

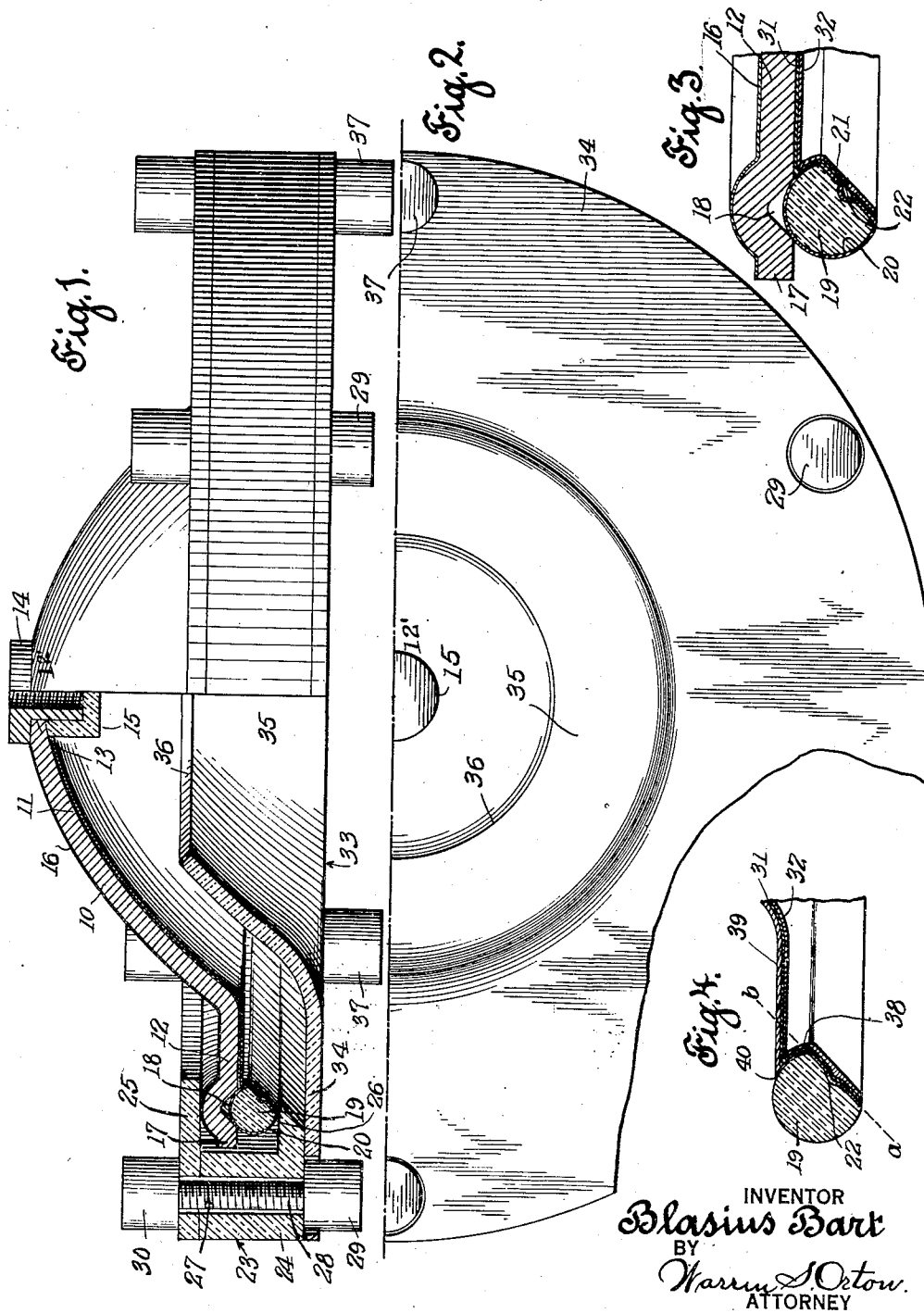
Aug. 16, 1932.

B. BART

1,872,221

METHOD AND APPARATUS FOR FORMING MOLDS AND ARTICLES PRODUCED THEREBY

Filed Oct. 28, 1926



INVENTOR
Blasius Bart
BY
Warren S. Ostow
ATTORNEY

UNITED STATES PATENT OFFICE

BLASIVS BART, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO THE FRINK CORPORATION, OF LONG ISLAND CITY, NEW YORK, A CORPORATION OF DELAWARE

METHOD AND APPARATUS FOR FORMING MOLDS AND ARTICLES PRODUCED THEREBY

Application filed October 28, 1926. Serial No. 144,904.

