APPARATUS FOR VAPOR COATING OF LARGE SURFACES

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Fig. 1

Fig. 2

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This invention relates to new and improved means and process for coating surfaces and more particularly to the coating of such surfaces by deposition of a vaporized coating material in a vacuum.

An object of the present invention is to provide new and improved means and method for the coating of surfaces of large rigid objects by deposition of a vaporized coating material in an evacuated chamber.

Another object of the invention is to provide a new and improved means and method for coating the surface of a large rigid object whereby substantially uniform distribution of the coating material over the entire surface of the object may be obtained.

Another object of the invention is to provide new and improved means and method whereby the surface of a large object may be coated with greater speed than previously possible and with greater uniformity of coating.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that many changes may be made in the details of construction, arrangement of parts and steps of the process without departing from the spirit of the invention as expressed in the accompanying claims. I, therefore, do not wish to be limited to the exact details of construction, arrangement of parts and steps of the process shown and described as the preferred form and process have been given by way of illustration only.

Referring to the drawings:

Fig. 1 is a sectional view of an apparatus for carrying out the invention;

Fig. 2 is a sectional view taken on line 2-2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a sectional view taken on line 3-3 of Fig. 2 looking in the direction of the arrows;

Fig. 4 is a view similar to Fig. 1 but showing a further form of apparatus for carrying out the invention; and

Fig. 5 is a fragmentary top or plan view similar to Fig. 2 but showing the form of the invention shown in Fig. 4.

In the coating of the surfaces of large objects such as large plates of glass for windows, etc., with reflection reducing coatings or with reflective coatings it is desirable that the coating be obtained in such a short a time as possible for ease and economy in manufacture and also that the deposited coating be uniformly distributed over the entire surface. In the past this has required either a plurality of sources or else a single source was placed a considerable distance from the surface to be coated which increased considerably the size of the chamber to be evacuated and made difficult the obtaining of uniform coatings. It is, therefore, the object of the present invention to provide a new and improved means and method of coating the surface of a large object whereby the coating will be uniformly distributed over the entire surface and whereby said coating will be deposited in a relatively short time.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout, the several views of the form of apparatus shown in Figures 1 to 3 inclusive for carrying out the invention comprises a base 1 on which is positioned the vacuum chamber or bell jar member 2 which may be evacuated through the opening 3 in the usual manner. The openings 3 may be of desired number depending upon the size of the vacuum chamber.

Within the evacuated chamber are the upright supports 4 for supporting the object to be coated 5 which may be a large sheet of glass, plastic or other similar material with the surface thereof to be coated placed in the direction of the source of coating material. If desired apparatus could be provided for rotating the article to permit coating of both sides but this would require the vacuum chamber to be large.

On the surface of the base 1 is placed the guide member 6 or this guide member 6 may be formed directly in the upper surface of the base 1 itself if desired. This guide member 6 has the guide way 7 which contains the rails 8 and 9 which may be energized by the current from the leads 10 and 11.

Within the guide way 7 is the traveling carrier 12 which comprises the crucible portion 13 containing the coating material 14 which coating material is adapted to be vaporized by heat from the heating coil 15 which is energized by the leads 16 and 17 from the terminals 18 and 19 respectively which in turn receive current by means of the leads 20 and 21 from the posts 22.

The traveling carrier 12 has the wheels 23 which are adapted to be driven by the electric motor 24 which receives current from the tracks 8 and 9 which are energized by current from the leads 10 and 11 as previously described.

Surrounding the crucible 13 and supporting said crucible is a shield member which both acts as a support for said crucible and also acts as a...
radiation shield to retain the heat within said crucible. It is pointed out that if desired the heating coil 18 could be eliminated and the coating material 14 vaporized by resistance heating in which case the current would be applied directly to the crucible which would then become heated and vaporized said coating material.

The vaporized coating material from the crucible 13 is deposited on the surface of the plate 5 on the side toward said source to form the desired coating on said surface.

The pattern or design of the guideway 7 and tracks 8 and 9 is so computed or determined as to provide the desired uniformity of coating on the surface of the article to be coated and the traveling carrier traverses the full extent of the way 7 and then is reversed by the members 9, engaging either of the switches 25 or 26 to reverse the motor 24 which may be of the universal type, to reverse its direction of travel and it therefore returns to the starting point where it again is reversed and this travel of the carrier continues until the coating of desired thickness is deposited which thickness can be observed directly by the operator observing the coated surface through the chamber member 2 where the said chamber member is transparent or through suitable windows in said chamber.

If desired, instead of the heating coil 18 and the resistance form of heating as previously described the crucible 13 could be heated by induction heating coils surrounding said crucible.

