United States Patent [19]

Grenfell

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[54] **COATING APPARATUS**

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[30] **Foreign Application Priority Data**

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May 19, 1972 Great Britain 23618/72

[52] **U.S. Cl.** **118/421,** 118/429, 118/DIG. 5
[51] **Int. Cl.** **B05c 3/09**
[58] **Field of Search** ..... 118/429, DIG. 5, 421; 228/37, 36; 259/4, DIG. 24; 209/474, 475; 141/67; 117/DIG. 6, 100

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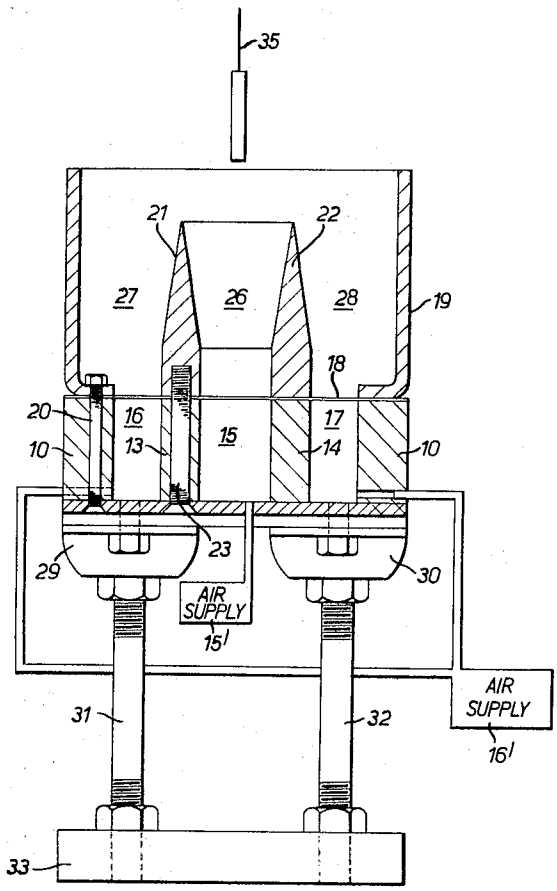
Attorney, Agent, or Firm—Lawrence E. Laubscher

[57] **ABSTRACT**

This invention relates to coating apparatus of the type in which an article to be coated is immersed in a main fluidized bed of the coating material. At least one supplementary fluidized bed is provided which contains a supply of additional coating material, the level of the supplementary bed being capable of being raised to a level above that of the main bed whereby additional coating material is transferred from the supplementary bed to the main bed to replenish the coating material therein. Once the desired level has been achieved, the level of the supplementary bed is lowered and any surplus coating material is arranged to fall back into the supplementary bed.

