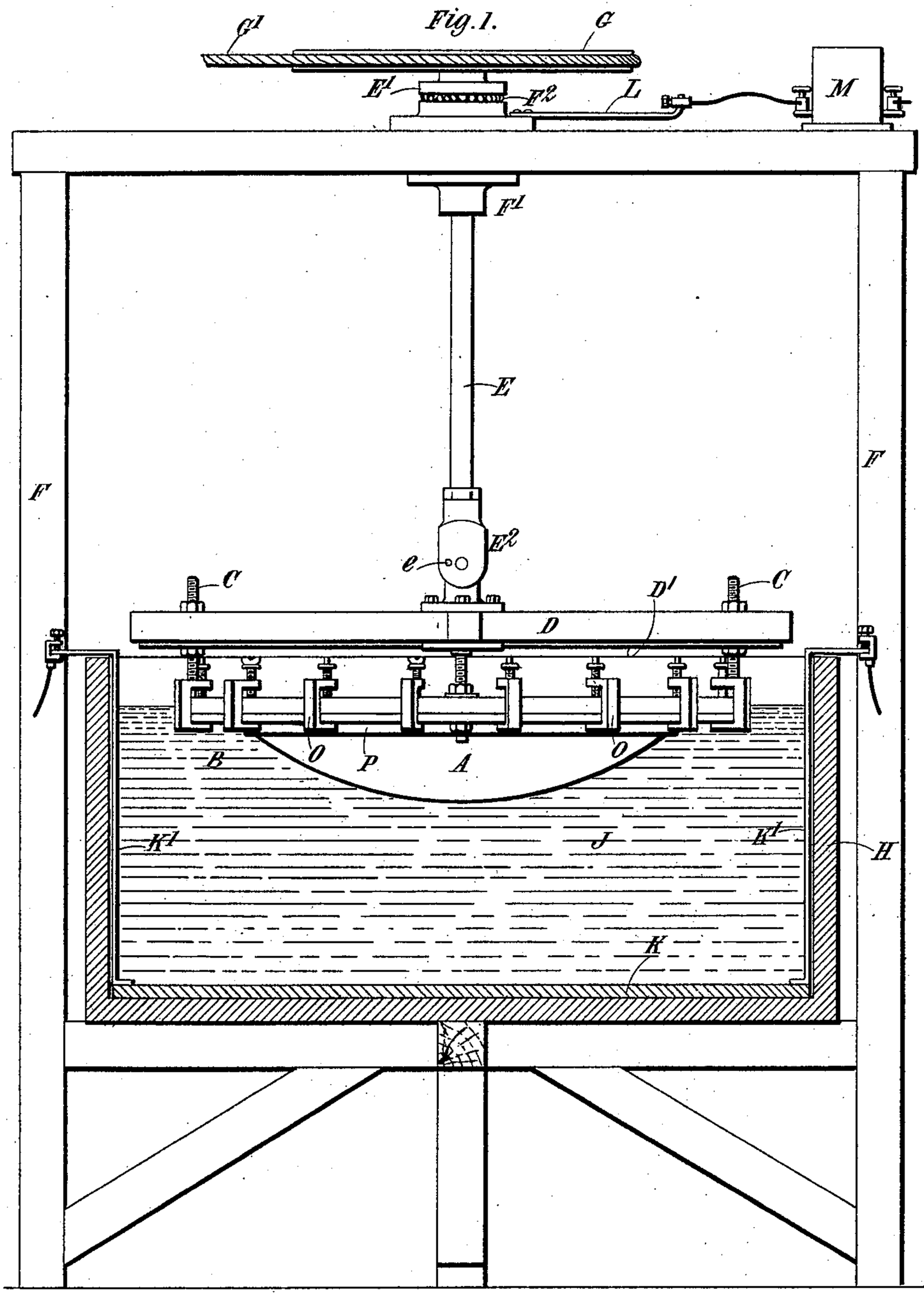
(No Model.) 3 Sheets—Sheet 1.

S. O. COWPER-COLES.

MANUFACTURE OF REFLECTORS.

No. 602,306. Patented Apr. 12, 1898.

Fig. 1.



Witnesses
J. B. Keefer
Victor Coombs

Inventor
Sherard O. Cowper-Coles
by James L. Norris.
attorney

(No Model.) 3 Sheets—Sheet 2.

