

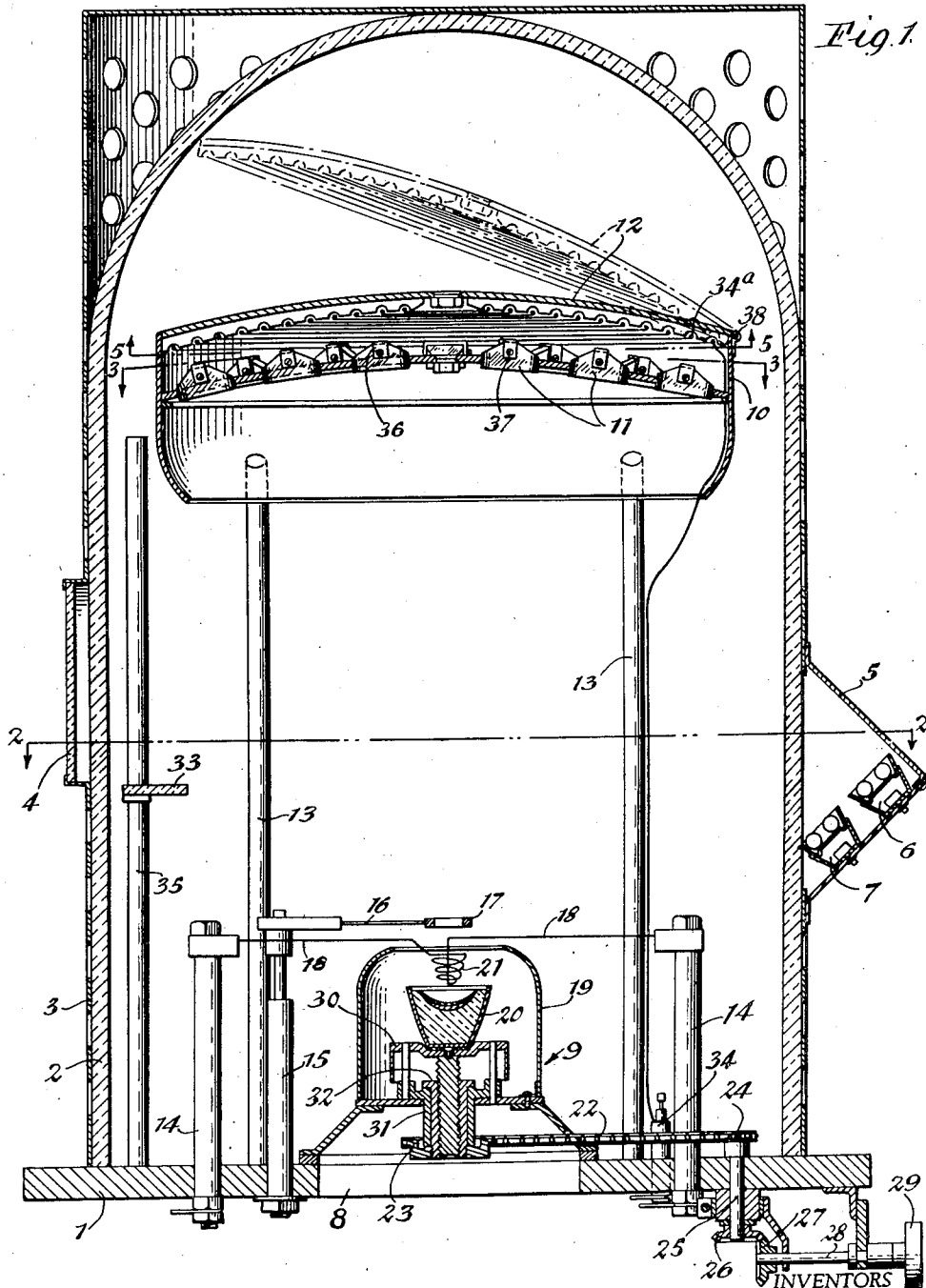
May 10, 1949.

H. OSTERBERG ET AL
APPARATUS FOR COATING ARTICLES

2,469,929

Filed Sept. 24, 1943

4 Sheets-Sheet 1



BY

Raymond A. Paquin
ATTORNEY

INVENTORS
HAROLD OSTERBERG
ROGER E. MATTER.

May 10, 1949.