5 Claims, 5 Drawing Figures



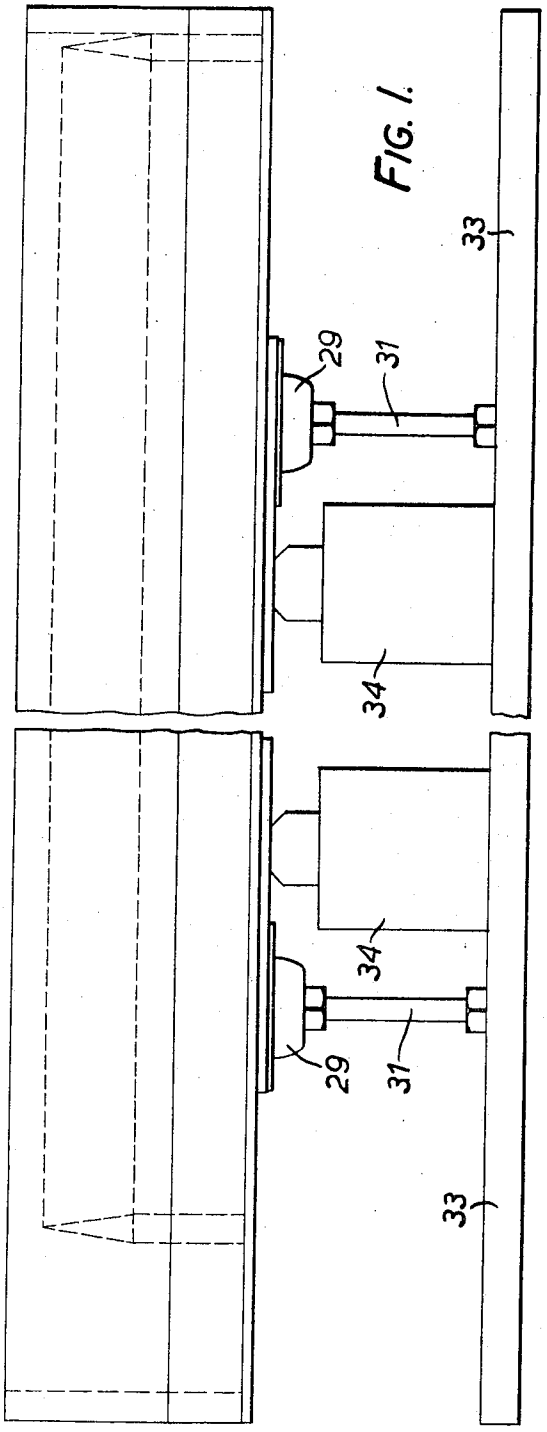


FIG. 1.

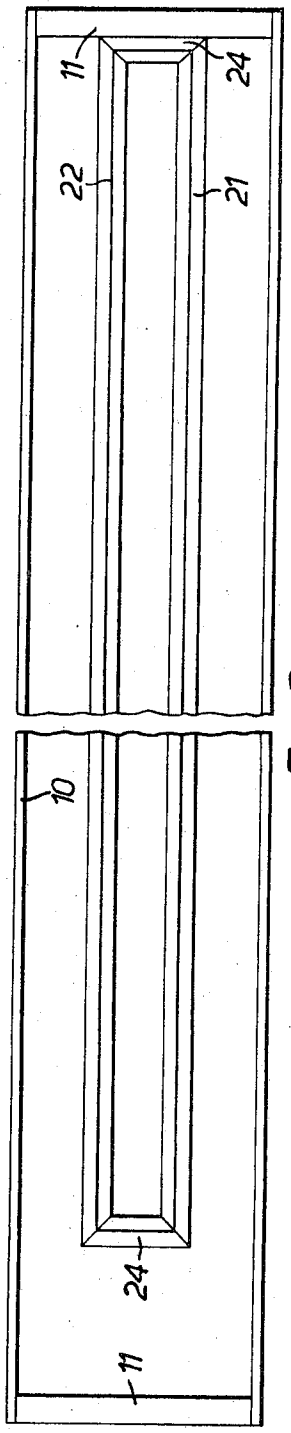
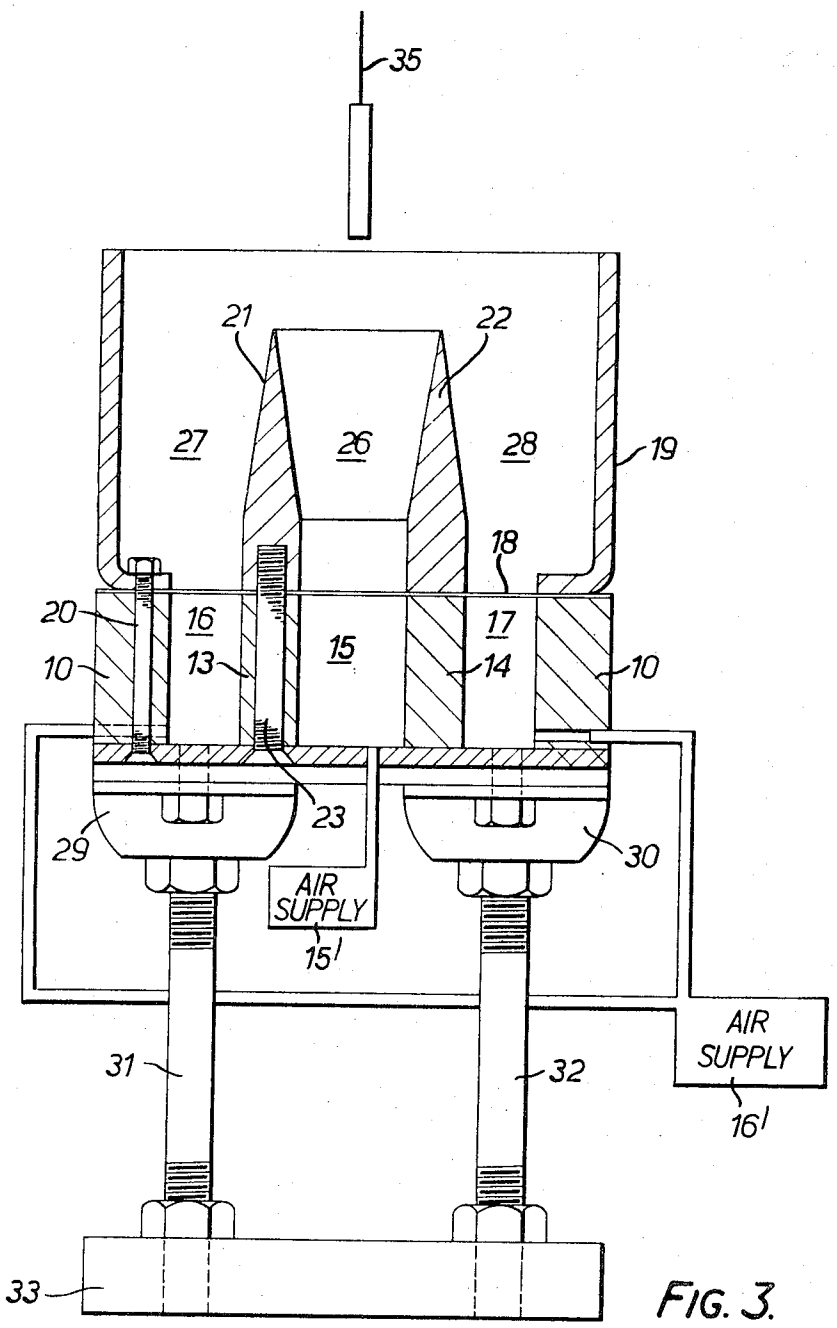


