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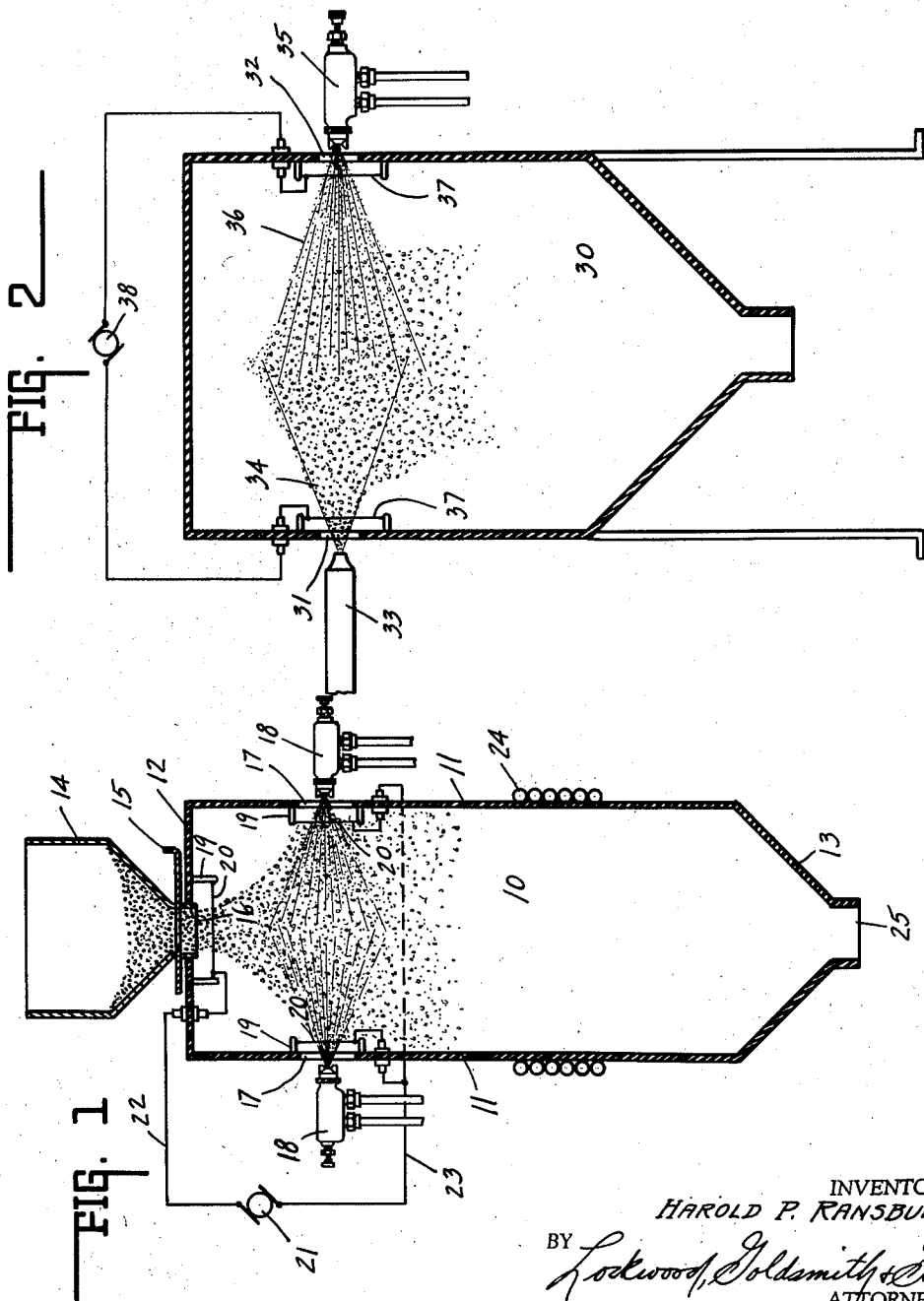
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2,270,341