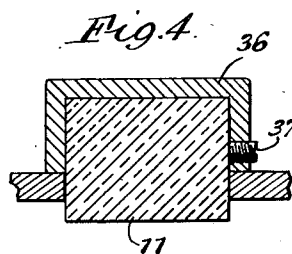
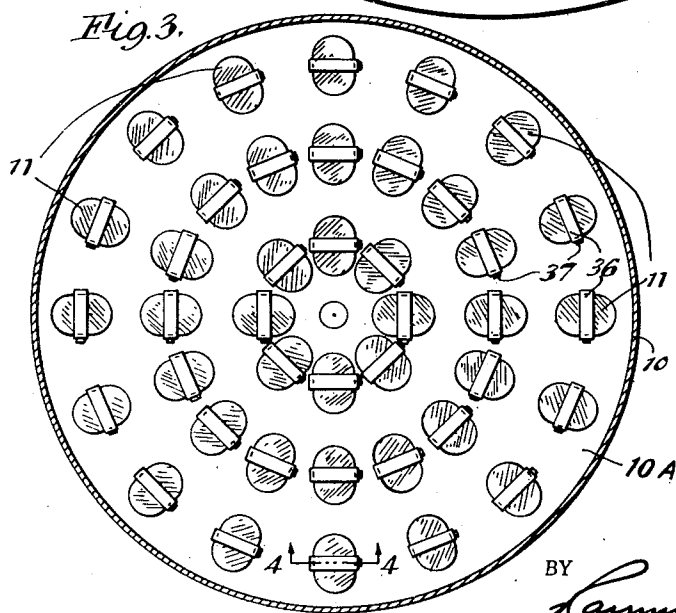
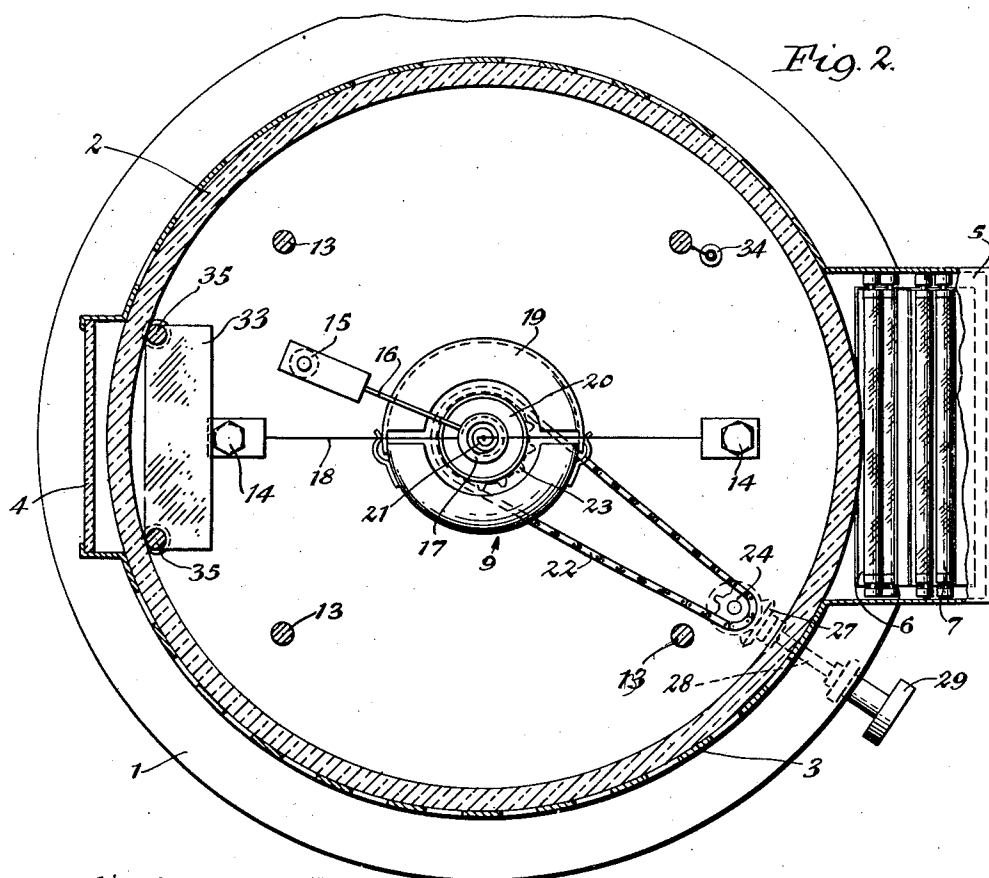
H. OSTERBERG ET AL

2,469,929

APPARATUS FOR COATING ARTICLES

Filed Sept. 24, 1943

4 Sheets-Sheet 2



INVENTORS
HAROLD OSTERBERG
ROGER E. MATTER
1 A. Pagnin
ATTORNEY

May 10, 1949.