FIG. 2.


35
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10
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AIR SUPPLY
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AIR SUPPLY
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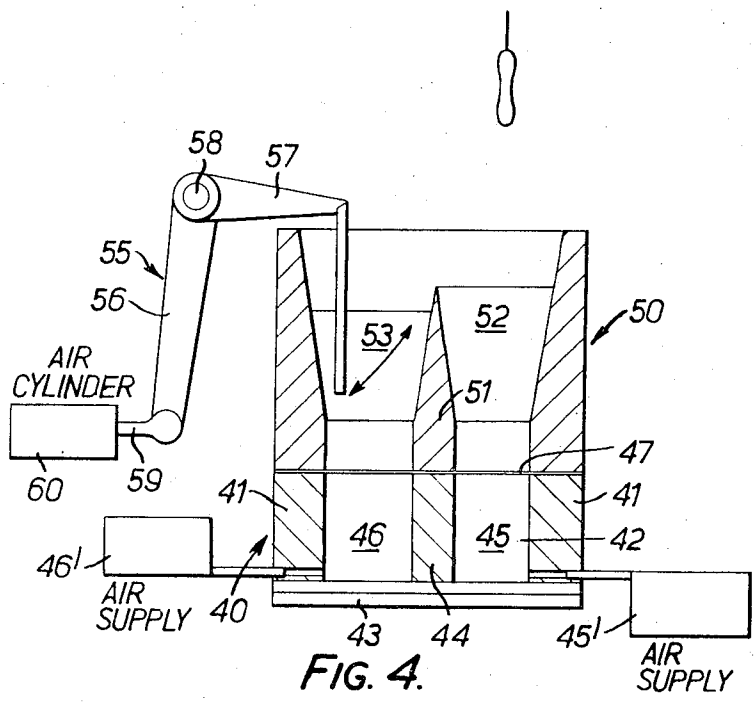
33

