March 27, 1945. A. K. GRAHAM ET AL 2,372,567

PLATING RACK FOR OPTICAL DIES

Filed Dec. 10, 1941 2 Sheets-Sheet 1

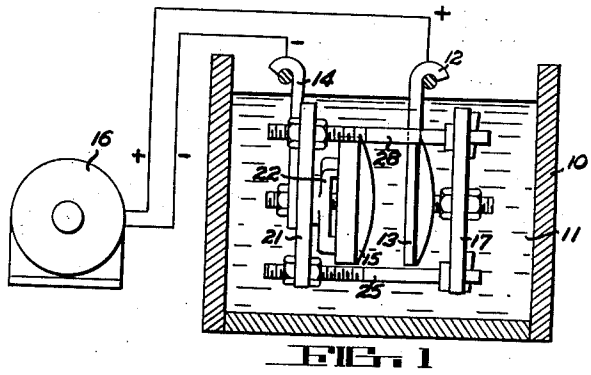


FIG. 1

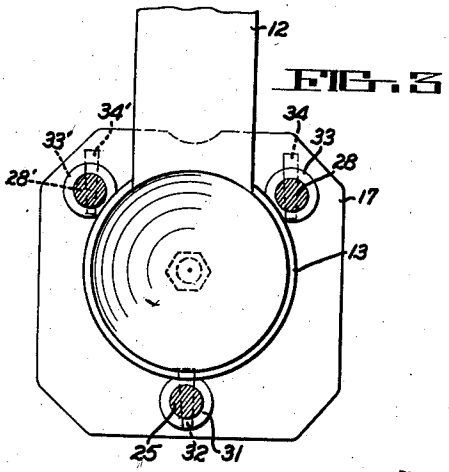


FIG. 3

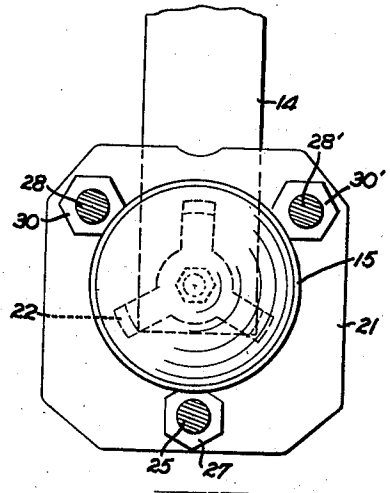


FIG. 4

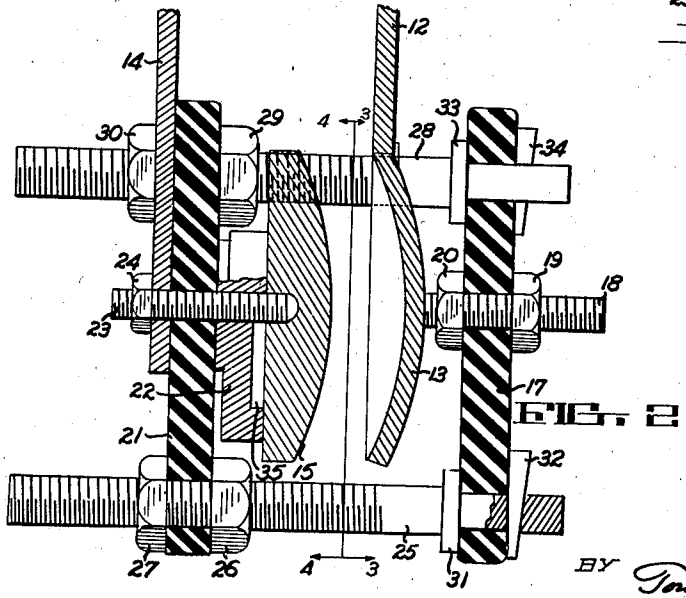


FIG. 2

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PLATING RACK FOR OPTICAL DIES