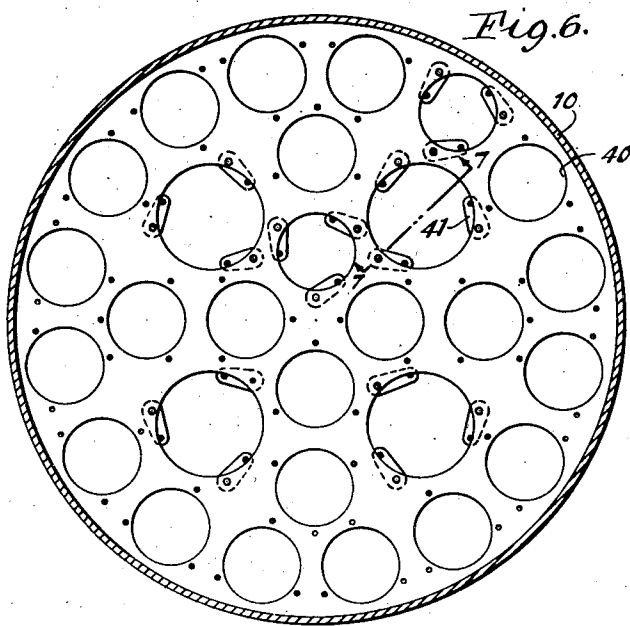
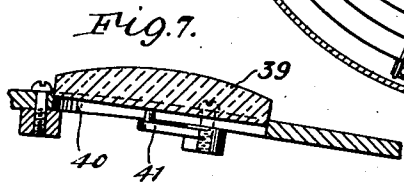
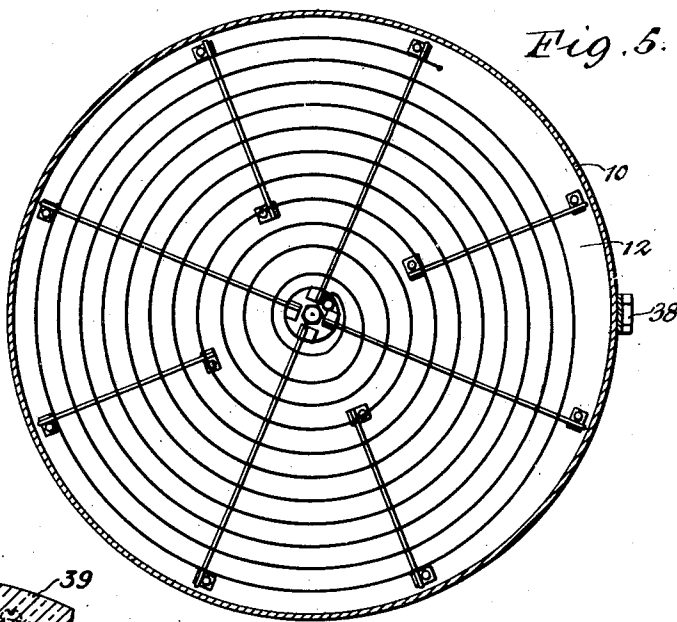
H. OSTERBERG ET AL

2,469,929

APPARATUS FOR COATING ARTICLES

Filed Sept. 24, 1943.

4 Sheets-Sheet 3



INVENTORS
HAROLD OSTERBERG
ROGER E. MATTER
BY *Raymond A. Paquin*
ATTORNEY

May 10, 1949.