FIG. 3.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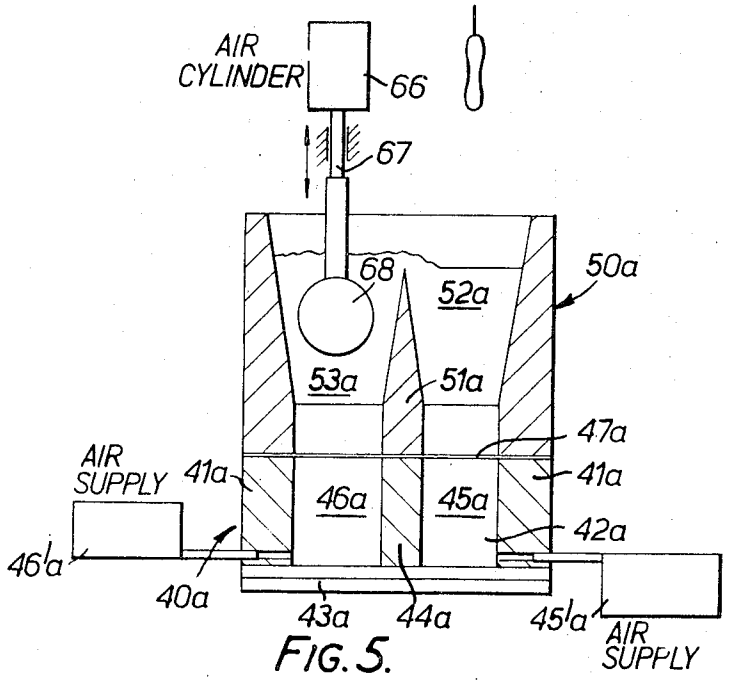
45'
AIR SUPPLY

FIG. 4.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67
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50a
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53a
51a
47a
41a
41a
AIR SUPPLY
46a
45a
42a
46'a
40a
43a
44a
45'a
AIR SUPPLY

FIG. 5.

COATING APPARATUS

This invention relates to coating apparatus of the type in which an article to be coated is immersed in a fluidized bed of the coating material in powder form.

In the coating of articles by means of a fluidized bed of powdered coating material, one method involves the establishment of the fluidized bed, into which the articles to be coated, usually preheated, are immersed. A coating of the powder adheres to each article, and the powder coat can be made into a coherent coating, sometimes by the heat of the preheated article or sometimes by subsequent heat treatment, or both. The coating process can be repeated if necessary to secure an adequately thick coating.

In some circumstances, it is required that the article should be immersed in the fluidised bed to a specific depth. For example, in the coating of certain electrical components, such as capacitors, it may be required to coat components, such as capacitors, it may be required to coat the body of a component, including the junction between the component and its lead-out wires, leaving the wires themselves uncoated.

This operational requirement necessitates that the level of the bed of fluidized material should be maintained to fairly close limits, and this is sometimes a matter of difficulty. In the coating of substantial numbers of articles, the material of the bed is consumed, and must be replenished from time to time. In addition, the level of the fluidized material depends to some extent upon the supply of air used for fluidized it, and any incidental variations may give rise to variations of fluidized bed level.

The present invention provides coating apparatus comprising a first recepticle, means for producing coating material in a fluidized condition in the receptacle, a second receptacle, means for producing coating material in a fluidized condition in the second recepticle, and means for inducing flow of material in a fluidised condition from the second receptacle to the first receptacle.

Features and advantages of the invention will appear from the following description of embodiments thereof, given by way of example, in conjunction with the accompanying drawings, in which:

FIG. **1** is a fragmentary side elevational view of a fluidized bed apparatus;

FIG. **2** is a plan view of the apparatus of FIG. **1**;

FIG. **3** is a sectional view taken on the line **111—111** of FIG. **1**;

FIG. **4** is a view similar to that of FIG. **3** showing a further fluidized bed apparatus; and

FIG. **5** is a view similar to that of FIG. **4** showing yet another fluidized bed apparatus.