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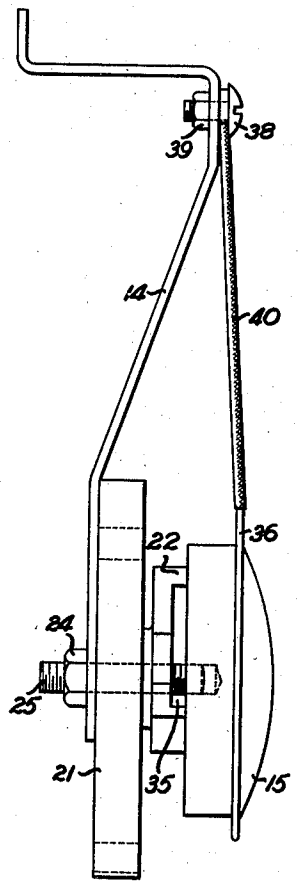


FIG. 5

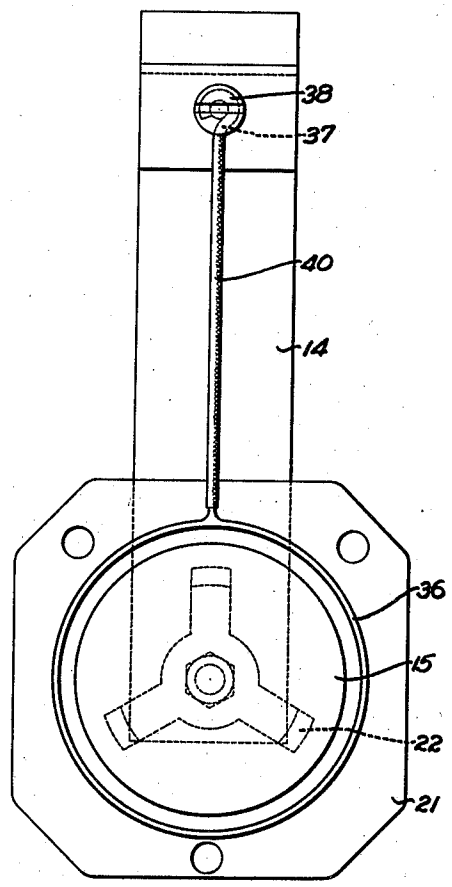


FIG. 6

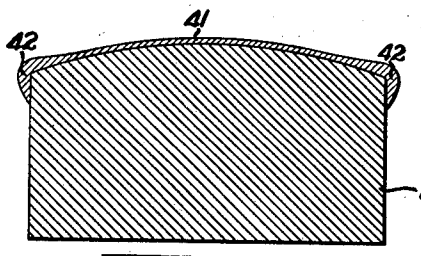


FIG. 7

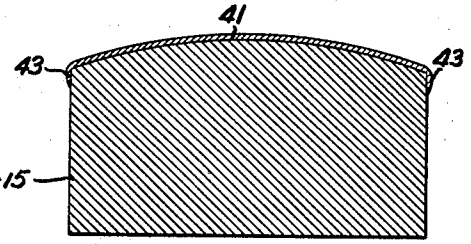


FIG. 8

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PLATING RACK FOR OPTICAL DIES

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Application December 10, 1941, Serial No. 422,320

6 Claims. (Cl. 204—297)

This invention relates to plating rack, and more particularly to a plating rack for optical dies.

In the plating of optical dies; that is to say, dies having accurate dioptric curves, it is requisite that the plate be deposited as a thoroughly uniform and homogeneous layer free from flaws and blemishes and adapted to be ground and polished to a high degree of precision, in view of the fact that a surface curvature aberration of as little as six millionths of an inch will suffice to produce lenses unsuited for ophthalmic purposes.

It is thus necessary that the surface to be plated be in the best possible condition to receive the plate, and therefore, it should be in an active state.

Plating racks hitherto used have had the drawback of being cumbersome and requiring too long a time to mount the object to be plated thereon, with the result that passivation of the metal surface presents itself as an undesirable feature leading to improper plating and the consequences that such a condition brings about.