S. O. COWPER-COLES.

MANUFACTURE OF REFLECTORS.

No. 602,306. Patented Apr. 12, 1898.

Fig. 2.

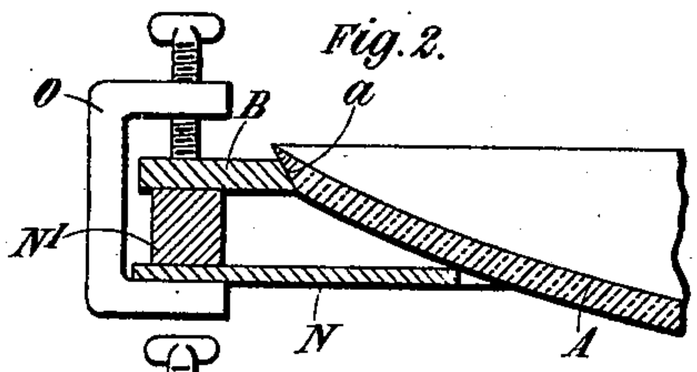


Fig. 5.

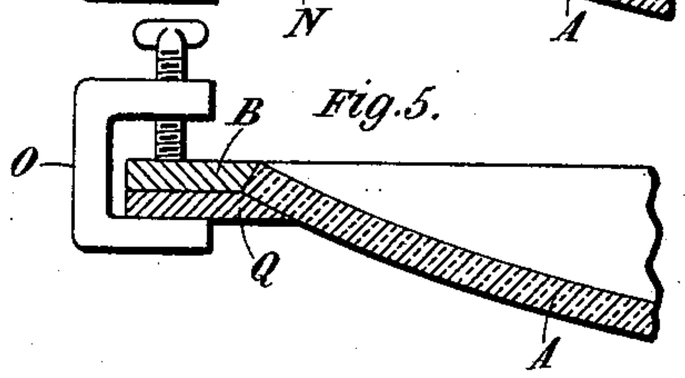


Fig. 3.

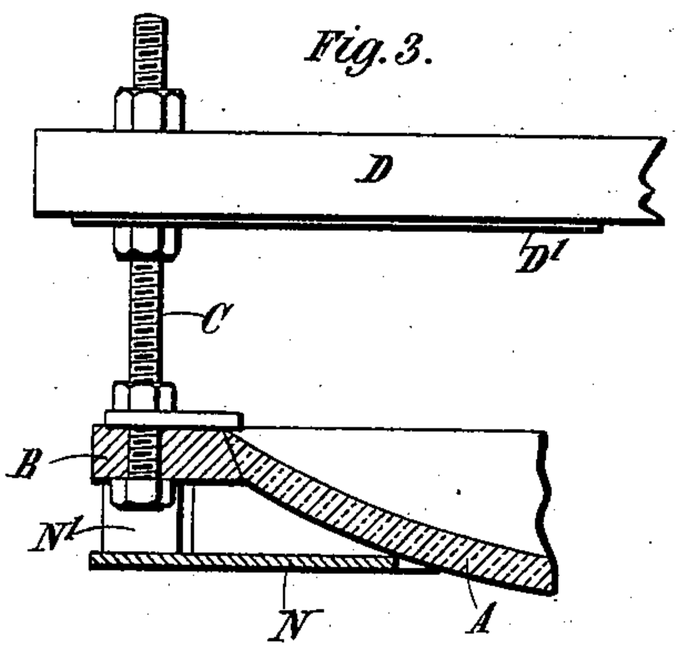


Fig. 6.