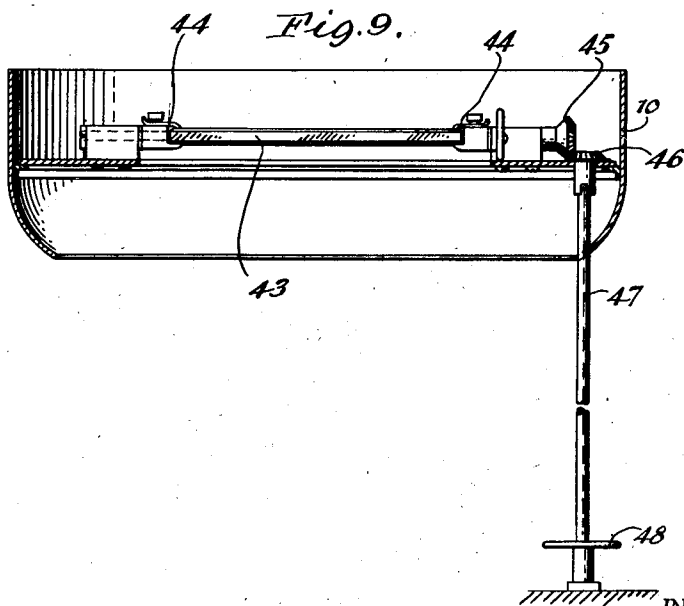
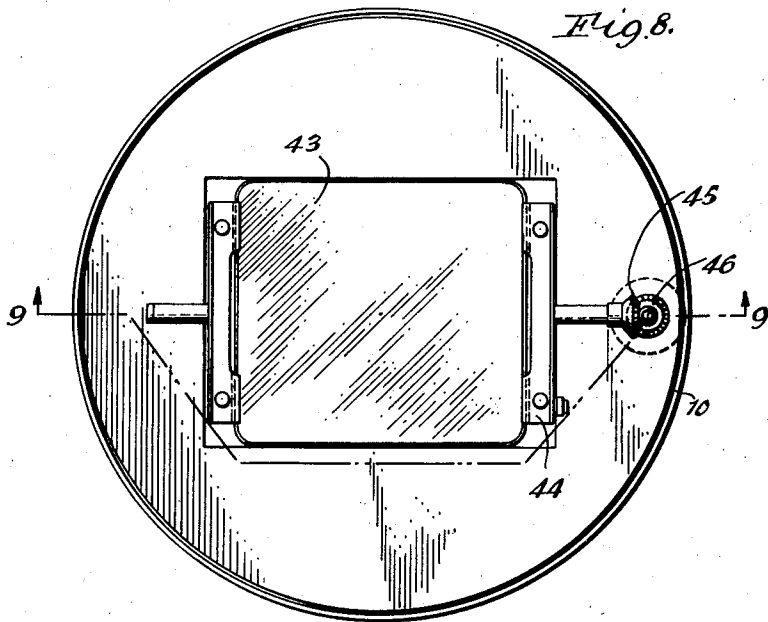
H. OSTERBERG ET AL

2,469,929

APPARATUS FOR COATING ARTICLES

Filed Sept. 24, 1943

4 Sheets-Sheet 4



BY

Raymond A. Faquin
ATTORNEY

INVENTORS
HAROLD OSTERBERG
ROGER E. MATTER

UNITED STATES PATENT OFFICE

2,469,929

APPARATUS FOR COATING ARTICLES

Harold Osterberg and Roger E. Matter, Buffalo, N. Y., assignors, by mesne assignments, to American Optical Company, Southbridge, Mass., a voluntary association.

Application September 24, 1943, Serial No. 503,674

10 Claims. (Cl. 91—12.2)

1

This invention relates to new and improved coating apparatus and has particular reference to new and improved apparatus for forming coatings of vaporized coating material in an evacuated chamber.

An object of the present invention is to provide new and improved means for forming durable, wear resistant coatings of vaporized coating material deposited in an evacuated chamber.

Another object of the invention is to provide new and improved means for supporting an article during the coating operation;

Another object of the invention is to provide new and improved means for coating an article in an evacuated chamber whereby the article may be observed during the coating operation;

Another object of the invention is to provide new and improved means for pivoting an object to be coated during the coating operation;

Another object of the invention is to provide new and improved means for adjustably supporting the coating material in an evacuated chamber;

Another object of the invention is to provide new and improved means for adjustably supporting an object to be coated in an evacuated chamber which permits the coating of both surfaces of the object without disturbing the coating operation;

Another object of the invention is to provide new and improved means for heating the article to be coated;

Another object of the invention is to provide a new and improved evacuated chamber member for coating apparatus;

Another object of the invention is to provide new and improved means for adjusting the relative positions of the source of coating material and heating element from without the evacuated chamber and without disturbing the coating operation.

