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APPARATUS FOR ELECTRODEPOSITING METAL ON BEARING SHELLS AND THE LIKE

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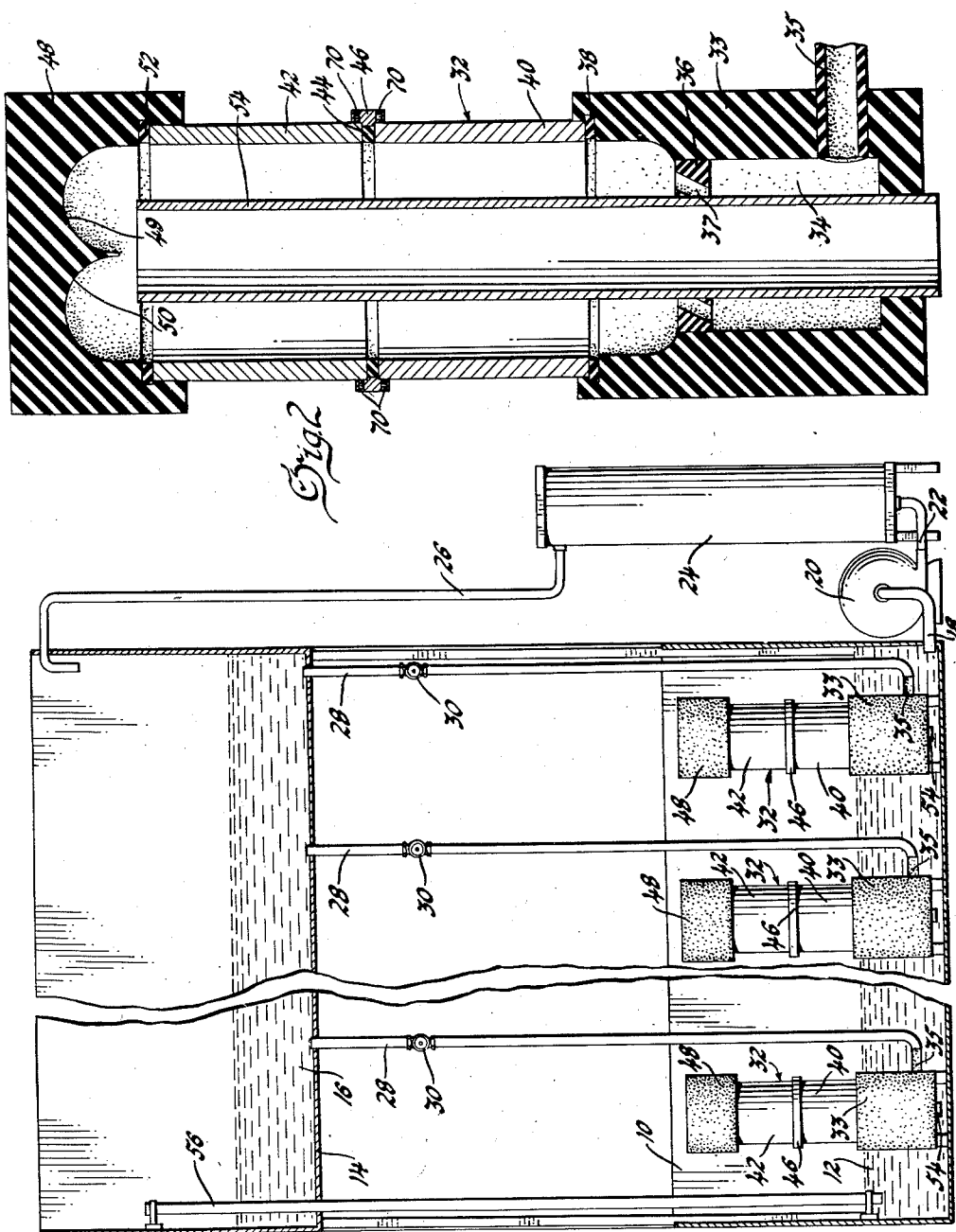


Fig. 1

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APPARATUS FOR ELECTRODEPOSITING
METAL ON BEARING SHELLS AND THE
LIKE

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1. Claim. (Cl. 204—272)

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This invention relates generally to the art of electrodepositing metals and more particularly to electrodepositing a layer or coating of metal on the inside of bearing shells and the like.