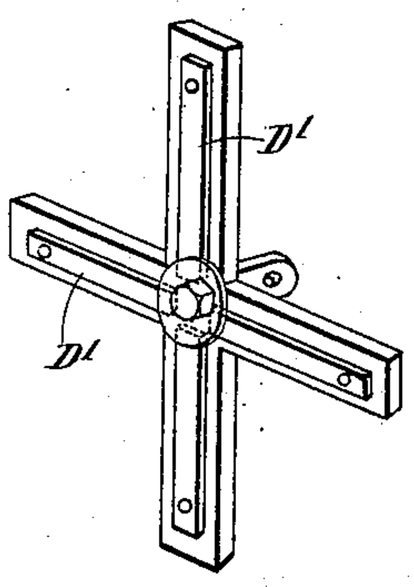
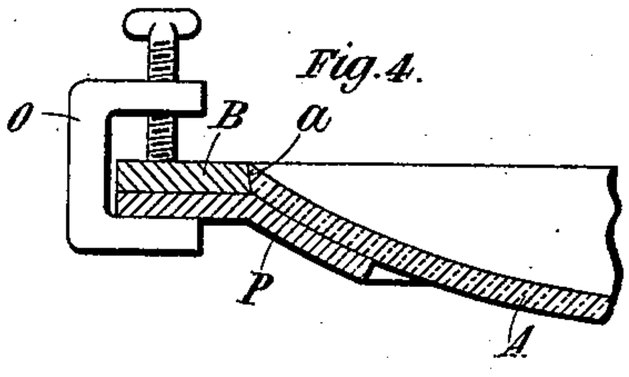


Fig. 4.



Witnesses

J. B. Tisdale

Vinton Coombs

Inventor

Sherard O. Cowper-Coles

by James L. Norris.

attorney.

(No Model.) 3 Sheets—Sheet 3.

S. O. COWPER-COLES.

MANUFACTURE OF REFLECTORS.

No. 602,306. Patented Apr. 12, 1898.

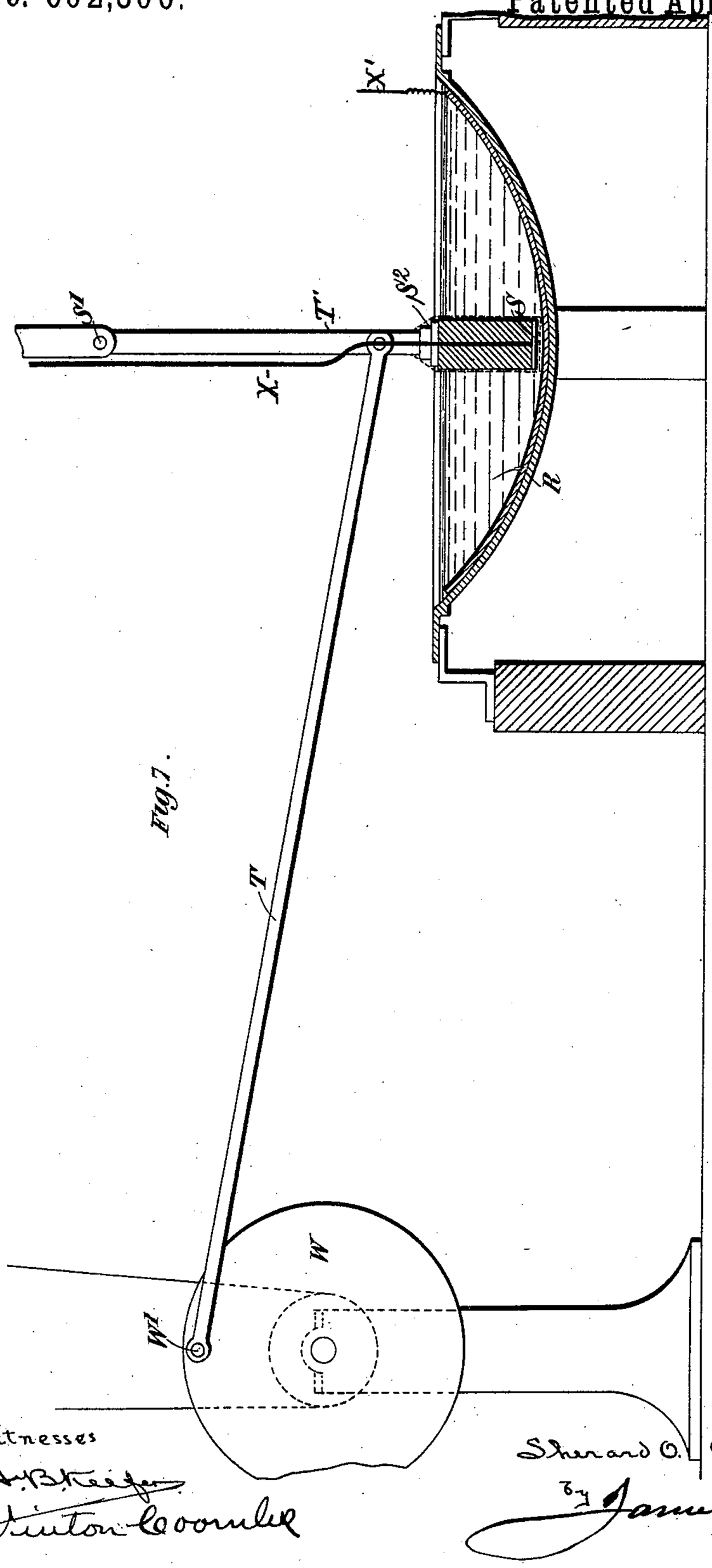


Fig. 7.