The plating rack of our invention is eminently well adapted to avoid such undesirable consequences. It is adapted to receive the object to be plated, such as an optical die, with a minimum of delay, and properly to locate it with respect to the anode to insure the obtainment of a plate of uniform thickness and homogeneous texture substantially corresponding in surface contour to the ultimate surface desired in the optical die.

The plating rack of our invention, because of the ease with which it is handled and the details of its construction and arrangement of parts, brings about certain other benefits. For instance, the structure is so designed that it is free from recesses which might act as acid traps, and thus it prevents contamination of the plating bath by inclusion of etching medium carried over from the etching bath. Likewise, there is no carryover and contamination from any intermediate treatment.

Furthermore, the anode can be pre-set to any desired or required position, removed for activation, and then quickly reset before substantial passivation of the etched or treated surface has taken place. The anode is also preformed substantially to the desired curvature, whereby, as previously stated, a uniform substantially dioptrically curved plate is deposited on the cathode.

It might be added that it is desirable to have the curvature of the anode match that of the cathode within ⅛ to ¼ of a diopter. It is likewise desirable but not requisite that all parts in contact with the plating solution should be of stainless steel or non-ferrous metal in order to prevent iron contamination. Ferrous metals may be used if properly protected with suitable stop-off. Of course, the anode is of lead.

Besides the advantages of the plating rack of our invention which have been set forth hereinbefore, there are others which will appear evident from the following description taken in connection with the drawings in which:

Fig. 1 is a view of the plating rack of our invention positioned in the plating bath and connected to a source of electric current;

Fig. 2 is a cross sectional view of the rack itself;

Fig. 3 is a view taken along line 3—3 of Fig. 2;

Fig. 4 is a view along line 4—4 of Fig. 2;

Fig. 5 is a side elevation of a modified form of cathode mounting having a wire thief surrounding the cathode;

Fig. 6 is a front elevation of the same;

Fig. 7 is an enlarged cross-sectional view of a die plated without using the wire thief; and

Fig. 8 is an enlarged cross-sectional view of a die plated using the wire thief as shown in Figs. 5 and 6.

Referring in detail to the drawings, and particularly to Fig. 1, 10 is a plating tank containing plating solution 11; 12 is the bus bar of the anode 13 (see Fig. 2); 14 is the bus bar carrying the negative pole to the cathode (die to be plated) 15; and 16 is a source of electric current.

Referring now to Fig. 2, 17 is an insulated structure on which the anode is mounted by means of bolt 18 and nuts 19 and 20, and 21 is an insulated structure carrying the cathode (die to be plated) 15 held in place by spider 22, bolt 23 and nut 24. Bolt 23 and nut 24 also serve to affix bus bar 14 firmly against the insulated structure 21 and bolt 23 carries the negative pole from bus bar 14 to the cathode 15 which is the die to be plated.

A rod 25 is threaded at one end and provided with nut 26 and nut 27 which serve to lock in place the insulated structure 21 at its lower extremity and rod 28 threaded at one end is provided with nut 29 and nut 30 which serve to lock in place insulated structure 21 at its upper extremity.

Rod 25 is provided at its unthreaded end with a shoulder 31 adapted to rest against insulated structure 17 and a wedge 32 adapted to cooperate with shoulder 31 for the purpose of securely holding insulated structure 17. Likewise, rod 28 is provided at its unthreaded end with a shoulder

33 and a wedge 34 adapted to cooperate with each other for the purpose of securely holding insulated structure 17.

Referring now to Figs. 3 and 4, it will be noted that rod 28 has a counterpart rod 28' provided with a nut 30', a shoulder 33' and a wedge 34'. It will be understood that the elements 28', 30', 33' and 34' are the duplicates of elements 28, 30, 33 and 34 hitherto described.