METHOD OF COATING GRANULAR MATERIALS

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2 Sheets-Sheet 1



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FIG. 4

FIG. 5

FIG. 6

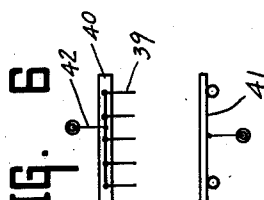
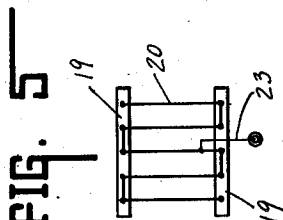
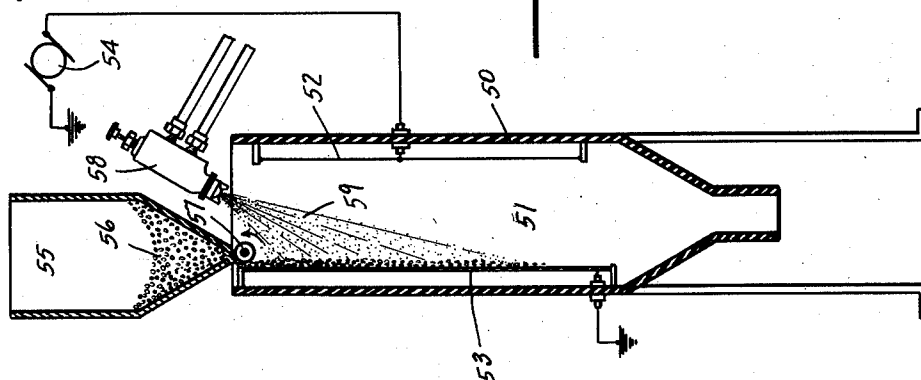
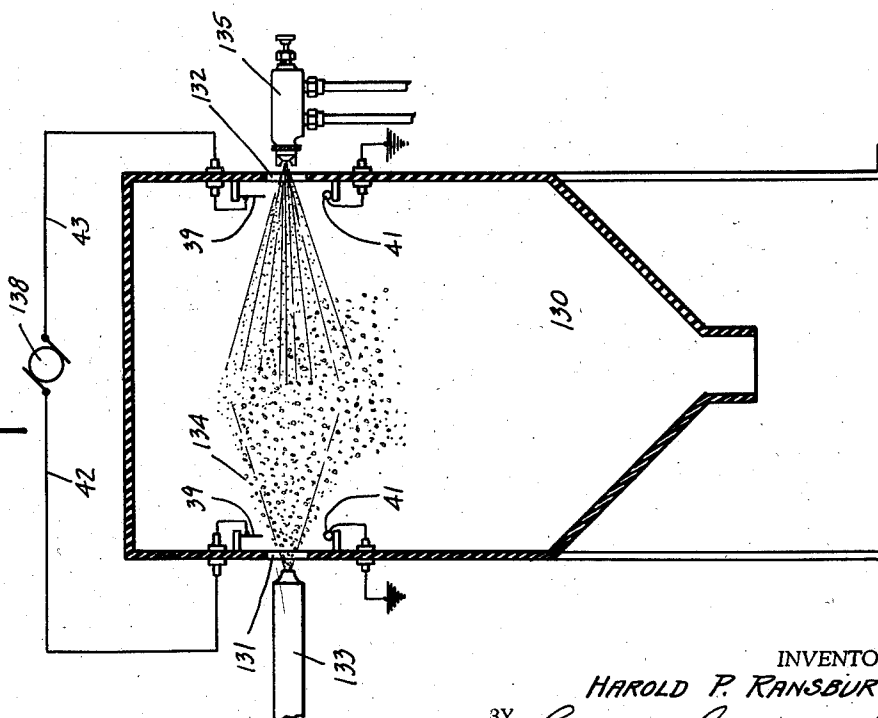


FIG. 3



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UNITED STATES PATENT OFFICE

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METHOD OF COATING GRANULAR MATERIALS

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4 Claims. (Cl. 91-68)

This invention relates to a method of coating granular materials. The method is particularly adapted to the coating of ground cork with adhesive material for the manufacture of molded cork articles such as the cork seals used in crown bottle caps. Another use of the invention is in the coating of ground cork or other similar material with paint or coloring matter in the manufacture of press board or insulating roofing material. Many other similar uses of the invention are possible.

In the past it has been the practice to coat such granular materials by mixing the same with the coating material in a pug mill or other form of apparatus by which they are mechanically mixed. This process is not entirely satisfactory for giving a thorough and uniform coating to all particles of the granular material unless excessively long periods are allowed in the pug mill. Even with a lengthy pugging operation there is a tendency for the smaller particles to accumulate in masses coated only on the outside, the individual particles within the mass having all or a large portion of their surface uncoated. The prior process, moreover, is restricted in use since some materials can not be handled at all in that manner.

One object of the present invention is to provide a simple and efficient method of coating granular materials of the type described which insures a thorough coating of the surface of all particles.

Another object of the invention is to provide a method for coating such materials with coatings which have not been possible by the prior methods.

In its simplest form the invention provides for intermingling dispersed streams of the granular material and coating material in an electrostatic field in such manner that the particles of the coating material are directed to the particles of granular material by electrostatic attraction. In one form of the invention the electrostatic attraction is produced by impressing static surface charges of opposite potential upon the particles of the two streams. In this form of the invention like charges impressed on the particles of granular material serve to scatter the particles by electrostatic repulsion and so facilitate access of the coating material to individual particles. This in itself is of great importance even when the coating material is not electrically charged. In another form of the invention a stream of the granular material is passed over the surface of an electrode which is used to attract electro-

statically a spray of coating material toward the stream of granular material.

