Nov. 20, 1956 A. O. ROSS 2,771,415

ELECTROLYTIC APPARATUS

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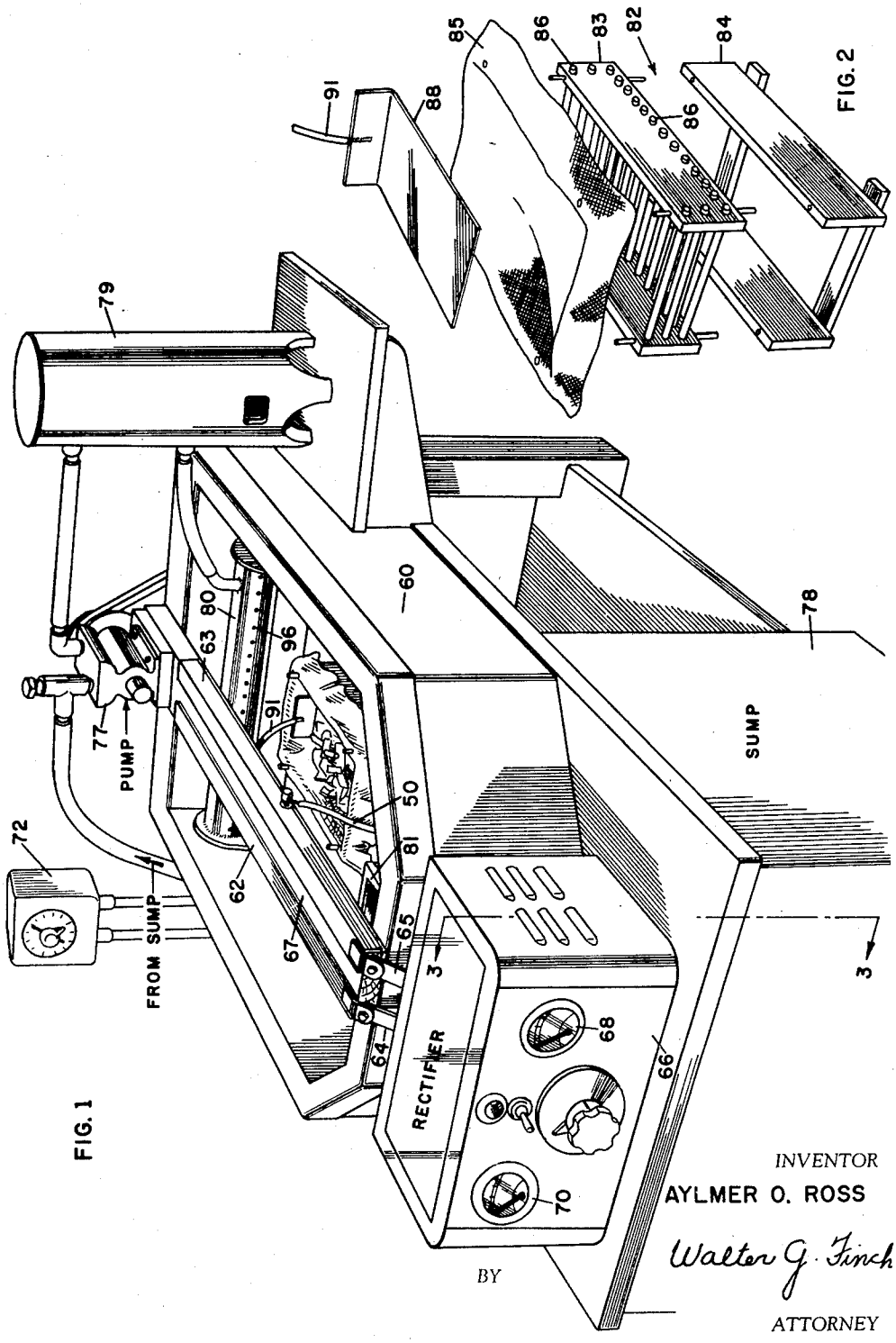