The form of the invention shown in Figures 4 and 5 is similar to that shown in Figures 1 to 3, inclusive, except that in this case instead of the traveling carrier 12 being directly associated with the motor, the carrier is driven by a magnet 29 which is driven by the motor 30 and which magnet rides on the tracks 32 and 33 which are bent in the base 4 and through which magnet 29 causes movement of the magnet 28 and carrier 12 to the same extent as the movement of the magnet 29. The wheels 30 and 31 are driven by the motor 34.

The movement of the magnet 29 automatically causes movement therewith of the traveling carrier 12 within the evacuated chamber and the motor 34 is reversed by the member 35 engaging the member 36 in the manner described above for the prior form and the coating continued until the desired coating is applied. The carrier 12 in this case rides in the grooves 40 and 41 which grooves are arranged in a pattern similar to the tracks 32 and 33 for the wheels 30. In this case the base 30 is supported by the legs 37 on a support 38.

It is pointed out that should the surface to be coated be irregular, that is, not all the same plane, then the contour of the guideway 7 could be formed to correspond to the contour of the surface to be coated so that the distance between the source of coating material and surface to be coated could be kept constant during the coating operation.

Before the surface is coated it should, of course, be cleaned in the usual way and may if desired be heated by placing a heating coil within the vacuum chamber between the upper surface of the article to be coated and the top of the chamber. This will facilitate the coating and also decrease the hardness of the resultant coating.

It is also pointed out that if desired instead of moving the crucible or source of coating material relative to the surface to be coated that the article to be coated could be movably mounted ed relative to a stationary source of coating material but this would require a much larger vacuum chamber than otherwise necessary.

From the foregoing it will be seen that I have provided simple, efficient and economical means for obtaining all of the objects and advantages of the invention.

Having described my invention, I claim:

1. In a device of the character described, means for supporting the large rigid object the surface of which is to be coated, a movable carrier, said carrier having means for supporting a coating material, means for vaporizing said coating material and a guideway in space related with an object supported by said object support and extending substantially over the area thereof for guiding said carrier during the distribution of the coating material on the surface to be coated, said conduction means in said guideway and means on said carrier adapted to be energized by current from said current conducting means in said guideway to cause movement of said carrier in said guideway.

2. In a device of the character described, a vacuum chamber, means in said vacuum chamber for supporting an object the surface of which is to be coated, a movable carrier, said carrier having means for supporting a coating material and means for vaporizing said coating material, a guideway for guiding said carrier along paths substantially uniformly distributed relative to the surface of the object to be coated and means operable during evacuation of said chamber for moving said carrier along the paths of said guideway.

3. In a device of the character described, a vacuum chamber, means in said vacuum chamber for supporting an object to be coated, said guideway being arranged according to the distribution desired of the coating material, a carrier adapted to be movable in said guideway, said carrier having means for supporting a coating material and means for vaporizing said coating material, a guide member without the evacuated chamber and being of substantially the same configuration as the guideway within the chamber and movably on said guideway without the evacuated chamber, said movable means having means for causing simultaneous movement of the carrier within the chamber whereby said carrier may be moved relative to the surface to be coated while causing emission of said coating material.

4. Apparatus for coating relatively extensive surfaces comprising a vacuum chamber, means for supporting an object to be coated within said chamber, a container for the coating material to be applied to said object, said container being movably supported within said vacuum chamber, means associated with said container for vaporizing the coating material therein, and means for producing movement of said container within said vacuum chamber along a network of paths distributed substantially uniformly relative to the surface to be coated.

5. Apparatus for coating relatively extensive surfaces comprising a vacuum chamber, means in said vacuum chamber for supporting an object to be coated, a container for the coating material, a carrier for said container movable in said vacuum chamber, means associated with said container for vaporizing the coating material and transport means operable during evacuation of
said chamber for moving said carrier along paths substantially uniformly distributed relative to the surface of the object to be coated.

6. Apparatus for coating relatively extensive surfaces comprising a vacuum chamber, means for supporting an object to be coated within said chamber, a container for the coating material, a carrier for said container movable in said vacuum chamber, electric heating means associated with said container for vaporizing the coating material, and means for producing movement of said carrier within said vacuum chamber along paths substantially uniformly distributed relative to the surface of the object to be coated.

7. Apparatus for coating relatively extensive surfaces comprising a vacuum chamber, means for supporting an object to be coated within said chamber, a crucible for containing the coating material, a carrier for said crucible movable in said vacuum chamber, heating means associated with said crucible for vaporizing the coating material, and transport means operable by a servo-motor movable therewith for moving said carrier along a network of paths distributed substantially uniformly relative to the surface to be coated.

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