Witnesses

J. B. Keeler

Clinton Coonradt

Inventor

Sherard O. Cowper-Coles

by James L. Norris.

attorney

UNITED STATES PATENT OFFICE.

SHERARD OSBORNE COWPER-COLES, OF LONDON, ENGLAND, ASSIGNOR TO THE REFLECTOR SYNDICATE, LIMITED, OF SAME PLACE.

MANUFACTURE OF REFLECTORS.

SPECIFICATION forming part of Letters Patent No. 602,306, dated April 12, 1898.

Application filed June 10, 1897. Serial No. 640,189. (No model.)

To all whom it may concern:

Be it known that I, SHERARD OSBORNE COWPER-COLES, engineer, a subject of the Queen of Great Britain, residing at 39 Victoria street, Westminster, London, England, have invented certain new and useful Improvements in the Manufacture of Reflectors, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to improvements in the manufacture of reflectors by a process of deposition.

According to the said invention I take a glass mold the convex side of which is accurately shaped and polished to form a true parabolic or other reflecting surface, and I deposit on the said surface a coating of silver by any known or suitable method. I then deposit electrically upon the silver a backing of copper or other suitable common or base metal of such a thickness as will insure the necessary rigidity to the finished reflector. During such deposition I prefer to rotate the mold to facilitate the attainment of great regularity in the thickness of the coating and at the same time to keep the solution or electrolyte in motion. It is usually advisable to burnish the silver before depositing the backing thereon. The copper or other backing adheres firmly to the silver, and together they form the reflector, which is separated from the mold by placing the whole in cold or lukewarm water and then gradually raising the temperature of the water to about 120° Fahrenheit. The concave surface of the reflector thus obtained is an exact reproduction of the convex surface of the mold and requires no further treatment to answer all the purposes of a reflector except that it is advisable to coat it with a film of palladium or similar metal to prevent tarnishing of the reflecting-surface.

In order that my invention may be clearly understood, I will now describe the same with reference to the accompanying drawings, in which—

Figure 1 is a vertical section of the depositing-tank and shows the mold suspended therein. Fig. 2 is a section of one side of the mold and its supporting-ring and of a stopping-off ring for determining the diameter of the reflector. Fig. 3 is a similar section, but taken along another diameter, and shows the mode of suspending the supporting-ring of the mold. Fig. 4 is a section similar to Fig. 2 and illustrates a modified form of stopping-off ring. Fig. 5 is a similar section illustrating a modified mode of supporting the mold. Fig. 6 is a perspective view, on a smaller scale, of the cross-frame for suspending the molds and shows the metal strips for conveying the electric current to the reflector; and Fig. 7 is a vertical section of the apparatus used for applying the protective coating to the face of the reflector.

Like letters of reference denote corresponding parts in the several figures.

A is a glass mold accurately shaped and ground upon its convex side to a true parabolic or other desired curve and formed with a beveled edge *a*, shaped to fit accurately in the corresponding inner beveled edge of a metal ring B, which serves to support the mold while the metal backing of the reflector is being deposited thereon, as hereinafter described. The ring B is suspended by bolts C from a cross-like frame D, which is connected to a vertical shaft. The said shaft is arranged to turn in a bearing F′, provided in the frame F, that supports the whole of the apparatus and is furnished with a collar E′, that rests on balls F^2, which support the shaft while allowing it to rotate freely.

G is a pulley through which the shaft and the mold may be rotated by a belt or cord G′. The connection of the frame D to the shaft E is made by a joint E^2, that allows of the mold being tilted for a purpose hereinafter described.

H is the depositing-tank, which is carried by the frame F and in which the mold is suspended so as to be in contact with the electrolyte J, which may be a solution of any suitable salt of the metal to be deposited.