FIG. 2

FIG. 1

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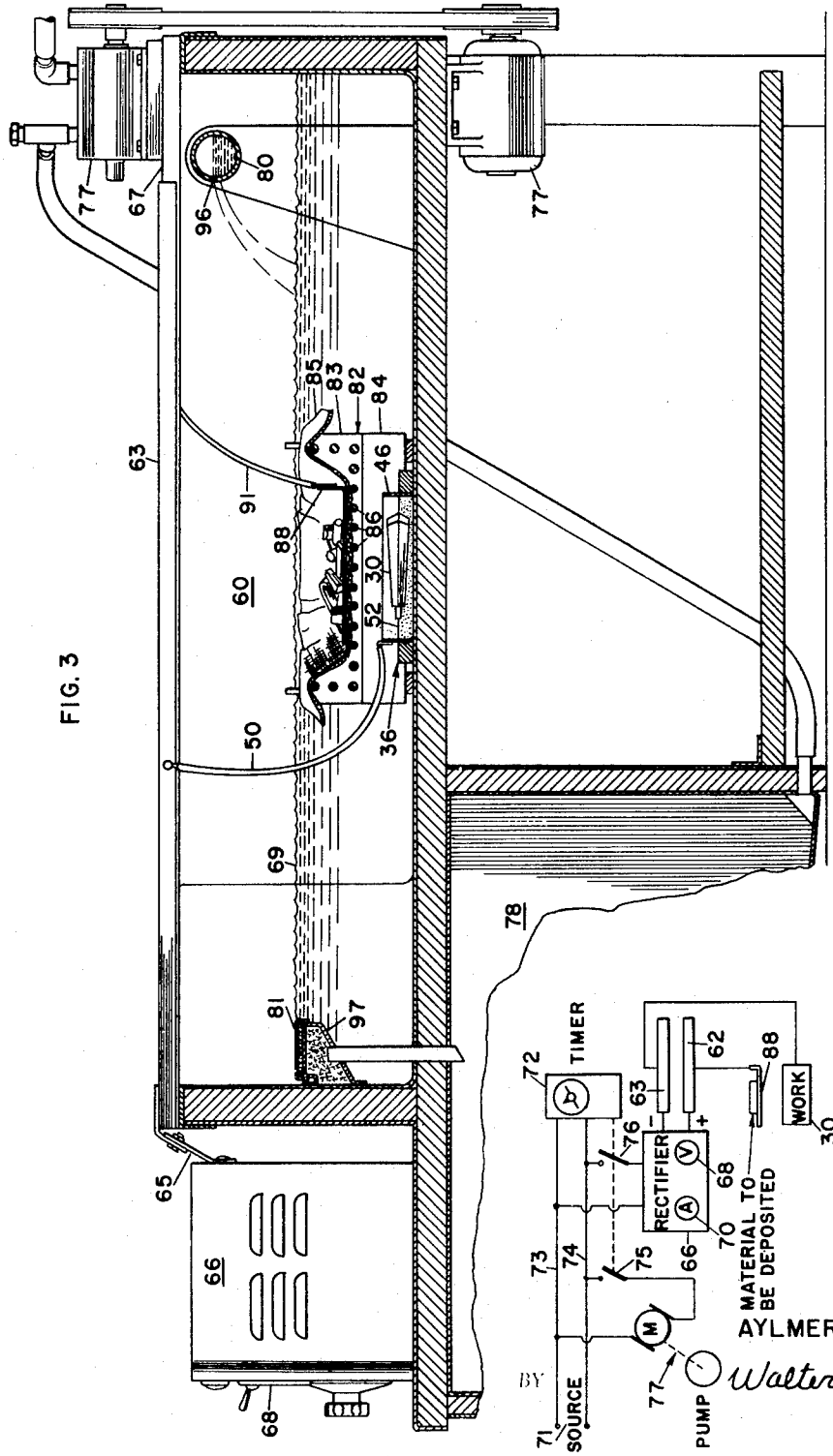


FIG. 3

FIG. 4

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ELECTROLYTIC APPARATUS

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Application October 28, 1952, Serial No. 317,229

4 Claims. (Cl. 204—238)

This invention relates, in general, to apparatus for electroforming metal products, and more particularly it pertains to electrolytic apparatus for electroforming mold cavities, force plugs, molds and dies by the electrodeposition of metals.