Preferably the two streams of material are intermingled in midair while unsupported, as distinguished from spraying coating material on a stream of material travelling on a conveyor. In this way the greatest dispersion of the granular particles is obtained and all parts of each particle are accessible to the coating material.

Other objects and features of the invention will be understood from the accompanying drawings and the following description and claims:

Figs. 1, 2, 3 and 4 are vertical sectional views partly diagrammatic of several forms of apparatus by means of which the method of the invention may be carried out. Fig. 5 is an elevational view of a portion of the apparatus shown in Fig. 1. Fig. 6 is a similar view of a portion of the apparatus shown in Fig. 3.

Referring now to Fig. 1, there is provided a chamber 10 having side walls 11, top 12 and hopper bottom 13. The walls, top and bottom of the chamber are preferably constructed of an electrically non-conducting material such as plywood, fibreboard or the like. A supply hopper 14 provided with a control gate 15 communicates with the chamber 10 by means of an inlet opening 16. The supply hopper 14 is adapted to contain a supply of material to be coated which may be fed into the chamber 10 through the opening 16 and the flow of which may be controlled by the gate 15. In the upper portion of each side of the chamber 10 there is provided an opening 17 through which a coating material, such as paint, glue, varnish or other similar substances, may be sprayed, as by pneumatic spray guns 18. The spray guns 18 may be of any conventional form well known in the art and suitable for the particular coating material to be supplied. For certain materials the rapid cooling effect of expanding compressed air associated with a pneumatic spray gun is detrimental. In such cases, a well-known type of centrifugal spray device may be provided instead.

Associated with each of the openings 17 and with the opening 16 there is provided a grid construction shown particularly in Fig. 5. Said construction consists of a pair of supports 19 mounted on the wall of the chamber and carrying an electrical conductor 20 which is repeatedly passed from one to the other of the supports 19 to form a grid between the strands of which the materials must pass in entering the chamber 10. A generator 21 adapted to supply direct current at a relatively high voltage may be located at any

convenient place adjacent the apparatus. This generator preferably supplies a potential of the order of 100,000 volts and several types well known in the art are available for the purpose. One terminal of the generator is connected by a conductor 22 to the grid 20 arranged beneath the opening 16. The opposite terminal of the generator is connected by a conductor 23 to both of the grids 20 associated with the coating material openings 17. By means of this construction a high potential electrostatic field is established within the chamber 10, the portion thereof adjacent the granular material supply opening 16 being charged with one potential and that adjacent the coating material openings 17 being charged in the opposite sense. Preferably the spacing of the grids and the voltage applied thereto is properly chosen so that a corona discharge takes place, since the voltages associated with such discharge are found to have the necessary effect in charging the atmosphere adjacent the grids and the particles of material passing through the grids.

In the operation of this form of the apparatus, the gate 15 is adjusted to permit a stream of the granular material to fall freely into the chamber 10. Even though the material is not such as would ordinarily be classed as a conductor of electricity still the particles thereof may pick up surface electric charges in passing through the grid 20 and the highly charged atmosphere surrounding the same. Since like charges are picked up by the particles, they tend to repel each other and the stream of material is thereby scattered. At the same time, the particles of coating material sprayed into the chamber 10 pick up electrical charges opposite to those on the particles of the granular material. The sprays of coating material are directed as best seen in Fig. 1 to converge upon the stream of granular material and since the latter stream has become dispersed by electrostatic repulsion of its particles, each particle has a much greater chance to receive its full complement of coating material than it would have if the stream were not so dispersed. The opposite electrical charges of the particles of granular material and coating material cause the same to be attracted toward each other and to neutralize each other. An intimate mixing of the two materials and a thorough coating of the granular particles is thus immediately produced.

In certain cases it is important that the coating on the particles be thoroughly dried before the particles are brought together in a mass. For such cases, heating coils 24 may be applied to the lower portion of the chamber 10 for maintaining a relatively high temperature therein. This temperature may be maintained in many cases sufficiently high to evaporate the solvent used in the coating material. The coated particles fall to the bottom of the chamber 10 and may be discharged through an opening 25 therein for such further steps in the process of manufacture as may be necessary.

Referring now to Fig. 2, there is shown therein a second form of apparatus for carrying out the invention. In that form a chamber 30 which may be of substantially similar construction to the chamber 10 is provided with side openings 31 and 32. Adjacent the opening 31 there is a pneumatic blow gun 33 by means of which a supply of granular material 34 may be blown into the chamber 30. Adjacent the opening 32 there is a spray gun 35 which may be similar to the guns 18 and which sprays a coating material 36

into the chamber 30. The stream of granular material and the stream of coating material are directed toward each other and collide in the center of the chamber. This in itself promotes intimate mixture of the two materials. However, an even more efficient mixing is produced by the provision of grids 37 similar to the grids 20 and arranged adjacent the openings 31 and 32. Said grids are electrically charged in opposite senses by a generator 38. The operation of apparatus of this form is similar to that of the apparatus shown in Fig. 1. The stream of incoming granular material is dispersed by electrostatic repulsion and the oppositely charged particles of the two streams are electrostatically attracted to each other in much the same manner as previously described.

