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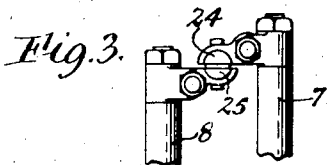
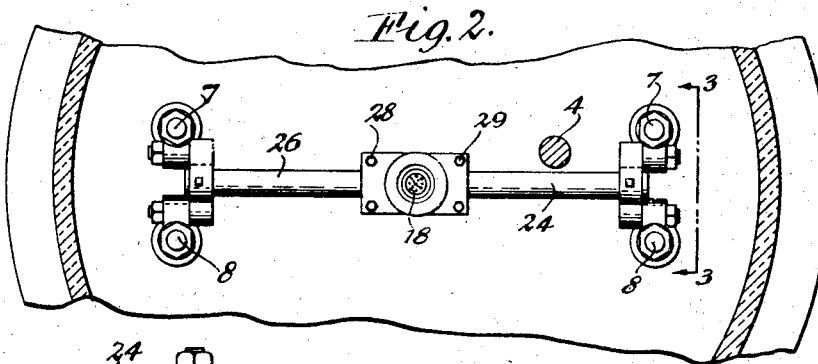
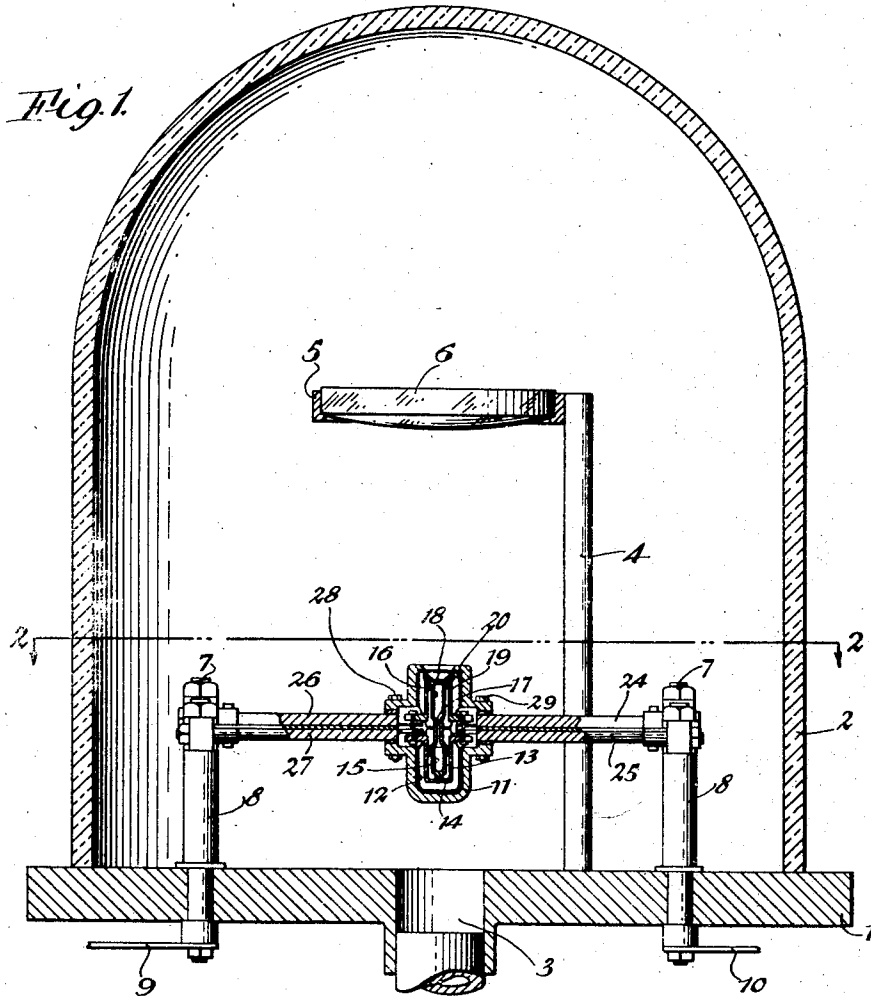
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2,416,211