The modification shown in Figs. 5 and 6 proves advantageous, particularly when heavy plates are being deposited on the surface of the die. A wire thief 36 shaped in the form of a loop is placed in position surrounding the cathode 15. The opposite end of the wire thief is brought into electrical contact with the bus bar 14. This contact may be effected by looping the wire thief, as at 37, over a screw 38 held in place by a nut 39. The shank 40 of the wire theif is insulated.

When the die is plated in the absence of a wire thief surrounding it, the plate 41 deposited thereon exhibits a heavy shoulder portion 42 (as shown in Fig. 7) which proves highly undesirable since it must be ground off or otherwise removed and the plate may be damaged in so doing. When the wire thief is in position, as shown in Figs. 5 and 6, the plate 41 deposited on the die 15 exhibits well rounded shoulders 43, as shown in Fig. 8. The use of the wire thief is highly desirable because it effectively prevents a piling of an excessive thickness of metal at the edge of the die, which would require an excessive amount of grinding on finishing the die in order to restore the plated surface to the proper dimensions and curvature.

By way of example, we now describe a typical procedure to be followed in assembling for use the plating rack of our invention.

The die 15 to be plated is attached to the spider 22 and bolt 23 with which it forms a unitary structure. Bolt 23 is mounted on insulated structure 21 and tightened thereon through the means of nut 24 after positioning bus bar 14 as shown in Fig. 2. Bus bar 12 carrying the anode 13 is permanently but removably mounted on insulated structure 17 by means of bolt 18 (which is permanently attached to anode 13) through the means of nut 19 and nut 20. The distance between the cathode 15 and the anode 13 is determined and regulated by adjusting nut 29 and nut 30 on rod 28, nut 29' and nut 30' on rod 28', and nut 26 and nut 27 on rod 25. The cathode 15 is definitely positioned and centered by movement of insulated structure 21 which is provided with loose fitting perforations at the points where rods 25, 28 and 28' pass therethrough.

Having thus mounted the die to be plated (cathode 15) in the desired position with respect to anode 13, wedge 32, wedge 34 and wedge 34' are removed and insulated structure 17 carrying anode 13 permanently mounted thereon through the means of bolt 18, nut 19 and nut 20 is then withdrawn from the assembly. The remaining parts of the assembly (that is to say, every member not permanently attached to insulated structure 17, and the wedges 32, 34 and 34') are then introduced into the etching bath and are given any other treatment required prior to plating as a unit.

After completion of the etching treatment and any other treatment desired or required to be given the cathode prior to plating, the assembly is again completed by mounting insulated structure 17 on rods 25, 28 and 28' and securely locking it in place by means of wedges 32, 34 and 34'. This operation can be carried out in a matter of seconds and the anode will lie with relation to the cathode in the exact pre-set position. The complete assembly is then introduced into the plating bath and the plating operation proceeds according to the usual manner.

It will be noted that there is a space 35 between the spider 22 and the cathode 15. The purpose of this spacing is to provide rapid and complete drainage of the etching solution or any other solution with which the cathode is treated prior to plating. This rapid and complete drainage prevents carryover from one bath to another and thus the plating bath is kept free from contamination.

The anode 13 is integral with bus bar 12 and they are both formed in a single operation by means of a simple pressing step. As has hitherto been pointed out, the curvature of the anode face is made substantially to conform in opposite sense with that of the cathode. This is brought about by forming the anode using a forming die having usbstantially the same curvature as the optical die to be plated.

As has hitherto been noted, the apertures on insulated structure 21 through which rods 25, 28 and 28' pass are provided with a loose fit in order to permit centering of the cathode with relation to the anode. Because of this fact, it is obvious that the anode must retain a fixed position at all times and this is brought about by providing a close fit on the apertures which serve to mount insulated structure 17 on rods 25, 28 and 28'.

In view of the foregoing, it will be readily appreciated that the plating rack of our invention is eminently well adapted to carry out plating operations of the character hereinbefore described; that is to say, plating operations where uniformity of plating thickness, homogeneous texture, and freedom from surface flaws and blemishes are of paramount importance and where ease of assembly and manipulation is a desirable characteristic in order to insure a plate of the highest quality which may be subsequently ground and polished to close tolerances or to a degree of exactness or accuracy of the order hereinbefore stated.