The invention relates in general to an improved method for forming articles by electrolytic precipitation; to the articles themselves, and to the apparatus used in the production of the articles by following the method herein featured.

The present application constitutes a companion case with an application filed under even date entitled "Method and apparatus for forming molds", (Case B) Serial Number 144,903.

The invention in the form herein selected for specific treatment relates to a method of forming curved and other types of non-planetary surfaced molds which are subsequently utilized for the purpose of forming, for instance, metallic flanged parabolic reflectors and similar articles which contain curved and other forms of surfaces required to have a mathematically exact configuration and which sometimes are required to possess a high degree of light reflection.

The primary object of the invention is to provide a simplified means for forming exact facsimiles of a master mold and which facsimiles will be accurate to molecular proportions; will not require polishing or other treatment to receive the subsequent electrolytic deposition forming the finished article, and which will provide an accurately defined outline to the finished article without necessity of retrimming the outline or otherwise modifying the electroformed structure.

Another object of the invention is to provide a mold of electrolytically precipitated metal which will be either of uniform thickness, or in which the thickness is graduated to give requisite strength at those portions of the mold where such strength is desired and to provide a technique of treatment which can be easily practiced and which will feature economy both in the amount of material used and in the electric current consumption.

In connection with the apparatus feature of the disclosure an object of the invention is to provide a simple form of mounting for the master mold and associated parts which go to make up the working mold produced thereon, and which apparatus will be de-

signed to produce exactly the desired working mold, economically with the least loss in current consumed, with an avoidance of the formation of trees or thinned out layers or other undesired parts, and which will provide for an easy manipulation of the structure in mounting the parts in position therein and in providing for a regulated access of the electrolyte thereto when the parts are assembled in the electrolytic bath for the electro-forming of the article.

Various other objects and advantages of the invention will be obvious from a consideration of the preferred method of practicing the invention hereinafter described and from an inspection of the accompanying drawing and in part will be more fully set forth in the following particular description of one method and of one form of apparatus for practicing the method and the invention also consists in certain new and novel operations and features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawing:

Fig. 1 is a view partly in side elevation and partly in radial section of a master mold mounting with a parabolic form of working mold partially formed thereon and which figure illustrates a preferred embodiment of the apparatus feature of this disclosure and also illustrates a step in the method feature of the disclosure;

Fig. 2 is a fragmentary view in plan of the underside of the structure shown in Fig. 1, it being understood that only one half of the circular form in plan of Fig. 1 is shown in this view;

Fig. 3 is an enlarged sectional view with the coatings on the master mold exaggerated in thickness and constituting an enlargement of the showing at the left of Fig. 1 with the clamping frame removed from the master and partially formed working mold; and

Fig. 4 is a sectional view corresponding to the showing in Fig. 3 of the finished working mold with the master mold removed and showing the finished reflector in position thereon.

In forming articles to be reproduced such

as parabolic flanged reflectors, it is necessary of course to first prepare a master mold which is usually done by preparing a wax form which is copper coated, finished mechanically to the desired configuration and polished to a final finish. The formation of these master molds is of course quite expensive as they necessitate the employment of the highest class of mechanical skill and extreme care must be exercised in their preparation. From the grand master mold thus carefully prepared it is the usual practice to make a series of master molds. In the instant case one of such master molds is shown at 10, Fig. 1, and the method of producing which forms no part of the present disclosure. Insofar as the present disclosure is concerned it need be considered simply that the master mold is formed of copper or some similar conducting metal.

The illustrated form of master mold 10 includes a central parabolic body portion 11 outlined by an outstanding flange 12 of somewhat greater width than the finished reflector which is to be formed on the working model herein featured. The inner face of the parabolic portion has a highly reflective surface. The body portion 11 is provided at the crown 12' with an aperture 13 in which is fitted a metallic connecting tip 14 by means of which current is conducted to the metal mold. When ready to be used the inner end of the connecting tip is capped by means of a celluloid thimble 15 which acts to stop off the deposition from the metal connecting tip. The outer exposed portion of the mold 10 which is not intended to be plated is covered with a coating 16 of insulating material preferably liquid cellulose which in this instant extends from the crown 12' to the outer edge 17 and across the upper or back side of the mold. The outstanding flange 12 is provided on its under or exposed side with a ring locating groove 18. This groove is designed to locate the position relative to the mold of a preformed outlining frame, herein shown to be an endless ring 19. This ring is formed of insulating material which at least has its outer exposed face of insulating material and in the instant case the ring is formed entirely of celluloid. Before the ring is mounted in position it is slightly but completely coated with a thin and readily removable layer of conducting material 20. In actual practice it is most economical to coat the ring by spraying the same with a reducing solution of silver salt so that the layer 20 in the illustrated case is a thin layer of metallic silver.