Referring to the drawings, the apparatus comprises an elongated base, comprising longitudinal side walls **10,** end walls **11** and a base plate **12.** Running along the length of the base are two partitions **13** and **14**; these partitions run the full length of the base, and so define a central cavity **15** and side cavities **16** and **17.** The top of the base portion is closed by an air permeable diaphragm **18,** the diaphragm closing the three cavities **15, 16** and **17.** Secured to the base portion above the diaphragm is an upper container **19,** secured by bolts such as **20** which also serve to hold the parts of the base together. Within the container **19** are two longitudinal

dividers **21** and **22** which are parallel to each other and to the sides of the container, the dividers being arranged above the partitions **13** and **14** respectively, and secured to them by bolts as at **23.** As is shown more clearly in FIG. **3,** the upper edges of the dividers are tapered to a fine edge. End members **24** are provided for the dividers.

In this way, there are provided within the container **19** a central region **26,** disposed above the cavity **15,** and chambers **27** and **28** disposed above the cavities **16** and **17.** The bottom plate of the base portion is carried on vibration mountings **29** and **30** from a series of support columns **31** and **32,** from a base platform **33,** and a vibrator assembly **34** is disposed between the base platform and the lower part of the base portion, so that the upper part of the general assembly can be vibrated in use.

Means **15'** are provided for supplying air under pressure to the cavity **15,** and a separately controllable supply **16'** of air to the cavities **16** and **17.**

In use, powder coating material, which is to be applied to an article, such as **35** to be coated is placed within the chamber **26.** The volume of powder inserted is such that with a suitable supply of air to the plenum chamber formed by cavity **15,** a fluidized bed will be established in the chamber **26.** The article **35,** conveniently pre-heated, can be inserted into the chamber or, as may be more convenient, the entire assembly can be lifted up to an extent such that the article becomes immersed in the fluidized material in the chamber **26.** After a suitable time, the article is withdrawn from the fluidized bed, for subsequent treatment.

In this coating operation, the fluidized material in chamber **26** is arranged substantially to fill that chamber but at the end of the dipping operation, or a series of such operations, it may be that the material then contained in the chamber is insufficient to raise the level of the fluidized bed to the upper extremity of the chamber, defined by the sharp edges of the dividers **21** and **22.**

Accordingly, further fluidized material is inserted into the chambers **27** and **28** and this material can be fluidized by the supply of air to the plenum chambers provided by cavities **16** and **17.** It is arranged that during the dipping operation the quantity of material and degree of fluidising is such that the level of material in these chambers is below the top edge of the inner chamber. At the end of a dipping operation or of a series of such operations the air pressure in chambers **16** and **17** is increased to raise the level of the supplementary beds in chambers **27, 28** to an extent sufficient to cause the fluidized material in the two outer chambers to spill over into the central chamber, after which the pressure in the cavities **16** and **17** is reduced, so that the level of material in the two outer chambers **27** and **28** will fall. If an excess of material has by this means been fed into the central chamber, which remains fluidized, the excess material will spill back into the two outer chambers, leaving the central chamber precisely filled at the air pressure then existing in cavity **15.** The dipping operation can then be repeated as desired.

As the fluidized material is used up, it may be necessary to replenish the material in the outer chambers **27** and **28** from time to time, but such replenishment will be required relatively infrequently.

Referring now to FIG. **4,** the apparatus comprises a base **40,** longitudinal side walls **41,** end walls **42** and a

base plate **43.** Running along the length of the base is a partition **44** which defines cavities **45** and **46.** The top of the base portion is closed by an air permeable diaphragm **47,** the diaphragm closing the cavities **45** and **46.** Secured to the base portion above the diaphragm is an upper container **50,** secured such as by bolts which also serve to hold the parts of the base together. Within the container **50** is a longitudinal divider **51** which is parallel to the sides of the container, the divider being arranged above and secured to the partition **44** such as by bolts. The upper edge of the divider **51** is tapered to a fine edge.

In this way, there are provided, within the container **50** a main chamber **52,** disposed above the cavity **45,** and a supplementary chamber **53** disposed above the cavity **46.** The bottom plate of the base portion can be carried on vibration mounting such as from a series of support columns mounted on a base platform, and a vibrator assembly disposed so that the upper part of the general assembly can be vibrated in use in the manner already disclosed.