The speed with which the plating rack of our invention may be assembled not only lessens the possibility of passivity being established but also lessens the development of objectionable tarnish on the metal die prior to plating.

Needless to say, it is highly advisable to eliminate dissimilar materials in the construction of the rack in order to reduce the possibility of metal contamination of the bath. Furthermore, the current carrying members should be of ample size and all parts of the rack should be properly insulated with some stop-off material of suitable characteristics in order to avoid current leakage and the possibility of attack on the materials of construction of the rack.

Those skilled in the art will readily appreciate that one of the features of the rack of our invention is that it affords the opportunity of close inspection of the significant surface of the die during the preparatory cleaning steps, and, furthermore, that it affords the opportunity of swabbing the die surface during treatment prior to plating.

The wire thief hereinbefore described and illustrated in the drawings is a desirable feature inasmuch as it is advantageous in improving the uniform distribution of metal on the significant surface of the die. As will be noted, such a wire

thief may be rigidly attached in a definite position surrounding the cathode and in a manner that will not interfere with processing and which will not cause it to be displaced in handling the rack.

It will be understood that while we have set forth a particular embodiment of our invention, we do not intend to have our invention limited to or circumscribed by the specific details of structure and arrangement of parts or manipulation herein set forth, since our invention may be varied within the spirit and scope of the appended claims.

I claim:

1. In a plating rack of the type described, in combination: an anode having a support substantially centrally disposed on the back portion thereof; a cathode having a spider support on the back thereof; insulating means adapted to receive the support of said anode and maintain it in fixed positional relationship therewith, said insulating means being provided with a plurality of apertures; insulating means adapted to receive the support of said cathode and maintain it in fixed positional relationship therewith, said insulating means being provided with a plurality of apertures, means for rigidly supporting each of said insulating means in spaced predetermined juxtaposition and adapted to permit removal and replacement of said anode and said cathode without altering their predetermined juxtaposition, yet capable of adjustment to vary the distance between said anode and said cathode when desired, said supporting means including a plurality of bars which are adapted to tightly fit the apertures in the cathode insulating means and adapted to loosely fit the apertures in the anode insulating means, a stop means on said bars adjacent said anode insulating means, and wedging means cooperating with said stop means to tightly press said anode insulating means against said stop means.

2. In a plating rack of the type described, in combination: an anode provided with a substantially accurate dioptically curved surface and having a support substantially centrally disposed on the back portion thereof, a cathode having a spider support on the back thereof and provided with a substantially accurate dioptically curved surface, said curved surface being in the opposite sense to the curved surface of said anode; insulating means adapted to receive the support of said anode and maintain it in fixed positional relation therewith, said insulating means being provided with a plurality of apertures; insulating means adapted to receive the support of said cathode and maintain it in fixed positional relationship therewith, said insulating means being provided with a plurality of apertures; means for rigidly supporting each of said insulating means in spaced predetermined juxtaposition and adapted to permit removal and replacement of said anode and said cathode without altering their predetermined juxtaposition and yet capable of adjustment to vary the distance between said anode and said cathode when desired, said supporting means including a plurality of bars which are adapted to tightly fit the apertures in the cathode insulating means and adapted to loosely fit the apertures in the anode insulating means, stop means on said bars adjacent said anode insulating means, and wedging means cooperating with said stop means to tightly press said anode insulating means against said stop means.