High quality bearings such as employed in aircraft engines may be made by electrodepositing a layer or layers of relatively soft metal or alloy having good antifrictional properties onto a support of a harder and stronger metal which acts as the cathode during the plating operation. Different forms of apparatuses have been proposed heretofore for electrodepositing metal on the inside of bearing shells and the like. While some of the plating apparatuses or devices have given satisfactory results and many high quality bearings produced thereby, all those apparatuses of which I am aware are subject to one or more disadvantages.

In plating bearings and the like it is desirable to electrodeposit the relatively soft metal at a rapid rate requiring relatively high current densities. This factor along with others makes it necessary or advantageous to provide a considerable amount of agitation of the plating solution. In some apparatuses heretofore employed reliance is placed on more or less complicated devices to agitate or rotate the anode and/or cathode during the process of electrodeposition in order to provide effective agitation and to bring a supply of fresh plating solution to the inside surface of the bearing shells. In other constructions a rotary means such as an impeller may be employed to provide agitation of the plating solution and which rotary means may be employed either by itself or with means to agitate or rotate the anode and/or cathode. Such movable means are not required in the preferred embodiment of my invention and the plating solution is agitated and a supply of fresh plating solution is brought continuously into contact with the inside surface of the bearing shells by simple means and without the use of rotary devices in the electrolyte.

In general there are advantages in flowing the electrolyte upwardly through a stack of bearings or other articles to be plated. It is desirable also to have positive pressure such as provided by a correct type of pump. It is desirable from practical considerations to employ a plurality of plating units for each tank of plating solution in order that a plurality of stacks of bearings can be plated at one time. However, unless a separate pump is used for each plating unit, it is difficult to control the rate of flow through the individual stacks and the rate of flow through one or more stacks cannot be altered without simultaneously

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changing the flow through all of the other stacks in the system. In accordance with the present invention by making use of a system including gravity flow, a constant head is provided for each stack and the flow through any stack of a plurality of stacks may be changed at will without influencing the rate of flow or pressure in any of the other stacks in the system.

Another disadvantage of some apparatuses heretofore employed is that masking of the bearing back or shell forming the cathode is necessary. The procedure of applying the masks and removing the same after plating is not only time consuming but the masks are a cause of plating reactions due to plating solution being trapped in the various types of masks employed. In the preferred embodiment of my invention no external masking devices are necessary.

One object of the invention is the provision of an improved apparatus for plating bearing shells and the like that eliminates defects in devices heretofore employed.

Another object of the invention is the provision of an apparatus for plating bearings and the like that is characterized by its simplicity and ease of operation and control.

It is also an object of this invention to provide an apparatus of simple construction adapted to plate a plurality of stacks of bearings and the like at one time and wherein the flow through any one stack may be changed without influencing the rate of flow through any of the other stacks.

It is also an object of this invention to provide an improved apparatus for plating a plurality of stacks of bearing and the like at one time in which only a single pump is required to circulate the plating solution and in which the flow characteristics through any one stack may be changed without affecting the flow characteristics through any of the other stacks.

A further object of the invention is the provision of an improved device of the class described in which it is practical to filter the plating solution so that only filtered solution flows past the cathode.

It is a further object of the invention to provide an improved apparatus for plating the inside of bearing shells and the like that eliminates the necessity of employing masking devices for the outside of the bearing shells.

A further object of the invention is to provide an improved means for maintaining a fresh and undepleted supply of plating solution at the surfaces to be plated.

It is also an object of the invention to provide

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a device of the class described in which no rotary devices are required in the electrolyte.

Another object of the invention is to provide a device of the class described in which only a small amount of floor space is required per stack of bearings or other articles being plated.

Other objects and advantages of the invention will become more apparent from the detailed description which follows.

Reference is herewith made to the accompanying drawing illustrating an apparatus in accordance with one embodiment of the invention.

In the drawing:

Figure 1 is an elevational view with parts broken away and with parts in section illustrating an apparatus in accordance with the invention.

