(Specimens.)

2 Sheets—Sheet 1.

T. A. EDISON.

ART OF PLATING ONE MATERIAL WITH ANOTHER.

No. 526,147. Patented Sept. 18, 1894.

Fig 1.

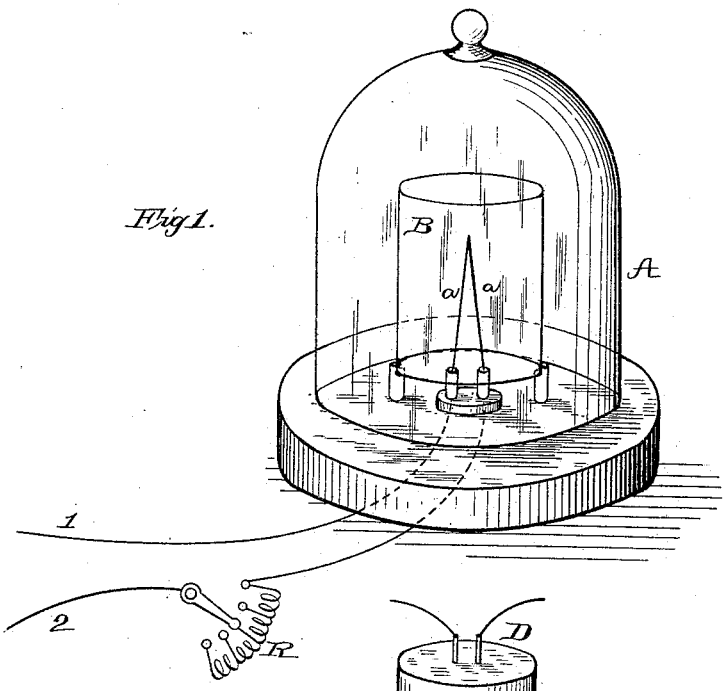
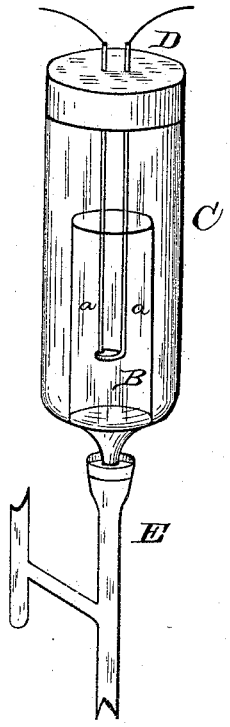


Fig 2.



WITNESSES:

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INVENTOR:

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(Specimens.) 2 Sheets—Sheet 2.

T. A. EDISON.

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Fig. 3.

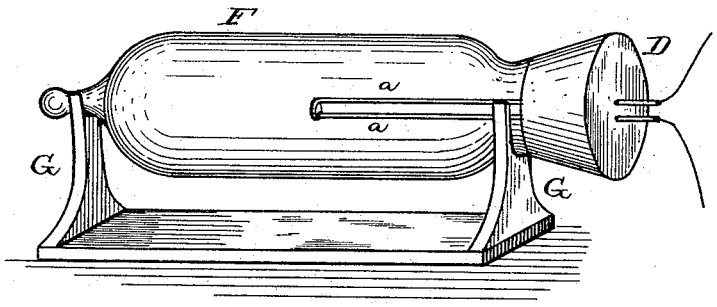


Fig. 4.

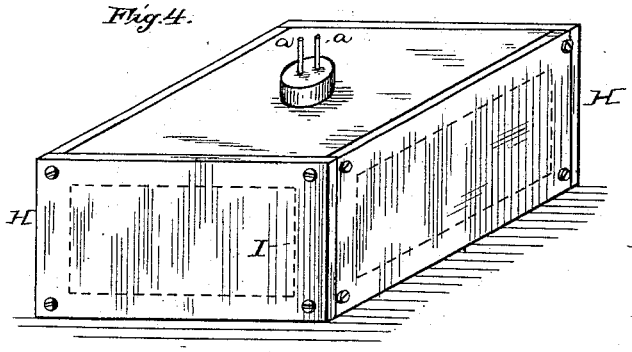


Fig. 5.