APPARATUS FOR COATING ARTICLES

Filed Sept. 15, 1943

2 Sheets-Sheet 1



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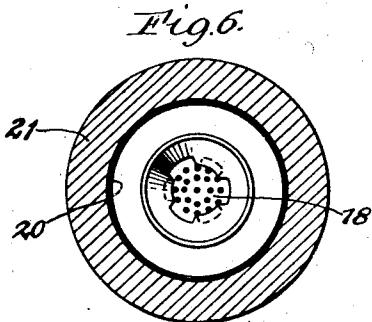
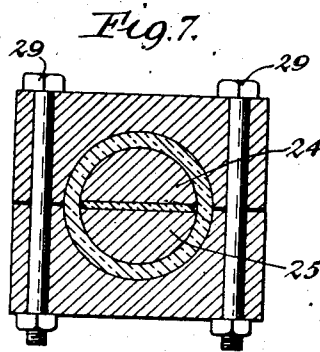
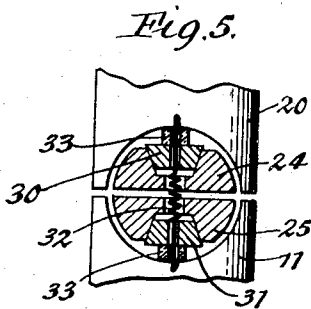
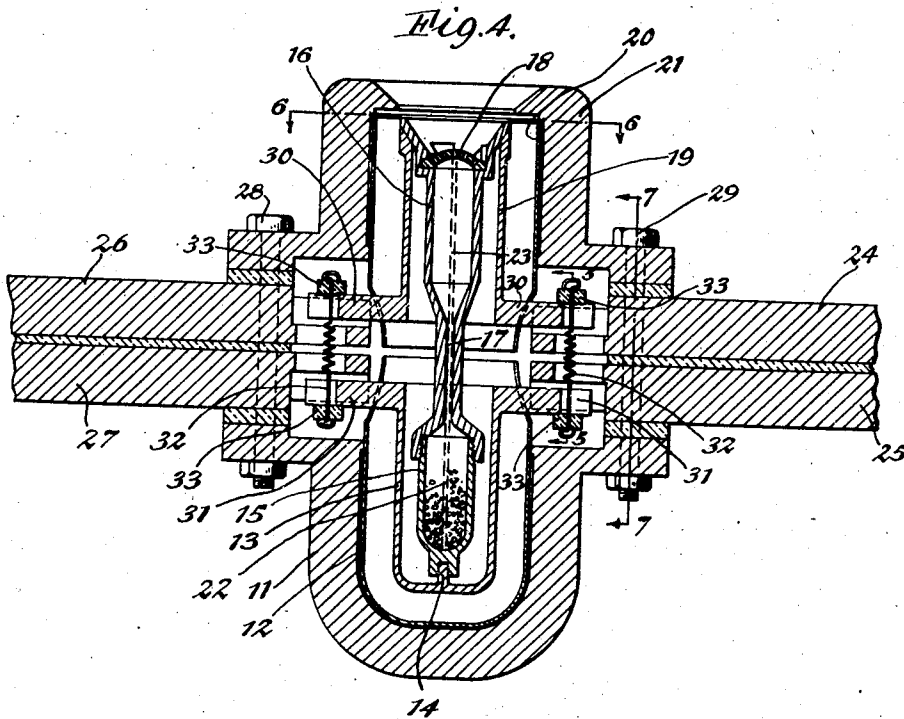
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APPARATUS FOR COATING ARTICLES

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2 Sheets-Sheet 2



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APPARATUS FOR COATING ARTICLES

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7 Claims. (Cl. 91—12.2)

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This invention relates to new and improved apparatus for coating articles and more particularly to new and improved apparatus for vaporizing the coating material.

An object of the invention is to provide new and improved apparatus for coating the surfaces of articles wherein the coating material is vaporized in a vacuum and which will provide more durable, wear resistant coatings.