The ring is flattened on its inner periphery and as particularly shown in Figs. 3 and 4 along a line *a-b* inclined to the axis of the ring. This inclined face 21 of the inner periphery of the ring is roughened as by being provided with a locking groove 22 particularly designed to assist in locking the ring

to the electrolytically deposited layer hereinafter referred to. The silver coated ring is positioned to intrude partly into the groove as shown in Figs. 1 and 3 and the assemblage is then mounted in a clamping frame 23.

This clamping frame is of ring-like form and includes a main circular body portion 24 and a ring shaped cover plate 25. The body portion 24 includes an inwardly extending seat 26 on which the ring 19 is positioned so that the inner edge of the seat will come opposite to the lower end of the inclined face 21. The cover plate 25 is positioned on top of the celluloid-back master mold 10 and the frame is tightened into clamping screws 27 spaced apart circumferentially of the clamping frame. The shank portions 28 of the clamping screws are formed of metal, preferably brass, but the heads 29 and the nuts 30 at opposite ends are formed of insulating material, preferably celluloid.

With the parts thus assembled, the mold with its attached parts forming the assemblage shown in Fig. 1 is suspended in and subjected to the action of an electrolytic bath. It is suggested that it be subjected, first, to the action of a bath containing nickel and in this case there is formed on the metal exposed surfaces of the master mold 10, a thin layer 31 of nickel which will extend across the inner polished face of the master mold 10 from the thimble 15 across the inner portion of the flange 12 and across the inclined face 21 of the ring up to the insulating seat 26. It is the present practice to deposit the nickel to about a thickness of one one-thousandth of an inch after which the assemblage is positioned in a copper containing bath where it is permitted to remain until the requisite thickness of copper has formed. In the instant case, this deposition is permitted to continue until there is a layer of copper of about one-eighth of an inch thick.

Under some conditions, the following of this method as outlined would result in a greater thickness of deposit on the ring and adjacent portions of the flange with the thickness of deposition more or less gradually decreasing towards the crown 12' where the deposit would be of minimum thickness. In order to prevent this and to insure a more uniform deposition over the entire exposed portion of the mold and the ring, the depositing action is partially stopped off before the copper coating has acquired its requisite thickness. In the instant case the assemblage is removed from the copper bath after about one thirty-second of an inch of copper has formed on the flange 12, and a stopping off or equalizing screen is added to the assemblage.

Referring to Fig. 1, there is shown an equalizing screen 33 of insulating material preferably sheet celluloid. This is circular in outline with the outer portion 34 flat so

as to rest firmly against the under side of the clamping frame. The central portion of this screen is funnel shaped in form as shown at 35. This equalizing screen follows somewhat the configuration of the surface of the mold being electroplated and is spaced therefrom so as to permit access of the electrolyte to all portions of the exposed surface of the mold and ring even when the equalizing screen is in position. The funnel 35 converges inwardly and upwardly as particularly shown in Fig. 1 and forms a somewhat restricted opening 36 concentric with and positioned below the thimble 15. This equalizing screen is demountably held in position on the clamping frame by means of screen clamping screws 37 resembling in construction the frame clamping screws 27 and alternating with these screws about the circumference of the screen and frame.

With the screen in position there is a more active deposition of the copper or other electroforming metal adjacent the crown portion of the master mold than at the outer edges of the mold and in this way the natural tendency of the copper to accumulate adjacent the ring is compensated, and as a result a substantially uniform layer of copper is deposited across the exposed portion of the master mold. This precipitation layer of metal attaches itself at its outer edge firmly to the silver coated celluloid ring 19 so that the ring and formed layer constitute a unit which is eventually removed from the master mold to form a working mold 38. When sufficiently formed the unit is removed from the clamping frame by loosening the screws 27 and 37 and separating the assembly from the metal master mold which is usually facilitated by slightly heating the same. When free of the master mold, the working mold 38 contains on the part of the ring 19 which was not exposed to the electrolyte, the remnant of the silver layer 20 which is removed by washing the silver particles off and recovering the silver. The finished article with the celluloid ring exposed at its perimeter and herein identified as a working mold is subsequently used in forming the finished reflector shown at 39 in Fig. 4, but the method of forming this finished reflector is no part of this disclosure.