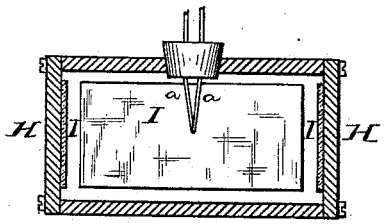
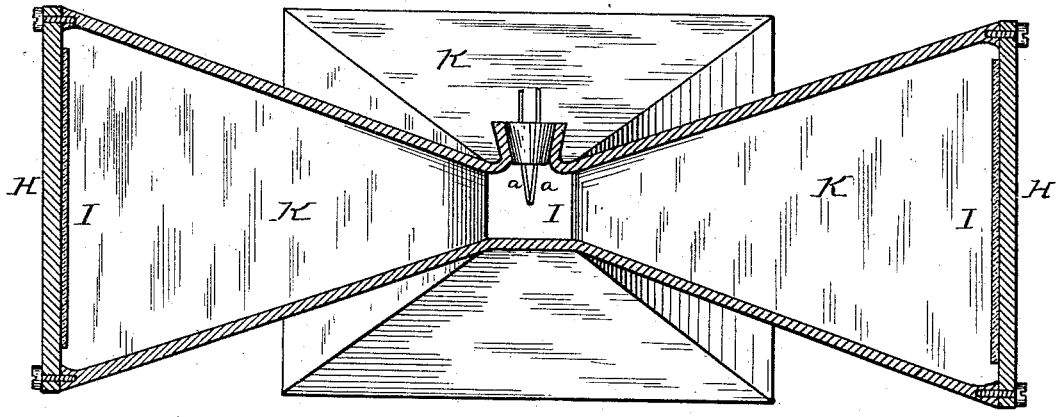


Fig. 6.



WITNESSES:

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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

ART OF PLATING ONE MATERIAL WITH ANOTHER.

SPECIFICATION forming part of Letters Patent No. 526,147, dated September 18, 1894.

Application filed January 28, 1884. Serial No. 118,942. (Specimens.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in the Art of Plating One Material with Another, (Case No. 615,) of which the following is a specification.

The object of this invention is to produce a coating of one material upon another; and said invention consists in producing such a coating by throwing the material to be deposited into the form of a vapor in a vacuum, by means of a continuous current, the object to be coated or plated being within the vacuous chamber so that the material is deposited upon it from the vapor.

I vaporize the material by electrical heating and the best method of doing this is to place electrodes of the depositing material in the vacuum chamber, forming a continuous arc between them. A dense even homogeneous and adherent deposit will then be rapidly formed upon the interior walls of the chamber and upon the surface of any object which may be placed within said chamber.

The deposit may be obtained by rendering the material to be deposited electrically incandescent within the vacuum by means of a continuous current, but the arc process is more rapid; also, I may produce a deposit of a non-conducting material by coating a conductor of carbon with such material and heating the same to incandescence. The material will be vaporized and deposited, while the carbon will withstand the heat. Any substance which will volatilize in the incandescent heat may be so used. This process of depositing in an exhausted chamber by electrical vaporization by means of a continuous current or a continuous arc, as distinguished from an intermittent current and from a series of sparks, I term electro vacuous deposition.

My invention is adapted to the plating of any material whether a conductor or non-conductor of electricity, while in the ordinary process of electro-deposition only conductors can be treated.

The uses of the invention are almost infinite, for coatings of any material and of any desired thickness may be formed. Metal sheets so fine as to be transparent and yet even and homogeneous can readily be produced.

It is found especially advantageous in coating glass for mirrors as a very even deposit can be obtained in a very simple manner.

Alloys or compositions of different metals or substances may be produced by making each electrode of a different metal.

To produce a more rapid deposition two or more arcs may be formed in the chamber.

The invention may be applied to the manufacture of metallic foil especially gold, silver, and platinum foil. To accomplish this a cylinder of polished glass, coated internally with a film of material soluble in alcohol or water, such as shellac or gelatine, is placed in the exhausted chamber, and the arc is formed within said cylinder, upon the interior of which an even coating of the metal or alloy is formed, which can be stripped off in a homogeneous sheet, with the soluble material which is then dissolved off; or a very thin film of gold, silver or platinum may be formed upon a backing of cheaper material or upon both sides of a sheet of such material.

It is evident that the deposit may be made upon flat plates or upon objects of any form whatever; and by using screens of different forms to intercept portions of the deposit, which proceeds in straight lines from the arc, the deposit may be made in any pattern or design. The finest tracery of lace, for instance, may thus be accurately reproduced in any metal.

I may use an ordinary piston air-pump and form the arc and place the object to be plated, within the exhausted bell-jar or receiver thereof. The evenness of the deposit, however, increases with the degree of vacuum, and on this account it is often desirable to employ a Sprengel pump and by keeping the same continually in operation, constantly maintain the vacuum at the highest point.