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 and arrangement of parts without departing from the spirit of the invention as expressed in the accompanying claims. We, therefore, do not wish to be limited to the exact details of construction and arrangement of parts shown and described as the preferred form has been given by way of illustration only.

2

Referring to the drawings:

Fig. 1 is a sectional view of an apparatus embodying 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. 1 looking in the direction of the arrows;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3 looking in the direction of the arrows;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1 looking in the direction of the arrows;

Fig. 6 is a view similar to Fig. 3 but showing a modified form of holding apparatus;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6 looking in the direction of the arrows;

Fig. 8 is a view similar to Figs. 3 and 6 but showing a further modified form of supporting apparatus; and

Fig. 9 is a sectional view taken on line 9—9 of Fig. 8 looking in the direction of the arrows.

The apparatus of the present invention is shown adapted for the purpose of providing optical elements such as lenses, prisms or the like with reflection reducing coatings but it will be understood that the apparatus may be adapted for other coating purposes such as the coating of mirrors or reflectors with reflective coatings.

The apparatus embodying the invention comprises a base 1 adapted to support a housing member 2 to form an evacuating chamber in which the coating operation is carried out. This evacuated chamber comprises the bell jar or the like 2 which may be surrounded by the housing 3. The housing 3 is preferably a metallic housing adapted to extend around the bell jar 2 and to have openings therethrough permitting the passage of light into the interior of the evacuated chamber.

The purpose of the casing 3 is to prevent injury to the bell jar 2 and also to prevent injury to the operator should the bell jar 2 crack or break for any reason.

The casing or housing 3 has diametrically opposed openings one of which openings contain the window 4 and the other of said openings has the housing member 5 aligned therewith which housing member contains the fluorescent lamps 6 and 7 for observing the work during the coating operation. The base 1 is provided with an opening 8 through which the evacuated chamber may be evacuated by vacuum pumps in the usual manner and overlying this opening is the sup-

porting structure 9 for adjustably positioning the source of coating material.

Spaced from the source of coating material is the housing member 10 adapted to support the articles 11 the surfaces of which are to be coated and which member 10 has the hinged cover 12 as hereinafter described.

The member 10 is supported by the uprights 13 which may be of desired number.

Extending through the base 1 are the lead members or posts 14. The post 15 is adapted to support the adjustable member 16 which supports the annular or ring shaped diaphragm member 17 in alignment with the source of coating material. The ring shaped member 17 is interposed between the source of vaporized coating material and the articles to be coated and acts as a vignetting member. The vignetting member is so positioned between the two that it does not cast a total shadow or any portion of the surface to be coated. On the contrary the partial shadow which it casts brings about substantially uniform distribution of the coating material on the surfaces to be coated, even though they are not all at precisely the same distance from the source of the vaporized coating material. This vignetting member per se is described and claimed in the application of Harold Osterberg, Gilbert E. Pride, and Paul C. Heijn, Serial No. 498,972, filed August 17, 1943, which issued October 1, 1946, as Patent 2,408,529.

The posts 14 each support a lead or source of current 18 for the coil member 21, which coil member is for the purpose of heating the coating material to vaporize said material. The coating material is positioned within the crucible 20 which crucible is surrounded by the shield member 19 to prevent loss of heat and also to direct the vaporized particles toward the surfaces to be coated. As will be seen from Fig. 2 this shield member 19 is formed in two portions with spring clamps adjacent their abutting edges to retain the parts in aligned relation.

It is pointed out that during the coating operation it is necessary that the heating coil 21 be retained in proper position relative to the coating material within the crucible 20 and this position may be maintained by adjustment of the crucible 20 vertically by means of the chain 22 which connects the sprockets 23 and 24. The shaft 25 from the sprocket 24 extends through the base 1 and the chain 22 may be moved by means of the handle or knob 29 through the beveled gears 26 and 27 and the shaft 28 to which the handle 29 is secured.

The table 30 is adjusted by means of the members 31 and 32 as rotation of the handle 29 causes movement of the chain 22 and sprocket 23 which causes vertical movement of the table 30 relative to the vignetting member 17 and the article or articles to be coated depending upon the direction of turning of the handle 29.