It will be seen that the working mold 38 is an exact reproduction of the inner polished surface of the master mold from the crown 12' to the inner peripheral edge of the slot 18. To this accurately formed metal portion the celluloid ring 19 is secured by an electrolytic soldering action of the layer as it is formed. The ring acts during the formation of the finished reflector to outline and limit the outer peripheral edge 40 of the finished reflector. The celluloid ring not only defines the outline of the flange of the finished reflector but it also acts to strengthen and maintain the configuration of the working mold 38.

Should these working molds become damaged in use, the metal is recovered, and incidentally the celluloid ring is separated, cleaned and may be reused over and over again.

As the result of using a working mold of the type herein disclosed, it is possible to form flanged reflectors in which the parabolic curved or other non-planar reflecting surfaces may be formed as exact duplicates of each other, all highly polished with substantially the same degree of brilliancy as characterizes the grand master mold and these reflectors may be formed in large numbers as a factory production and without necessity of polishing either the finished reflectors or the molds on which they are formed.

The partial stopping off of the deposition after it has started tends to insure a uniform thickness of the deposited metal across the entire surface of the mold under treatment and eliminates the formation of trees and other irregularities which normally tend to form about the outlining ring.

While I have shown and described, and have pointed out in the annexed claims, certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In the art of forming working molds for flanged parabolic reflectors, the method which consists in securing a ring to one side of the flange of a flanged master mold, exposing the ring and the said side of the master mold as cathode to the action of an electrolytic bath until a layer of metal less than the desired thickness is laid over the ring, the portion of the flange and the parabolic portion within the outlines of the ring thereby soldering the ring to the layer thus formed, and partially, but not entirely, stopping off the deposition from the portion of the mold adjacent the flange and ring while permitting the deposition to continue uninterrupted adjacent the center of the parabolic portion of the mold until the desired thickness of metal has formed.

2. In the art of forming working molds for subsequent use in forming articles by electrolytic deposition on the working molds, the method which consists in positioning on a master mold a preformed outlining frame of insulating material which has been temporarily coated with a readily removable conducting material, subjecting the master mold with the coated frame thereon as cathode to the action of an electrolytic bath while stopping off the deposition from the outer portion of the frame, thereby to form the working mold with the frame soldered there-

to at its perimeter and removing from the frame any exposed part of the precoated readily removable conducting material.

3. In the art of forming articles electrolytically, the method which consists in temporarily coating a frame of insulating material with a conducting material, locating said coated frame on a mold, subjecting the same as cathode to the action of an electrolytic bath while stopping off the deposition from a portion of the frame thereby to cause the deposited layer of metal to be soldered electrolytically to the frame and removing from the frame any portions of the coating material.

4. In the art of forming articles electrolytically, the method which consists in subjecting to the action of an electrolytic bath, a mold as cathode to which is secured a preformed frame thereby to cause the formation of a layer of metal on the mold and soldered to the frame, and then partially stopping off the deposition of metal on to the portion of the mold adjacent the frame while permitting the electrolytic deposition on other parts of the mold.

5. A mold for use in forming flanged parabolic reflectors, including a central parabolic portion outlined by an outstanding flange formed of electrolytically deposited metal, and outlined by a frame secured to one side to the outstanding flange and having its exposed portions defined by an insulating surface.

6. A device for use in forming flanged parabolic reflectors by electrolytic precipitation, comprising a metal mold having a central parabolic portion outlined by a flange integral therewith and provided on one side with a ring receiving groove, a ring demountably positioned in said groove and clamping means of insulating material for temporarily securing the ring to the flange, while leaving portions of the mold and ring exposed.

7. A device for use in forming flanged parabolic reflectors by electrolytic precipitation, comprising a metal mold having a central parabolic portion outlined by a flange, a ring engaging the flange, clamping means of insulating material for temporarily securing the ring to the flange, while leaving portions of the mold and ring exposed, and an equalizing screen for incompletely stopping off the electrolytic deposition from parts of the mold and ring.

8. In a device of the class described, the combination of a ring-like form of clamping frame, provided with means for mounting a mold therein, an equalizing screen for partially closing the opening in the frame, said screen including a funnel shaped central portion provided with an opening, and means for securing the screen to the frame.

9. A master mold construction for use in

forming work molds by electrolytic deposition, comprising a master mold of parabolic form outlined by a flange provided with a groove on the side thereof which has the concaved face of the mold, a ring of insulating material coated with a layer of conducting material located in said groove with a part of the ring exposed, and a clamp of insulating material temporarily securing the ring to the mold.