To coat small articles, a number of them may be placed in an exhausted receiver, adapted to be rotated. The arc being formed and the receiver turned, the articles are coated evenly on all sides.

For coating mirrors, I cement the glass plates upon the inner side of the removable

walls of an air tight box, which is exhausted and in which the arc is formed, a deposit being made upon the glass, which is then removed.

My invention is illustrated in the annexed drawings, in which—

Figure 1, illustrates the use of a piston air pump where the deposit is made on the interior of a glass cylinder. Fig. 2, represents a Sprengel vacuum pump used in the same way. Fig. 3, shows the rotating receiver for coating small articles. Fig. 4, is an elevation of a box for coating mirrors; Fig. 5, a section of the same; Fig. 6, a section of a form of box used for very large mirrors.

Referring first to Fig. 1, A is the exhausted bell-jar of an air pump and B is a hollow glass cylinder placed therein.

Electrodes *a*, *a*, of the desired metal are placed in the cylinder with their ends a little apart or very slightly in contact so that an arc is formed between them.

The circuit wires 1, 2, lead to the electrodes from any suitable source of continuous electric current whereby a continuous arc is produced between the electrodes.

An adjustable resistance R may be placed in the circuit to regulate the current.

The glass cylinder is internally coated with a soluble material such as shellac or gelatine. The deposit is rapidly and evenly formed on the interior of the cylinder, and is readily stripped off in homogeneous sheets, together with the soluble coating which may then be dissolved off.

In Fig. 2, a receiver C, hermetically closed by a rubber stopper D is placed in connection with the exhaust tube of a Sprengel pump E. The cylinder B is suitably supported in said receiver and the electrodes *a*, *a*, are inclosed by such cylinder. The operation of the pump being continued the highest vacuum is maintained throughout the whole process of deposition.

It is evident that any object which is to be plated may be substituted for the glass cylinder in the receiver or bell-jar.

In Fig. 3, a receiver F is shown, adapted to be rotated in supports G, G.

The electrodes *a*, *a* pass through the rubber stopper D. Any object or objects placed within the receiver will, when it is rotated, receive an even deposit. For instance, hooks and eyes, or small articles of jewelry may be readily plated in this way.

In Figs. 4 and 5, H, H, are the sides of the box, preferably of iron and removably secured together with air tight joints. Upon the inner sides are cemented plates of glass I, I, from which mirrors are to be made and which receive the deposit from the arc, formed by the electrodes *a*, *a*.

For very large plates of glass, the box shown in Fig. 6 is used, with compartments K, K, diverging from the center at which the arc is placed. The vaporous particles extend in straight lines in every direction from the arc, and consequently deposit evenly upon the glass plates I, I. The box is then taken apart and the glass plates are removed. The deposit is so even that it may be made very thin, and the thin coating of silver backed up by zinc or other cheaper metal.

I am aware of experiments which have been made in which by the use of a high tension induction spark between electrodes in a vacuum it was found that a coating was produced in a vacuum chamber. This is merely a laboratory experiment and could not be practically applied because the formation of the deposit by the intermittent or alternating spark is too slow to be commercially useful. I have found that by using a continuous arc the process is made infinitely more rapid and certain, so that the useful results hereinbefore enumerated can be produced on a commercially practicable scale.

What I claim is—

1. The process of plating bodies with electrical conducting material, which consists in supporting the body to be plated in an exhausted chamber, supporting an electrode of the material to be deposited in said chamber, electrically vaporizing such metal in the chamber, and moving said body to bring different portions of it successively into proximity to the electrode of the material being deposited, substantially as described.

2. The process of plating bodies with electrical conducting material which consists in supporting the body to be plated in an exhausted chamber, supporting electrodes of the material to be deposited in said chamber, maintaining a continuous electric arc between said electrodes in the vacuum, and moving said body to bring different portions of it successively into proximity to the electrode or electrodes of the material being deposited, thereby coating the body evenly, substantially as described.

3. The process of plating bodies with an alloy or composition of electrical conducting materials, which consists in supporting the body to be coated in an exhausted chamber, supporting electrodes of different conducting materials in said chamber, and maintaining an arc between said dissimilar electrodes, substantially as described.

4. The process of making metallic foil, which consists in providing a suitable body in an exhausted chamber, and an electrical circuit extending within the same and including within the chamber a section of the metal to be made into foil, maintaining a continuous current in said circuit whereby metal is deposited on said body, and subsequently stripping off said deposited metal, substantially as described.

This specification signed and witnessed this 22d day of January, 1884.

THOS. A. EDISON.

Witnesses:
H. W. SEELY,
EDWARD H. PYATT.