Referring now to Fig. 3, there is shown therein a construction similar in many respects to that of Fig. 2 and in which parts numbered in the one hundred series have the same construction and function as correspondingly numbered parts in the unit series of Fig. 2. In this construction the grids 37 are not used and are replaced by a construction shown in detail in Fig. 6. In said construction a plurality of downwardly extending electrical conductors 39 are mounted on a support 40 and are electrically connected to each other. Beneath each of the openings 131 and 132 there is mounted a conductor 41 in opposed relation to the conductors 39. The conductors 39 associated with the granular material supply opening 131 are connected to one terminal of the generator 138 by a conductor 42 and the conductors 39 associated with the coating material supply are connected to the opposite terminal of the generator by a conductor 43. Both of the conductors 41 are grounded.

By means of this construction separate electrostatic fields are set up between each of the conductors 39 and its associated conductor 41. Since the gap between said conductors is much less than half of the gap between the grids 37 of Fig. 2 the voltage required to establish corona discharge is much less. In addition, the ends of the conductors 39 constitute discharge points which intensify corona discharge. The two fields, since they are connected to opposite terminals of the generator, charge the atmosphere in their immediate neighborhoods in opposite senses so that particles of the granular material entering the opening 131 are charged in opposite sense to particles of coating material entering the opening 132. The resulting interaction of the charged particles is similar to that previously described in connection with Figs. 1 and 2.

Referring now to Fig. 4, there is illustrated an apparatus suited for the coating of materials which are not so well adapted to the reception of electrostatic surface charges. In the use of this construction, less reliance is placed upon the electrostatic attraction between the particles of the two materials and additional means are provided for directing the spray of coating material upon the stream of granular material. In this form of apparatus there is provided a casing 50 of electrical non-conducting material defining a chamber 51. Adjacent opposite sides of the chamber 50 there are provided electrodes 52 and 53 connected to opposite terminals of a generator 54 adapted to supply high voltage direct current. The electrode 52 is preferably in the form of a vertical wire having very small surface area. Electrode 53 is a plate of conducting material having many times the surface area of the

electrode 52. Above the chamber 51 there is provided a storage hopper 55 adapted to contain a supply 56 of the granular material to be coated. Said material is supplied from a suitable opening in the bottom of the hopper 55 to a rotating gate roller 57 which is adapted to regulate by its speed of rotation the flow of material from the hopper. Said material is permitted to fall freely across the face of the electrode 53 and thus passes through the electrostatic field established between the electrodes 52 and 53. A spray gun 58 is mounted to supply a spray of coating material 59 into the upper part of the chamber 51 between the stream of granular material and the electrode 52. As discussed in more detail in co-pending application of Harold P. Ransburg and Harry J. Green, Serial No. 281,766, filed June 29, 1939, coating material sprayed into an electrostatic field is attracted to the electrode having the largest surface area in much greater degree than toward the electrode of small surface area. Thus the spray of coating material is attracted to the electrode 53 but is intercepted by the stream of granular material dispersed over the surface of the electrode and is intimately mixed therewith.

Several forms of apparatus by means of which the method of the invention as defined in the appended claims may be carried out have been described. Other forms will be apparent to those skilled in the art.

The invention claimed is:

1. A method of coating granular material comprising establishing an electrostatic field between two spaced points, introducing a stream of the material to be coated in the neighborhood of one

of said points, introducing a stream of liquid coating material in the neighborhood of the second of said points whereby said streams are electrically charged in opposite sense, and directing said streams to convergence within said field whereby particles of one stream are attracted to particles of the other.

2. A method of coating granular material comprising establishing a corona electric discharge between a pair of oppositely charged electrodes, and introducing converging streams of said material and a coating material into the space between said electrodes, one of said streams passing sufficiently close to one of said electrodes to receive electrical charges therefrom and the other similarly receiving charges from the other of said electrodes, whereby particles of one stream are attracted to particles of the other.

3. A method of coating granular material comprising spraying said material and coating material into an electrostatic field said streams entering said field through oppositely charged portions thereof and converging within said field.

4. A method of coating granular material comprising establishing an electrostatic field of high potential between two electrodes one of which has a surface area many times greater than the other, passing a freely falling stream of said material between said electrodes and close to the larger electrode, and spraying coating material into the space between said stream and the smaller electrode, said coating material being electrostatically attracted toward said larger electrode and thereby mingling with the stream of material to be coated.

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