Aligned with the window 4 is the reflector 33 which is supported on the uprights 35 whereupon illumination of the lamps 6 and 7 light or an image of said lamps from said lamps will be reflected from the surfaces being coated into the reflector 33 where said surfaces may be observed by the operator during the coating operation.

The post 34 provides current for the heating coil 34a which allows the heating of the lenses to be coated before, during and/or after the coating operation as set forth in the application of Osterberg et al., Serial No. 440,778, filed April 28, 1942.

To support the objects to be coated on the plate 10a, where the objects are prisms as shown in Figs. 1 and 3 the said plate 10a is provided with openings of the shape of the object and with the object positioned in said opening with the surfaces to be coated in the direction of the source of coating material. A clamp 36 is then placed over the upper surface of each of the articles 11 and secured in said position by means of the screw 37 and then the article 11 is placed through the opening in the plate 10 and supported in said position by the lower portions or ends of the clamp member 36 which rest on the upper surface of the plate 10a as shown in Fig. 4. As shown in Figs. 1 and 3 one of these clamp members is provided for each object to be coated.

The plate 10a with the objects to be coated in position thereon may be placed within the housing member 10 by raising the cover 12 which is pivoted at 38 as shown in Fig. 1 and supported therein by the annular or marginal flange on the housing member 10.

Another form of apparatus for supporting the objects to be coated is shown in Figs. 6 and 7 which form is particularly adapted for use in the coating of lenses 39 one of which is placed in each of the openings 40 as shown in Fig. 7 and supported in said opening by means of the pivotal fingers 41 a plurality of which are provided for each lens and a few only of which have been shown in Fig. 6 for the purpose of illustration.

In Figs. 8 and 9 is shown another form of apparatus for supporting the object to be coated and which is particularly adapted for larger objects and which apparatus allows the coating of both surfaces of an object without disturbing the coating operation and without opening the evacuated chamber.

In this form the object to be coated 43 is supported by the clamp members 44 one of which is connected to the shaft which in turn is connected to the beveled gear 45 which meshes with the gear 46 on the shaft 47 and to this shaft 47 may be connected a pulley or chain 48 in a manner similar to the chain shown in Fig. 2 at 22 and then the shaft, beveled gears and handle as shown in Fig. 1 may be provided for effecting rotation of the member 43 from without the evacuated chamber or the shaft 47 may extend directly through the base 1 and have a gear arrangement such as the beveled gears 26 and 27, shaft 28 and handle 29 associated therewith as shown in Fig. 1 which would eliminate the necessity of a chain drive such as 22 or 48 and thus simplify the construction. It is pointed out that by employing the heating coil 34a in the form of a continuous spiral coil with one end grounded to the cover 12, which in turn is grounded by way of the uprights 13 for completion of the circuit to the current supply, and the other end connected to the current supply that a better control or more uniform control of the heating may be obtained and also that by grounding this coil to the cover 12 that it is only necessary to have one wire from the post 34 thus simplifying the construction.

It is pointed out that the lamps 6 and 7 should be daylight lamps.

From the foregoing it will be seen that we have provided simple, efficient and economical means 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, for use in adjustably positioning a crucible member

5

in an evacuated chamber whereby the position of said crucible member may be adjusted without disturbing the vacuum in said evacuated chamber, said means comprising a support for said crucible member, a member for raising or lowering said support member, means connected with said adjustable member and operable from without the evacuated chamber and means for operating said adjustable member to adjustably position said support and crucible member.

2. In a device of the character described, a vacuum chamber member, said chamber member comprising a base and a bell jar on said base, a housing over said bell jar, supporting means in said vacuum chamber, a member supported by said supporting means and containing a removable support member for supporting objects to be coated, means in said vacuum chamber for supporting a source of coating material and means positioned between said means for supporting a means for coating material and said means for supporting objects to be coated, said means being in fixed relative position to said coating material and said objects to be coated and being for the purpose of providing uniform distribution of the coating material over the surface to be coated, means for vaporizing the coating material and means for adjusting the relative position of said coating material and said means for vaporizing said coating material from outside of said vacuum chamber.