10. A master mold construction for use in forming work molds by electrolytic deposition, comprising a master mold of parabolic form outlined by a flange provided with a groove on the side thereof which has the concaved face of the mold, a ring of insulating material coated with a layer of conducting material located in said groove with a part of the ring exposed, a clamp of insulating material temporarily securing the ring to the mold, and an equalizing screen conforming substantially to the master mold, extending parallel thereto and provided at the crown of its parabolic portion with an aperture facing the crown of the master mold.

11. A master mold construction for use in forming articles by electrolytic deposition, comprising a master mold of parabolic form outlined by a flange, a ring engaging one side of said flange, said flange provided with means for locating the ring accurately in prefixed position on the flange, and means for temporarily securing the ring in position.

12. A master mold construction for use in forming articles by electrolytic deposition, comprising a master mold of parabolic form outlined by a flange, a ring engaging one side of said flange, means for temporarily securing the ring in position, and an equalizing screen conforming substantially to the master mold, extending substantially parallel thereto and provided with an opening in spaced relation to said ring.

13. A master mold construction for use in forming articles by electrolytic deposition, comprising a master mold of parabolic form outlined by a flange, a ring engaging one side of said flange, means for temporarily securing the ring in position, an equalizing screen conforming substantially to the master mold, extending substantially parallel thereto and provided with an opening in spaced relation to said ring, and means distinct from the ring securing means for temporarily securing the screen in place.

14. A mold construction comprising a master mold including a parabolic portion and an outstanding flange, a ring engaging said flange, and a layer of metal extending across the joint between the mold and the ring and soldering the ring to the flange.

15. A mold construction for use in an electrolytic bath, including a mold, a ring of insulating material having a metallic coating thereon engaging said mold, a clamp of in-

insulating material securing the ring to the mold and having one jaw engaging the side of the ring opposite the side engaging the mold thereby to limit the part of the ring exposed to the action of the electrolytic bath.

16. A mold construction for use in forming articles electrolytically, including a mold, a preformed frame of insulating material provided with a readily removable coating of conducting material, mounted on the mold, and insulating means engaging the frame for stopping off the deposition from a part of the frame and for leaving the joint between the frame and mold exposed.

17. A mold construction including a metal mold having a part coated with an insulating material leaving a part exposed, and a preformed frame secured temporarily to the exposed part of the metal mold and having a portion of its surface coated with a layer of conducting material continuous with the exposed metal part of the mold whereby a layer of metal deposited electrolytically across the exposed part of the mold and the coated part of the frame will secure the frame to the layer of metal.

18. A mold for use in forming flanged parabolic reflectors, including a central parabolic portion outlined by an outstanding metallic flange, said flange outlined by a frame soldered on one side to the outstanding flange and having its exposed portions defined by an insulating surface.

19. An article including a ring of insulating material having portions of its inner periphery rough and coated with metal, and an electrolytically deposited metal layer outlined by said ring filling the space within the inner periphery of the ring and electrolytically soldered to the rough metal coated portion of the inner periphery of the ring.

20. In a device of the class described, the combination of a rugged ring-like clamping frame provided with an inwardly extending seat integral with the rugged ring-like frame, a ring shaped cover plate fitted on top of the clamping frame and having an inwardly extending part coacting with the seat to form an annular mold receiving space therebetween, said frame and cover plate being formed of insulating material and the rugged portion of the frame exteriorally of its seat and the portion of the cover plate overlapping the same provided with circumferentially spaced registering screw holes, clamping screws having threaded metal shanks passed through the holes and having wide bearing heads and said exterior portions of the nuts at opposite ends formed of insulating material and engaging said exterior portions of the frame and cover plate to form all exposed surfaces of the frame, cover plate and its associated clamping screws of insulating material and said frame and cover plate coacting to enclose and protect

the threaded metal shanks of the clamping screws.

21. A working mold having a surface formed in part of an outlining ring of insulating material and a layer of electrolytically deposited metal contacting at its outer edge with and secured to the inner periphery of said ring.

22. An article formed mainly of a sheet of electrolytically deposited metal and a reinforcing member therefor outlining the sheet of metal and provided with a locking groove, said layer and member secured by virtue of the interlocking engagement of the layer with said locking groove, and the major portion of the metal sheet being spaced from the said outlining reinforcing member.

23. An article including a sheet of metal and a reinforcement for one edge of said sheet, said reinforcement comprising an insulating member, having one edge of the sheet electrolytically soldered thereto.

Signed at New York, in the county of New York and State of New York, this 20th day of October, A. D. 1926.

BLASTIUS BART.