K is the anode, which is a copper plate, if copper is being deposited, so that the strength of the solution may be maintained at the expense of the anode.

K′ K′ are the conductors for conveying the positive current to the anode. The electrical connection between the reflector and the negative terminals is made through the bolts C,

strips of metal D′ in the arms of the frame D, the shaft E, the bearing F′ and balls F², and the conductor L.

M is an ammeter for measuring the electric current supplied.

In carrying out the manufacture of reflectors by this process it is essential that the glass mold be perfectly clean and free from grease before the silver is applied thereto. I have found that if the cleaning is solely effected chemically by strong acids or alkalies there is a great liability of causing too firm an adherence of the silver to the glass, whereby the mold is in great danger of being broken during the removal of the reflector. I overcome this difficulty by cleaning the mold with a suitable polishing paste or powder and then removing such paste or powder by washing the glass with a weak solution of ammonia. This cleaning operation is repeated prior to the production of each reflector.

After the convex side of the mold has been properly cleaned, as above described, a thin coating of silver is applied thereto in any known or convenient manner, and the mold is placed in the ring B, which is then attached to the frame D. To determine the size of the reflector that is to be formed and to insure a clean edge thereto, I place around the mold a ring N, Figs. 2 and 3, having the proper internal diameter and bearing at its inner edge against the mold, as indicated in said figures. Wooden blocks N′ of the required thickness are inserted between the rings B and N, and the latter ring is secured in place by clamps O, as indicated in Fig. 2. The ring N may be made of electrically-non-conducting material or it may be a brass or copper ring having its lower face protected by a suitable varnish to prevent the deposition of metal thereon.

During the deposition the mold is rotated in order to insure a uniform thickness of deposit all over the mold and to agitate the solution J, so as to keep it thoroughly mixed and of uniform strength throughout. If desired, the solution may be kept clean during the process by slowly drawing off the solution from the bottom of the tank and gradually running fresh solution in at the top.

When first lowering the mold into the solution, it is advisable to avoid throwing upon the silver the work of conveying the electric current. I therefore proceed as follows—that is to say, I raise the shaft E by means of pulley-blocks or otherwise and suspend the mold therefrom. I then tilt the mold and gradually lower the shaft, and thereby bring the edge of the mold in contact with the solution, whereupon, the circuit being established, a thin film of the copper or other base metal is immediately deposited on the mold at the place of contact near the edge of the mold. I then continue to lower the shaft until it rests on the balls F² and at the same time allow the mold to gradually assume its horizontal position, the whole operation occupying but a few seconds. At this stage the ring N has not been applied, and the mold simply rests in the ring B. The shaft is then rotated and the operation of depositing the base metal proceeds until a sufficiently thick coating is applied to act as a good conductor for the electric current during subsequent deposition. The ring B, with the mold in it, is then lifted out of the bath, and the ring N is then applied to determine the size of the reflector that is to be formed, after which the mold is again placed in the bath and the operation of depositing the backing proceeds until the required thickness is attained. A pin *e* is inserted through the joint E² to prevent the tilting of the mold during the depositing operation. During this stage the copper or other metal is deposited on the mold up to the inner edge of the ring N, which thus determines the diameter of the reflector and also insures a clean and even edge to the reflector. In lieu of the flat ring N (shown in Figs. 2 and 3) I sometimes employ for the same purpose a leaden ring P, Fig. 4, which is secured to the ring B by the clamps O. This ring being soft and pliable, it will bend at the angle formed by the mold and the ring B and therefore does not require to be blocked up, as does the ring N. I sometimes employ a mold having its edge beveled in the direction indicated in Fig. 5—that is to say, in the reverse direction to that shown in Fig. 2. In such instances the mold is supported by a number of short rigid fingers Q, clamped to the ring B by the clamps O.