Another object of the invention is to provide new and improved apparatus for coating the surfaces of articles by evaporation in a vacuum whereby the rate of evaporation and the hardness or durability of the coating may be more accurately controlled.

Another object of the invention is to provide new and improved means for vaporizing the particles at a relatively low temperature and then increasing the speed of said particles by heat and pressure.

Another object of the invention is to provide a new and improved means for vaporizing the coating material and for depositing said vaporized coating material wherein more durable wear resistant coatings will be obtained.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings and 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 scope of the invention as expressed in the accompanying claims. We, 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 has been shown by way of illustration only.

Referring to the drawings:

Fig. 1 is a side view partly in section of a coating apparatus embodying the present invention;

Fig. 2 is a sectional view taken on lines 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 sectional view of the vaporizing means shown in Fig. 1 but on an enlarged scale;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 4 looking in the direction of the arrows;

Fig. 6 is a sectional view taken on line 6—6 of 50

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Fig. 4 looking in the direction of the arrows; and

Fig. 7 is a sectional view taken on line 7—7 of Fig. 4 looking in the direction of the arrows.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, the coating apparatus shown in Fig. 1 comprises a base 1 on which is positioned the bell jar or the like 2 to form a vacuum chamber adapted to be evacuated through the opening 3 which is connected with suitable vacuum chambers not shown.

The upright 4 is provided with the supporting ring 5 adapted to support the article 6 such as a lens or the like which has the surface thereof to be coated in the direction of the vaporizing apparatus.

Extending through the base 1 are the posts 7 and 8 adapted to receive current through the leads 9 and 10 respectively to provide such current to the vaporizing apparatus.

The vaporizing apparatus comprises the radiation shield 11 formed of carbon or graphite or the like with a lining 12 of platinum and within said platinum member 12 and spaced therefrom is the heater member 13 which may be of carbon or the like or as desired might be formed of other suitable material and which has the projecting portion 14 adapted to receive and support the carbon crucible member 15 which member is adapted to contain the coating material to be vaporized.

The crucible member 15 is threadedly connected to the super heater 16 which may also be formed of carbon or the like and which has the narrow portion 17 through which the vaporized particles are adapted to pass into the super heater member 16 which is provided with the spray nozzle type header 18 through which the particles pass to reach the space to be coated.

Surrounding the super heater 16 is the heating member 19 of carbon or the like and surrounding this member 19 is the platinum lining 20 for the radiation shield member 21.

The shield 21 and lining 20 have openings aligned with the spray nozzle 18.

The heater member 13 is provided with the slot 22 and the heating element 19 is provided with the slot 23.

Current for the heater 13 is received through the posts 8 and leads 27 and 25 and current for

the super heater is received through the posts 7 and leads 26 and 24.

The leads 26 and 27 and the flange portions on the radiation shield members 11 and 21 are held together by the screw members 28 and the leads 24 and 25 and opposite flange members on the radiation shields 11 and 21 are held together by the screw 29.

The heating members 13 and 19 are provided with the integral flanges 30 and 31 which are secured in opposite positions by the tungsten spring or clip member 32 which is insulated from said heating members by the insulators 33.

As shown in the drawings insulation members are provided between the leads 26 and 27 and the leads 24 and 25 and also between the flanges on the shield 21 and the leads and again between the flanges on the shield 11 and the leads.

It will be noted that the flanges 30 and 31 on the ends of the heaters 19 and 13 are wedge shaped and adapted to enter wedge shaped openings in the leads and held therein in tight engagement as shown in Fig. 5 to insure proper current for said heating members.

In use the member 16 and member 15 are removed from the vaporizing apparatus as a unit and the member 15 separated from the member 16 by means of the threaded connection between the parts and then the coating material is placed in the member 15, the parts again connected and the unit replaced in the vaporizing apparatus. Current is then applied to the heating member 13 sufficient to vaporize the coating material within the crucible member 15 which vaporized coating material passes through the restricted opening 17 and reaches the superheater member 16. The heating member 19 for the superheater 16 is then raised to a temperature above the temperature necessary to vaporize the coating material and because of this heat and pressure the vaporized coating material is forced through the spray nozzle 18 and caused to impinge upon the surface to be coated with considerably greater force than otherwise and therefore forms a wear resistant, durable coating.