3. In a device of the character described, a transparent vacuum chamber, a source of vaporized coating material in the lower portion of said chamber, a rack in the upper portion of said chamber for supporting an article to be coated with a lower surface exposed to the vaporized material from said source, a reflector adjacent said transparent vacuum chamber for facilitating viewing of said lower surface by the operator, and a lamp adjacent the opposite side of said chamber and in alignment with said surface of the article and with said reflector for permitting the operator to observe in said reflector a beam of light from said lamp reflected thereto by said surface.

4. In a device of the character described, a transparent vacuum chamber in the form of a bell jar, means in the lower portion of said chamber for vaporizing coating material, a support in the upper portion of said chamber for an article to be coated with a lower surface of the article exposed to coating by said material, a lamp adjacent said chamber for causing light from said lamp to be reflected from said exposed surface of the article, and a reflector aligned with said lamp and surface for permitting the operator to observe in said reflector said light reflected from the surface being coated.

5. In a device of the character described, the combination as set forth in claim 4 including a housing surrounding said vacuum chamber, said housing having openings for said lamp and said reflector respectively.

6. Coating apparatus comprising a vacuum chamber, means within said vacuum chamber for vaporizing coating material, a support within said chamber for holding an article to be coated, a heater arranged adjacent said article for heating the same and disposed at the side of the article and support remote from said means, and a shield surrounding all sides of the support except the side toward said means and cooperating with said support for forming an enclosure

6

for said heater while shielding the adjacent wall of said vacuum chamber from heat radiated by said heater.

7. Coating apparatus comprising a vacuum chamber, means within said vacuum chamber for vaporizing coating material, supporting means within said chamber for holding a plurality of articles to be coated above said first mentioned means, a housing within said vacuum chamber surrounding said supporting means and said articles on all sides except the side toward said first mentioned means, a heater within said housing for heat treating said articles, said housing forming a heat confining enclosure adjacent the upper surfaces of said articles and shielding the adjacent walls of said vacuum chamber from heat radiated by said heater.

8. Coating apparatus comprising a vacuum chamber, means within said vacuum chamber for vaporizing coating material, a rack within said chamber for supporting an article to be coated above said means, a housing within said chamber and surrounding all sides of said rack and said article except the side toward said means, and a heating coil within the enclosure formed by said housing and said rack for heat treating the article supported by said rack, said housing including a lid above said heater, said lid and said heater being movable relative to said rack for exposing the article carried thereby, said housing and rack serving as means to shield the adjacent walls of said vacuum chamber from heat radiated by said heater.

9. Coating apparatus comprising a vacuum chamber, a member within said vacuum chamber for supporting coating material to be vaporized, an article support within said chamber for positioning an article to be coated by said material, a heater in said chamber between said article support and member for supporting said coating material for heating said coating material and positioned closely adjacent the latter, and a two-part shield extending around said member, coating material and heater for preventing loss of heat and for directing the vaporized coating material toward said article, said shield having inturned rim portions defining a discharge orifice in line with said article for the vaporized coating material, said two-part shield being separable to allow coating material to be placed within said shield without disturbing said heater.

10. Coating apparatus of the character described comprising a base and a bell jar positioned thereon so as to form a vacuum chamber, an object support in said chamber for fixedly positioning an object so that a surface portion thereof may be coated, adjustable means in said chamber for supporting a source of coating material, vignetting means positioned between said object support and said adjustable means and in relatively fixed spaced relation to said object support, said vignetting means serving to control the distribution of coating material upon the surface portion of the object during the coating thereof, means for heating the source of coating material for causing vaporization thereof, and means for varying the operative position of said adjustable means relative to said vignetting means and said object support from outside said vacuum chamber.

HAROLD OSTERBERG.
ROGER E. MATTER.

(References on following page)

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,354,418	Pershing	Sept. 28, 1920
1,562,936	Ainsworth	Nov. 24, 1925
1,608,293	Beebe	Nov. 23, 1926
1,954,950	Russell	April 17, 1934
2,100,045	Alexander	Nov. 23, 1937

Number

2,103,623
2,160,981
2,239,452
2,260,471
2,351,537
2,398,382

Name

Kott Dec. 28, 1937
O'Brien June 6, 1939
Williams et al. April 22, 1941
McLeod Oct. 28, 1941
Osterberg et al. June 13, 1944
Lyon April 16, 1946

Date

OTHER REFERENCES

Ser. No. 233,455, Berghaus et al. (A. P. C.), pub. May 4, 1943.