After the thin coating has been applied to the mold in the manner above described the ring B, with the mold in it, is removed from the bath and turned over. The fingers Q are then removed and a ring, such as P, Fig. 4, is applied to the mold to determine the size of the reflector; or instead of removing the fingers Q and applying the ring P a ring, such as N, Fig. 2, can be applied to the mold, which is then replaced in the bath and the process of deposition is continued as before. After the requisite thickness of metal has been deposited the operation is stopped and the mold, with the reflector thereon, is removed from the ring B and placed in a bath of cold or lukewarm water, which is then raised to a temperature of about 120° Fahrenheit, whereupon, owing to the difference of expansion of the glass mold and the metal backing, the latter separates from the mold. The separation may be effected by cooling the bath instead of by heating it. The concave surface of the deposited metals forms an accurate and brilliant reflector without the necessity for any further treatment except that of coating the same with a thin film of palladium or similar metal to prevent tarnishing. For this purpose I place the reflector in a pan R, Fig. 7, and cover it with a solution of a salt of palladium—for example, palladium ammonium chlorid. Above the pan is suspended at S′ a suitable anode S, which is incased in a muslin bag or cover S²,

acting as a sieve to prevent any large particles of the metal that may become detached passing into the solution.

T is a rod connected at one end to the arm T′, carrying the anode, and at the other end to a pin W′ in a rotary disk W, by which means the anode is caused to swing to and fro, thereby agitating the solution and preventing the deposition upon the reflector of particles of foreign matter that may be present in the solution. The positive terminal of the electric circuit is connected to the anode and the negative is connected to the reflector.

The letter X indicates the conductor for conveying the positive current to the anode, and the letter X′ the electrical connection between the reflector and the negative terminal.

Preferably the back of the reflector is varnished before it is placed in the pan R to prevent local action setting up which would interfere with the evenness of the coating.

After being coated as described the reflector is complete. The edge of it is then trimmed by shears or by a file, and it is then mounted in its frame in any suitable or convenient manner.

What I claim is—

1. The manufacture of reflectors by a process of deposition consisting in applying to a prepared mold a coating of silver or other suitable metal, then depositing thereon electrically a backing of a common or base metal, and then separating the reflector from the mold by heating the same in a water-bath, substantially as described.

2. The manufacture of reflectors by a process of deposition consisting in applying to a prepared mold a coating of silver, then depositing thereon electrically a backing of a common or base metal, then separating the reflector from the mold by heating the same in a water-bath and lastly applying a film of a non-tarnishable metal to the surface of the reflector to prevent tarnishing thereof, substantially as described.

3. The manufacture of a reflector consisting in coating the convex surface of a suitably shaped and polished glass mold with silver, then depositing electrically on the silver a backing of copper of the required thickness, then separating the reflector from the mold by heating the same in a water-bath, and finally covering the reflecting-surface with a film of palladium to prevent tarnishing thereof, substantially as described.

4. The manufacture of a reflector consisting in coating the convex surfaces of a suitably shaped and polished glass mold with silver, then depositing electrically on the silver a backing of a base metal, then applying a stopping-off ring to determine the diameter of the reflector and then continuing the deposition of the base metal until the required thickness has been attained, then separating the reflector from the mold by heating the same in a water-bath, then coating the reflecting-surface with a film of a suitable non-tarnishable metal, and finally trimming the edge of the reflector, substantially as described.

5. In means for the manufacture of reflectors by a process of deposition, the combination with a tank containing an electrolyte, of a glass mold having a metallic coating and having a beveled edge, a ring for carrying the mold, a stopping-off ring to determine the diameter of the reflector and to insure a clear edge thereto, means for suspending and rotating the mold in said electrolyte during the deposition of the metal backing, an anode in said tank, and electrical conductors leading to the metal coating on the mold and to said anode, substantially as described.

6. The combination of a tank containing an electrolyte of a glass mold having a metallic coating, a supporting-ring therefor, a stopping-off ring to determine the diameter of the reflector and to insure a clean edge thereto, a rotary shaft for suspending and rotating the mold in said electrolyte, a joint in the said shaft to admit of tilting the mold when first lowering it into the electrolyte, an anode in said tank and electrical conductors leading to the metal coating on the mold and to the anode in the tank, substantially as described.

7. For coating the reflector with a non-tarnishable metal, the combination of a pan for receiving the reflector and a solution of the metal to be deposited, an anode suspended in the electrolyte from a hinge so as to be capable of swinging, means for swinging the anode, and electrical conductors leading to the anode and to the reflector, substantially as described.

In testimony whereof I have hereunto set my hand this 14th day of April, 1897.

SHERARD OSBORNE COWPER-COLES.

Witnesses:
GEO. HARRISON,
J. F. GAIRNS.