The present apparatus may be employed for the forming of reflection reducing coating on the surfaces of light transmitting articles and in such cases the coating material might be magnesium fluoride, quartz, cryolite, or other suitable material and the device may also be employed for forming reflective coatings on the surfaces of reflectors and in such cases the coating material might be aluminum or other suitable material.

It is pointed out that by employing the present apparatus with the superheater being heated to a temperature considerably above the vaporization point of the coating material that a pressure is built up in the superheater which greatly increases the speed of the vaporized particles which are forced outwardly therefrom to form the coating with greater durability and adhesion as stated above.

It is also pointed out that by employing the present apparatus the rate of evaporation of the coating material can be more accurately controlled by controlling the temperature employed for vaporizing said material and this also allows a greater control of the hardness of the applied coating.

The present apparatus and method also allows the speeding up or accelerating of all of the vaporized particles thus providing greater adhesion of the particles to the surface and also provides a more durable, wear resistant coating.

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

Having described our invention, we claim:

1. In a device of the character described, a vacuum chamber, means for supporting in said chamber an article the surface of which is to be coated, means for distilling coating material for application to said surface, a superheating chamber communicating with said distilling means and through which said vaporized material is discharged from said distilling means into said vacuum chamber and means for heating said superheating chamber to a temperature higher than the temperature required to vaporize said coating material to increase the speed of emission of the vaporized particles.

2. In a device of the character described, a vacuum chamber, means for supporting in said chamber an article to be coated, and means in operative relation to said article for supplying vaporized coating material to be applied to a surface of said article, said supplying means including a heated crucible communicating with an elongated hollow refractory member through which the vaporized material is discharged to coat said surface, and means for superheating said hollow refractory member to raise the temperature of vapor passing through said member from the crucible.

3. In a device of the character described, a vacuum chamber, means for supporting in said chamber an article the surface of which is to be coated, a crucible for receiving the material to be vaporized, a superheating chamber supplied with vaporized material by way of a tubular connecting member from said crucible and discharging into said vacuum chamber, and means for heating said crucible to vaporize said material therein and for heating said superheating chamber to a sufficiently elevated temperature to increase the speed of said vaporized particles.

4. In a device of the character described, a vacuum chamber, means for supporting in said chamber an article to be coated, means for distilling the coating material to be applied to a surface of said article, a hollow heating member surrounding said distilling means, and an elongated hollow chamber surrounded by a superheater, said elongated chamber being supplied with vaporized coating material from said distilling means and discharging into said vacuum chamber, said elongated chamber being heated to a sufficiently elevated temperature to increase the speed of vaporized particles passing therethrough.

5. In a device of the character described, a vacuum chamber, means for supporting in said chamber an article to be coated, and means in operative relation to said article for supplying vaporized coating material to be applied to a surface of said article, said supplying means including a heated crucible communicating with an elongated hollow refractory member through which vaporized material is discharged to coat said surface, said member comprising a superheater chamber and a vapor inlet passage thereto of relatively restricted diameter, and means for superheating said superheater chamber of said member to raise the temperature of vapors passing through said member from the crucible.

6. In a device of the character described, a vacuum chamber, means for supporting in said chamber an article to be coated, means for distilling the coating material to be applied to a surface of

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said article, a superheating chamber supplied with vaporized coating material from said distilling means, said superheating chamber including a spray nozzle for discharging superheated vapor from said superheating chamber into said vacuum chamber, and means for heating said superheating chamber to a sufficiently elevated temperature to increase the speed of vaporized particles received from said distilling means.

7. In a device of the character described, a vacuum chamber, means for supporting in said chamber an article to be coated, means for distilling the coating material to be applied to a surface of said article, a chimney for discharging vaporized material from said distilling means into said vacuum chamber to impinge upon the surface to be coated, heating means co-operating

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with a portion of said chimney to superheat the vapors discharging from said distilling means into said vacuum chamber, said chimney being of reduced interior cross-section between said superheater portion and said distilling means.

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