Figure 2 is an enlarged sectional view of one of the plating unit assemblies shown in Figure 1.

In the drawing, 10 indicates a lower tank having a supply 12 of plating solution or electrolyte. Directly above the lower tank is another tank 14, in which is an amount of plating solution indicated by 16. For the purpose of pumping the plating solution from the lower tank to the upper tank there are provided; a pipe 18 leading from the lower tank to the inlet side of pump 20, a pump outlet 22, a filter 24 and a pipe 26 leading from the filter and discharging into the upper tank. In the bottom of the upper tank are a plurality of similar outlet tubes or pipes 28, in this case three in number. Each outlet tube has a valve 30 therein wherein flow of electrolyte therein can be stopped entirely or regulated in amount. Each of the outlet tubes 28 leads downwardly to a corresponding plating unit assembly in the lower tank indicated generally by 32. The plating unit assemblies each comprise a hollow support 33 formed of hard rubber or equivalent material, a chamber 34 in each support, a tubular connection 35 of rubber connecting the lower end of a pipe 28 and a chamber 34, an orifice plate or annular plug 36 of hard rubber or equivalent material having openings 37 through which electrolyte flows from each chamber, a soft rubber gasket 38, a bearing shell assembly including two bearing shells 40 and 42, a soft rubber gasket 44 and a metallic clamping ring 46, a cap 48 of hard rubber above the bearing shell assembly having inner curved portions 49 and 50, a soft rubber gasket 52 between the upper bearing shell and cap forming a tight seal therebetween, and a hollow anode 54 within the bearing assembly, said anode passing downwardly through the orifice plate 36 and hard rubber support 33 and discharging into the lower tank 10. The hollow support 33 is generally cup-shaped and has a base and upwardly extending walls of generally circular shape. The upper portion of the hollow anode is spaced from the stack of bearing shells so as to form an annular passage between the same, while the intermediate portion of the hollow anode is spaced from the upwardly extending walls of the hollow support 33 to form a passage of annular shape, the two annular passages being connected together. The lower end of the tubular anode passes through a centrally arranged opening in the base or bottom of the cup-shaped support and is in liquid-tight engagement therewith. The electrolyte enters the hollow support by means of tubular connection 35 and flows upwardly in the annular passages until it reaches the upper end of the cathode and then flows downwardly through the tubular anode for return to the lower supply tank. It will be understood that the anode will be connected to the positive side of a source

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of direct current and the metallic bearing shells 40 and 42 electrically connected to each other by metallic clamping ring 46 will be connected to the negative side of the source of current to form the cathode on which metal will be electrodeposited in the plating operation by means of electric current passing through the electrolyte from the anode to the cathode.

Another pipe 56 leads from a point in the upper tank to a point of discharge in the lower tank and acts as an overflow return should the pump 20 circulate more solution or electrolyte to the upper tank than is returned to the lower tank by means of the pipes or tubes 28 leading to the several plating units.

As shown the solution in the lower tank is below the lowermost bearing shell and surrounding the hollow supports 33. When the solution level is thus maintained no external masking is required for the bearing shells.

The upper tank is supported above the lower tank at a sufficient height to give sufficient volume of flow by means of gravity flow through each of the pipes 28 leading to the plating units. In most cases a head of 24 to 30 inches gives sufficient volume of flow upwardly through the plating units. For fine adjustment the valves 30 in the pipes 28 may be operated to control the flow. The flow through any pipe 28 may be cut off entirely without affecting the head or amount of flow through the other pipes.

As shown the jet or orifice plate 36 has the openings 37 arranged spirally at an angle of about 45° in order to impart a spiral flow to the electrolyte as it passes upward between the hollow anode and bearing shells. This most effectively brings fresh plating solution into contact with the surfaces to be plated. In some cases the orifices may be so disposed as to cause the flow to be straight up between the anode and bearing shells.

The anodes and other materials may be whatever is necessary to conform with the type of electrolyte. If, for example, the solution or electrolyte is a silver plating solution, the anode may be of silver. In this case, of course, the anode will be used up as the silver passes into solution during electrolysis and eventually the anode must be replaced. If the anode is of iron or other insoluble material, it will be necessary to replace or replenish the silver that is electrodeposited out of the electrolyte. This can be accomplished by adding a silver salt to the electrolyte from time to time, or other means may be employed.

