected by a suitable airjet tube having a plurality of apertures 126. Air is supplied under pressure through a suitable control valve 127 to the tube 125 and directed through apertures 126 against the deposited particles in coating 17. The air may act to remove substantially all of the deposited particles such as at portions 11c and 11d while allowing substantially all of the deposited particles to remain at portions 11a and 11b. The removal of the deposited particles at portions 11c and 11d may be maintained for a preselected period of time to permit the coating depth at portions 11a and 11b to reach a preselected desired depth. The coating operation may then be continued for a second preselected period of time with valve 127 closed so as to permit a preselected limited depth coating to be provided at portions 11c and 11d of the pin body and the depth of the coating on portions 11a and 11b to reach the desired final coating depth.

Alternatively, the force of the airjet from tube 126 may be controlled so that only a portion of the deposited particles are removed so that the depth of the coating at portions 11c and 11d merely build up at a slower rate than at portions 11a and 11b. It has been found, however, that such concurrent variable depth control is somewhat more difficult to regulate than where the apparatus is arranged to provide a two-step deposition as discussed above.

Referring now to the embodiment of FIG. 3, a further modified form of apparatus generally designated 210 is shown to comprise an apparatus generally similar to apparatus 110 but having mechanical means generally designated 228 for removing deposited particles from the pin body 11 to provide the desired variable depth coating 17. Thus, as shown in FIG. 3, the particle-removing means may comprise suitable brushes 228a and 228b adapted to contact the coating as it is being deposited and remove at least a portion of the deposited particles. Here, again, the brushes may be arranged to remove substantially all of the deposited particles from preselected portions of the body 11 wherein a subsequent uniform disposition after the brushes are removed from engagement with the coating may be utilized to effect the variable depth overall coating of the pin body. Alternatively, the brushes may be made to be sufficiently light in the brushing action to cause only a portion of the deposited particles to be removed.

Thus, each of apparatus 110 and 210 is similar to apparatus 10 and similar elements thereof are identified by similar reference numerals except 100 or 200 higher. Apparatuses 110 and 210 differ from apparatus 10 in providing a particle cloud tending to deposit the particles uniformly on the body to be coated and having portions of the particles removed subsequent to the deposit to provide the variable depth whereas in apparatus 10 the deposit on the body is controlled so as to provide the desired variable depth of the coating. In all respects, each of apparatus 10, 110 and 210 functions similarly in providing the desired variable depth coating.

Further as will be obvious to those skilled in the art, a combination of the different methods of controlling the coating depth may be employed within the scope of the invention. Illustratively, the variable density cloud method of FIG. 1 may be utilized in conjunction with either or both of the particle removable methods of FIGS. 2 and 3. Further, alternatively, different portions of the object may be coated to different depths by utilization of different ones of the methods, such as wherein a maximum depth of coating is provided on pin portion 11a by means of the maximum density cloud portion 15a, a lesser depth coating is provided on pin portion 11b by means of the airjet-removing means 125, and a minimum density coating is provided on neck portion 11d by means of the brush-removing means 228.

The foregoing disclosure of specific embodiments is illustrative of the broad inventive concepts comprehended by the invention.

We claim:
1. Apparatus for coating a body, comprising: means for holding a supply of coating particles; means for causing movement of the particles from the supply to said body to form a coating of said particles thereon; and means disposed externally of the body for causing a difference in the depth of the coating on preselected different portions of the body wherein said movement causing means is arranged to deliver the particles generally uniformly to said body and said means for causing a depth difference comprises means for removing substantially all of the delivered particles from different portions of the body for a first preselected period of time and subsequently permitting delivery of said particles to said different portions for a second preselected period.
2. Apparatus for coating a body, comprising: means for holding a supply of coating particles; means for causing movement of the particles from the supply to said body to form a coating of said particles thereon; and means disposed externally of the body for causing a difference in the depth of the coating on preselected different portions of the body wherein said movement causing means is arranged to deliver the particles generally uniformly to said body and said means for causing a depth difference comprises means for removing substantially all of the delivered particles from different portions of the body for a first preselected period of time and subsequently permitting uniform delivery of said particles to said body for a second preselected period.

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