The manufacture and production of metal dies by conventional methods, such as engraving, hobbing, or machining, is expensive, tedious and time consuming and, in addition, requires considerable mechanical skill. Even with the latter, it is difficult to produce mold cavities, molds, dies and the like, which are identical.

It is one of the objects of this invention, therefore, to provide novel electrolytic apparatus for the manufacture and production of mold cavities, molds, dies, and force plugs, which can be utilized for forming and shaping plastic and rubber and like articles and stampings.

Still another object of this invention is to provide electrolytic apparatus for forming multi-piece metal molds and dies by the electrodeposition of metals from an intricate design pattern in which the detail and design formed on the finished mold or die is clear and of the highest order.

Even another object of this invention is to provide electrolytic apparatus for manufacturing metal molds and dies by the electrodeposition of metals which is compact, inexpensive to manufacture, efficient and reliable in operation and which is easy to maintain.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view of an electrolytic apparatus embodying features of the invention;

Fig. 2 is an exploded perspective view of a basket for holding scrap metal which is to be electrodeposited on a pattern;

Fig. 3 is a cross section along plane 3—3 of the electrolytic apparatus shown in Fig. 1, showing a pattern, framework, and basket in position for the electrodeposition of metal thereon; and

Fig. 4 is a schematic of the circuitry for the electrolytic apparatus illustrated in Figs. 1 and 3.

In accordance with the invention, novel electrolytic apparatus is provided for electroforming metal products. This apparatus comprises a tray or tank for containing an electrolyte during the electroforming of the metal products, a sump for receiving excess electrolyte, and means for pumping electrolyte into the tray. In addition, there is provided means for heating the electrolyte either prior to introducing the electrolyte into the tray, or the heating means (electric coil means or the like) can be provided integrally with the tray. A manifold nozzle arrangement is provided in the tray for continuously and uniformly introducing the electrolyte into the tray. A rectifier is also provided for controlling the amount of electric power, together with a timing mechanism for timing the length of the electroforming operation.

A novel basket arrangement is provided in the tray for containing metal that is to be electrodeposited to form the metal products. This basket arrangement comprises a framework having at least one pair of sidewalls, together with a plurality of spaced truss members between the sidewalls for supporting the sidewalls and the metal that is to be electrodeposited.

The electrolytic apparatus of the present invention is particularly useful for carrying out the process for forming molds, mold cavities, force plugs, or dies by the electrodeposition of metal, as set forth in a companion application Serial No. 317,228, filed even date. Briefly, the process referred to above relates to forming, for example, a plurality of metal shells on a suitable pattern 30, shown in Fig. 3, which has been suitably treated prior to being introduced into the electrolytic apparatus subsequently to be described, to form molds and dies.

Pattern 30 is mounted in wax 52 surrounded by metal strip 46 in a suitable framework or cathode contact 36, and is then placed in the bottom of a large, specially designed electrolytic tank or tray 60, best seen in Figs. 1 and 3, in which the electrolytic deposition of the metal is to take place.

This tray is mounted on a suitable platform. Tray 60 comprises metal sidewalls and bottom for holding a suitable electrolyte 69. This tray 60 has extending above it two bus bars 62 and 63 connected to the positive and negative terminals 64 and 65 of a rectifier unit 66 having a source of alternating current 71, shown in Fig. 4.

The bus bars 62 and 63 are supported by and spaced apart by a wooden member 67, which extends above the tray 60. Rectifier unit 66 has provided therein a voltmeter 68 and an ammeter 70, for measuring voltage and current, respectively. Rectifier 66 is connected to an alternating current source of power 71 and a timing mechanism 72 by leads 73 and 74. A mechanical switching arrangement 75 and 76, controlled by the timing mechanism 72, is utilized for turning the current on for the rectifier 66 and a motor-pump arrangement 77.