3. In a plating rack of the type described, in combination: an anode provided with a substantially accurate dioptically curved surface of concave form and having a support substantially centrally disposed on the back portion thereof; a cathode having a spider support on the back thereof and provided with a substantially accurate dioptically curved surface of convex form; insulating means adapted to receive the support of said anode in fixed positional relation therewith, said insulating means being provided with a plurality of apertures; insulating means adapted to receive the support of said cathode in fixed positional relation therewith, said insulating means being provided with a plurality of apertures; means for rigidly supporting each of said insulating means in a spaced predetermined juxtaposition and adapted to permit removal and replacement of said anode and said cathode without altering their predetermined juxtaposition and yet capable of adjustment to vary the distance between said anode and said cathode when desired, said supporting means including a plurality of bars which are adapted to tightly fit the apertures in the cathode insulating means and adapted to loosely fit the apertures in the anode insulating means, stop means on said bars adjacent said anode insulting means, and wedging means cooperating with said stop means to tightly press said anode insulating means against said stop means.

4. A plating rack of the type described which comprises, in combination: an electrode having a support substantially centrally disposed on the back portion thereof adapted to receive a positive charge; insulating means adapted removably to mount said electrode in fixed position by means of said support; an electrode having a spider support on the back thereof adapted to receive a negative charge; insulating means adapted removably to mount said electrode in fixed position by means of said spider support; each of said insulating means being provided with a plurality of apertures; means for rigidly supporting each of said insulating means in spaced predetermined juxtaposition adapted to permit removal and replacement of each of said electrodes without altering their predetermined juxtaposition, and yet capable of adjustment to vary the distance between said electrodes when desired, said supporting means including a plurality of bars which are adapted to tightly fit the apertures in one of said insulating means and adapted to loosely fit the apertures in the other insulating means, stop means on said bars adjacent the insulating means which is loosely positioned on said bars, and wedging means cooperating with said stop means to tightly press the insulating means which loosely fits on said bars against said stop means.

5. In a plating rack of the type described, in combination: an anode; a cathode; insulating means adapted to support said anode in fixed positional relation therewith, said insulating means being provided with a plurality of apertures; insulating means adapted to support said cathode in fixed positional relation therewith, said insulating means being provided with a plurality of apertures; spacing means separating said insulating means and rigidly positioning them with respect to each other, means for rigidly supporting each of said insulating means in a spaced predetermined juxtaposition and adapted to permit removal and replacement of said anode and said cathode without altering their predetermined juxtaposition, and yet capable of adjust-

ment to vary the distance between said anode and said cathode when desired, said supporting means including a plurality of bars, said bars having threaded portions adjacent one end and a shoulder adjacent the other end, said bars being adapted to tightly fit the apertures in the first mentioned insulating means and being further adapted to loosely fit the apertures in the second insulating means, the shoulder on said bars being adapted to firmly bear against the inner surface of said first mentioned insulating means, and wedging means being adapted to tightly press said first mentioned insulating means against said shoulder means, whereby said first mentioned insulating means and said anode supported thereon are fixedly positioned on said supporting means.

6. In a plating rack of the type described, in combination: an anode; a cathode; insulating means adapted to support said anode in fixed positional relation therewith, said insulating means being provided with a plurality of apertures; insulating means adapted to support said cathode in fixed positional relation therewith, said insulating means being provided with a plurality of apertures; means for rigidly supporting each of said insulating means in a spaced predetermined juxtaposition and adapted to permit removal and replacement of said anode and said cathode without altering their predetermined juxtaposition, and yet capable of adjustment to vary the distance between said anode and said cathode when desired, said supporting means including a plurality of bars, said bars being adapted to tightly fit the apertures in the first mentioned insulating means and being further adapted to loosely fit the apertures in the second mentioned insulating means, a shoulder on each of said bars adapted to firmly bear against the inner surface of said first mentioned insulating means, wedging means adapted to slide on said bars for tightly pressing the first mentioned insulating means against said shoulders, whereby said first mentioned insulating means and anode supported thereon are fixedly positioned on said bars, locking means movably mounted on said bars and adapted to firmly bear gainst the inner surface of the second mentioned insulating means, and means threadedly engaging said bars for firmly bearing against the outer surface of the second mentioned insulating means, whereby said second mentioned insulating means may be positioned and firmly held in such position.

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