Means **45'** are provided for supplying air under pressure to the cavity **45,** and a separately controllable supply **46'** of air to the cavity **46.**

Adjacent the container **50** is a bellcrank lever **55** having arms **56** and **57** mounted on stub shaft **58.** The free end of arm **56** is connected by rod **59** to an air cylinder **60** whereby the lever can be pivoted on shaft **58.** Arm **57** extends over charging chamber **53** such that a paddle **61** depending from its free end extends into the charging chamber. Thus, with cylical actuation of air cylinder **60,** the paddle can be moved vertically and horizontally, with its free end oscillating along the line of arrow A—A.

In use, the coating of an article is carried out in the manner already described using the fluidised bed produced in main chamber **52.**

When further fluidized material is required due to a drop in the level of the fluidized bed in chamber **52,** this further material is fluidized in chamber **53** by the supply of air to the plenum chamber provided by cavity **46.** It is arranged that during the dipping operation the quantity of material and degree of fluidising is such that the level of material in these chambers is below the top edge of the inner chamber. At the end of a dipping operation or of a series of such operations the paddle **61** is moved as above indicated to generate a wave of fluidized material in chamber **53** to cause the material to spill over divider **51** into the chamber **52.** If an excess of material has by this means been fed into the central chamber, which remains fluidized, the excess material will spill back into chamber **53,** leaving the chamber **52** precisely filled at the air pressure then existing in cavity **45.** The dipping operation can then by repeated as desired.

As the fluidized material is used up, it may be necessary to replenish the material in the chamber **53** from time to time, but such replenishment will be required relatively infrequently.

With reference to FIG. **5,** there is shown apparatus in which components similar to those of FIG. **4** have the same reference number and suffix *a.* In this arrangement, there is provided above chamber **53***a* a plunger system comprising an air cylinder **66** operable to reciprocate a rod **67** as shown by arrow B—B and a cylindrical member **68** movable with the rod **67** and having its axis longitudinal of chamber **53***a.* Operation of the apparatus is similar to that described above for FIG. **4** except that at the end of a dipping operation or a series of such operations air cylinder **66** is actuated to move cylindrical member **68** into chamber **53***a* and thereby displace fluidized material into chamber **52***a.* On withdrawal of member **68,** any excess material fed to chamber **52***a* will spill back into chamber **53***a* leaving the former chamber precisely filled at the air pressure then existing in cavity **45***a.*

It will be appreciated that member **68** can be other than of cylindrical form.

It is an advantage of the arrangements described above that the dividers **21, 22, 51** and **51***a* are provided with surfaces which slope from the sharp edge defined at their upper edges, with the surfaces inclined. By this means it can be arranged that the material will spill easily, and without the formation of ledges of non-fluidized material, on the walls of the main chamber **26, 52** or **52***a* and similarly when excess material spills back from the main chamber to the supplementary chamber or chambers, after a filling operation, this material also will be less likely to form compacts of non-fluidized material on the outer walls of the dividers.

In this way it is possible to maintain an accurate level of material in the bed for coating, so that the depth of coating on the articles is controlled principally by the mechanical dimensions of the apparatus and is not substantially affected by the variations which would normally occur in the level of the fluidized bed.

It may be convenient to arrange that the edge of the dividers are provided by replaceable inserts, rather than shaping the edges as described above.

I claim:

1. Apparatus for coating an article with a fluidized material, comprising

a. a coating receptacle;

b. means for producing coating material in a fluidized condition within said coating receptacle;

c. a second receptacle;

d. means for producing coating material in a fluidized condition within said second receptacle, the level of the coating material in said coating receptacle being defined by the height of a wall separating said coating receptacle from said second receptacle;

e. means for raising the level of the coating material in the second receptacle above the height of said wall, thereby to induce the flow of material from the second receptacle to the first receptacle; and

f. means for submerging the article within the coating material contained in said coating receptacle.

2. Coating apparatus according to claim **1,** wherein said level raising means comprises means for increasing the gas pressure to the second mentary receptacle.

3. Coating apparatus according to claim **1,** wherein said level raising means comprises means arranged to be plumged into the coating material in the second recepticle to displace the material contained therein.

4. Coating apparatus according to claim **1,** wherein said level raising means comprises means for generating a wave of additional coating material.

5. Coating apparatus according to claim **4,** wherein said wave generating means comprises a pivotally mounted member.

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