Electrolyte 69, as shown in Figs. 1 and 3, is pumped into tray 60 by means of the suitable motor-pump arrangement 77 from a sump 78 located below the tray. This electrolyte is heated to the desired temperature by heater 79 prior to being introduced into the tray 60 through the manifold nozzle arrangement 80. Excess electrolyte is drained through an overflow filter or strainer arrangement 81 into sump 78.

A wooden basket 82, shown in Fig. 2, of special design serves to hold the anode. This basket 82 is specially prepared. The wood from which the basket 82 is made is first cooked in wax to preserve it and make it acid-resistant. The wood is cooked for approximately one-half an hour in paraffin at 180 degrees F., until it stops "gasing." The two sections 83 and 84 of the basket are then fastened together by using wooden dowel pins, such as 86, which pass through holes bored for this purpose. The basket 82 is so formed that there is no metal in its construction.

In the bottom of the basket 82 there is first placed a muslin cloth 85 which is held in place by dowel pins 86. This muslin cloth is used for straining impurities. A strip of metal 88, such as copper, which is the anode, is then placed in basket 82. Finely divided pieces of the same metal, copper, are then placed on the anode strip 88 in the basket. Metal pieces in the form of shots are preferred. This fine division of the metal scrap can be obtained by mechanical means, or by melting the metal and pouring it through a screen into water. The reason for utilizing scrap metal in finely divided form is that in electrolysis the anode is attacked only at and on its

surfaces. Therefore, the greater the surface area of the anode that is exposed to the electrolyte, the more efficient is the electrolysis. Thus, the more finely divided the metal is, the greater will be the surface area.

The basket 82, either before or after the preparation therein of the anode 88, is placed in the electrolytic tray 60 directly above the framework 36 holding the pattern 30. The anode strip 88 is then electrically connected to the positive bus bar 62 by lead 91. Since the finely divided metal pieces have been placed on the anode strip, there is good electrical contact between the positive bus bar and the entire anode. The terminal wire 50 from the pattern framework 36 is then attached to the terminal of the negative bus bar 63.

It is to be emphasized that although the anode is here illustrated as copper and the metal to be electrodeposited is copper, any other suitable metal can be used for carrying out the process previously mentioned for electroforming molds or dies and that the electrolytic apparatus is not to be limited to this metal.

The tray 60 is now filled with electrolyte 69 sufficient to cover the framework 36, pattern 30, and the scrap metal in the basket 82. If the metal in the basket 82 is copper, as indicated above, the electrolyte utilized would be copper sulphate.

The electrolyte 69 is pumped into the tray 60 through the manifold arrangement 80, which has a plurality of orifices 96, with each orifice 96 being about 3/32" in diameter. The electrolyte 69 enters the tray 60 in this way continuously throughout the electrolytic process. Any surplus electrolyte 69 escapes through the overflow filter or strainer arrangement 81 at one end of the tray. The electrolyte 69 which has thus escaped is filtered and again pumped into the tray 60 by motor-pump arrangement 77. The basket 82 is so constructed as to offer the least possible obstruction to the flow of electrolyte 69. The cloth 85 in the basket 82 acts as a filter. When the electrolyte 69 is copper sulphate, cotton 97 can be used as the filter or strainer for the excess electrolyte. It is important to keep the electrolyte 69 in constant circulation. The motor-driven pump 77 preferably has a capacity of 10 gallons per minute for this purpose.

An electric current from A. C. source 71 is now passed through the copper sulphate electrolyte 69 from the copper anode 88 in the basket 82 to the pattern 30 mounted in the framework 36, and a suitable metal shell is deposited on the pattern 30.