The number of units which may be used in the tank are, of course, limited only by the size of the tank desired.

While the construction illustrated in the drawings shows only two bearing shells in each assembly, it will be understood that a greater number can be plated at one time at each plating unit, or, of course, only one, if desired. After the desired thickness of metal is electrodeposited onto each bearing shell assembly, the rubber cap 48 and gasket 52 are removed from the upper bearing shell and the bearing shell assembly removed from its seat on the soft rubber gasket 38, whereupon an unplated bearing shell assembly can then be placed in position for plating. The operation of removing a plated bearing assembly and inserting an unplated bearing assembly is a simple one. The clamping ring 46 has adjustable screws 70 which, when tightened, secure the two bearing shells together as an assembly. When the screws are loosened the bearings can be sep-

arated from each other. The electrical connection leading to the negative side of the source of plating current may be attached to the clamping ring.

It will be understood that the soft rubber gaskets 38, 44 and 52 form liquid tight seals which prevent the electrolyte from escaping during upward flow of the electrolyte between the hollow anode and bearing assembly. The curved portions 49 and 50 of the caps are for the purpose of directing the electrolyte into the inside of the hollow anode with as little turbulence as possible. Each cap 48 forms a tight press fit with the bearing shell. If desired, suitable clamping or hold down means (not shown) may be employed to hold the caps in position during the plating operation.

In place of causing the electrolyte to return to the lower tank through the anode it is possible to omit the cap member and otherwise modify the construction to permit the electrolyte to flow over the upper edge of the upper bearing shell of the bearing shell assembly and return to the lower tank. In such case, however, suitable external masking means must be provided for the backs of the bearing shells. Suitable masking means also will be required in the apparatus illustrated in the drawing if the solution level is permitted to rise above the portion of the bearing shell assembly above the hollow support 32.

Various changes and modifications may be made without departing from the spirit and principles of the invention.

I claim:

An apparatus for electrodepositing metal on the inside of a stack of bearing shells and the like which comprises, a generally cup-shaped support having a base and upwardly extending walls of generally circular shape, the upper portions of said walls adapted to engage in liquid-tight relation and support a stack of bearing shells connected together to form a tubular cathode, said base having an opening centrally arranged therein, a tubular anode having an upper portion within the tubular cathode, an intermediate portion within the cup-shaped support and a lower portion extending through said opening, said upper portion being spaced from said tubu-

lar cathode to form an annular passage for electrolyte between said tubular cathode and said upper portion, said intermediate portion being spaced from said walls and forming therewith a passage of annular shape, said annular passages thus being connected together, said lower portion being in liquid-tight engagement with said opening, an annular plug in the annular passage between said intermediate portion and said walls at a point between said base and upper end of said walls, said plug having angularly arranged jet openings adapted to impart a spiralling effect to electrolyte as it flows therethrough, a cap in liquid-tight engagement with the upper end of said tubular cathode and spaced from the upper end of said tubular anode, means for flowing electrolyte into said annular passage below said plug, then upwardly through the angularly arranged jet openings, then spirally upward through said annular passageway formed between the upper portion of said tubular anode and said tubular cathode to the upper end of the cathode and then downwardly through the tubular anode, and means for passing electric current from the tubular anode to the tubular cathode through the electrolyte flowing spirally upward in said annular passageway between the two.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,259,683	Van Hasselt	Mar. 19, 1918
686,395	Dessolle	Nov. 12, 1901
2,297,252	Schmidt	Sept. 29, 1942
1,886,218	Olin	Nov. 1, 1932
1,594,509	Rosenqvist	Aug. 3, 1926
588,740	Becker	Aug. 24, 1897
1,872,290	Hitner	Aug. 16, 1932
1,927,162	Fiedler et al.	Sept. 19, 1933

FOREIGN PATENTS

Number	Country	Date
215,409	Switzerland	Nov. 3, 1939
825,071	France	Nov. 27, 1937