When the required metal shell is deposited on pattern 30, the framework 36 and pattern 30 are removed from tray 60. If additional metal shells are to be electroformed, then the electrolytic apparatus is again used as indicated heretofore.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An electrolytic apparatus for electroforming of a metal product, comprising, a tray for containing an electrolyte, a sump for containing excess electrolyte, conduit means located between said sump and tray, means for pumping said electrolyte through said conduit means, nozzle means cooperating with said conduit means for continuously and uniformly introducing said electrolyte into said tray from the top thereof, an electric circuit including an anode element and a cathode contact element, a source of electric power for said circuit, and a non-conducting basket arrangement for containing the metal to be electrodeposited to form said metal product, said arrangement including at least top and bottom sections, a first pin means for holding said sections together, said top section including at least two spaced sidewalls, said bottom section being formed of spaced members arranged in alignment with said sidewalls of said top section, said members defining a space for accommodating said cathode contact element and the product to be electroformed, said top section having a plurality of spaced truss members for interconnecting said sidewalls, a second pin means positioned on said top section, and screening means supported by said second pin means and resting against said plurality of spaced truss members, said anode element being positioned on top of said screening means and arranged to support the metal to be electrodeposited, said screening means being utilized to screen impurities from the electrolyte during the electroforming of said metal product.

2. An electrolytic apparatus for electroforming of a metal product, comprising, a tray for containing an electrolyte, a sump for containing excess electrolyte, a multi-nozzle arrangement, conduit means connecting said sump and multi-nozzle arrangement together, said multi-nozzle arrangement being arranged to uniformly and continuously introduce said electrolyte into said tray from the top thereof, means for pumping said electrolyte from said sump through said conduit means to said multi-nozzle arrangement, means for heating said electrolyte in said sump and conduit means prior to the introduction thereof into said tray, an electric circuit including an anode element and a cathode contact element, a source of electric power for said circuit, and a non-conducting basket arrangement for containing the metal to be electrodeposited to form said metal product, said arrangement including at least top and bottom sections, a first pin means for holding said sections together, said top section including at least two spaced sidewalls, said bottom section being formed of spaced members arranged in alignment with said sidewalls of said top section, said members defining a space for accommodating said cathode contact element and the product to be electroformed, said top section having a plurality of spaced truss members for interconnecting said sidewalls, a second pin means positioned on said top section, and screening means supported by said second pin means and resting against said plurality of spaced truss members, said anode element being positioned on top of said screening means and arranged to support the metal to be electrodeposited, said screening means being utilized to screen impurities from the electrolyte during the electroforming of said metal product.

3. An electrolytic apparatus for electroforming of a metal product, comprising, a tray for containing an electrolyte, a sump for containing excess electrolyte, conduit means located between said sump and tray, means for pumping said electrolyte through said conduit means, nozzle means cooperating with said conduit means for continuously and uniformly introducing said electrolyte into said tray from the top thereof, an electric circuit including an anode element and a cathode contact element, a source of electric power for said circuit, a non-conducting basket arrangement for containing the metal to be electrodeposited to form said metal product, said arrangement including at least top and bottom sections, a first pin means for holding said sections together, said top section including at least two spaced sidewalls, said bottom section being formed of spaced members arranged in alignment with said sidewalls of said top section, said members defining a space for accommodating said cathode contact element and the product to be electroformed, said top section having a plurality of spaced truss members for interconnecting said sidewalls, a second pin means positioned on said top section, screening means supported by said second pin means and resting against said plurality of spaced truss members, said anode element being positioned on top of said screening means and arranged to support the metal to be electrodeposited, said screening means being utilized to screen impurities from the electrolyte during the electroforming of said metal product, means for controlling the amount of electrical power utilized during the electroforming of said

metal product, and means for timing the electrodeposition of said metal.

4. A non-conducting basket arrangement for containing metal to be electrodeposited to form a metal product, said arrangement including at least top and bottom sections, a first pin means for holding said sections together, said top section having at least two spaced sidewalls, said bottom section being formed of spaced members arranged in alignment with said sidewalls of said top section, said members defining a space for accommodating said product being electroformed, said top section having a plurality of spaced truss members for interconnecting said sidewalls, a second pin means positioned on said top section, and screening means supported by said

second pin means and resting against said plurality of spaced truss members for receiving the metal to be electrodeposited, said screening means being utilized to screen impurities from an electrolyte during the electrodeposition of said metal.

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