Sept. 16, 1958 E. H. MUNDELL 2,852,450

METHOD OF COPPER PLATING

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FIG. 1

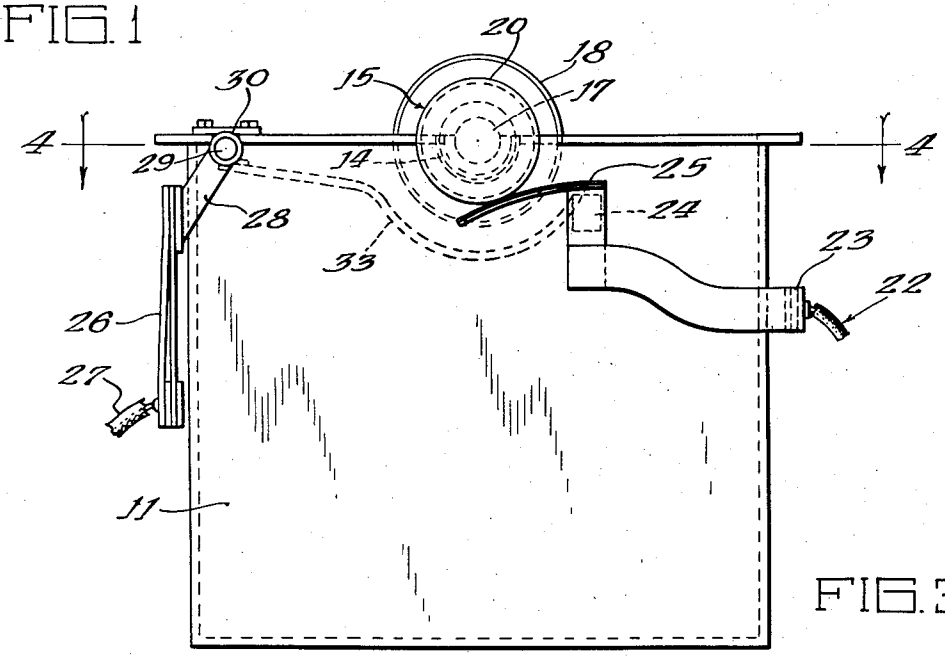

FIG. 3

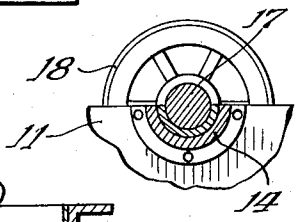

FIG. 2

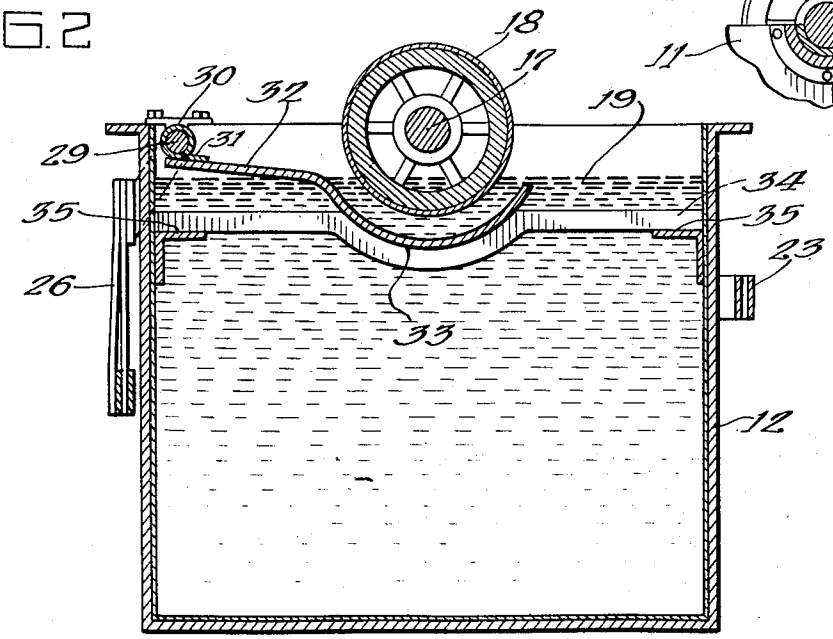

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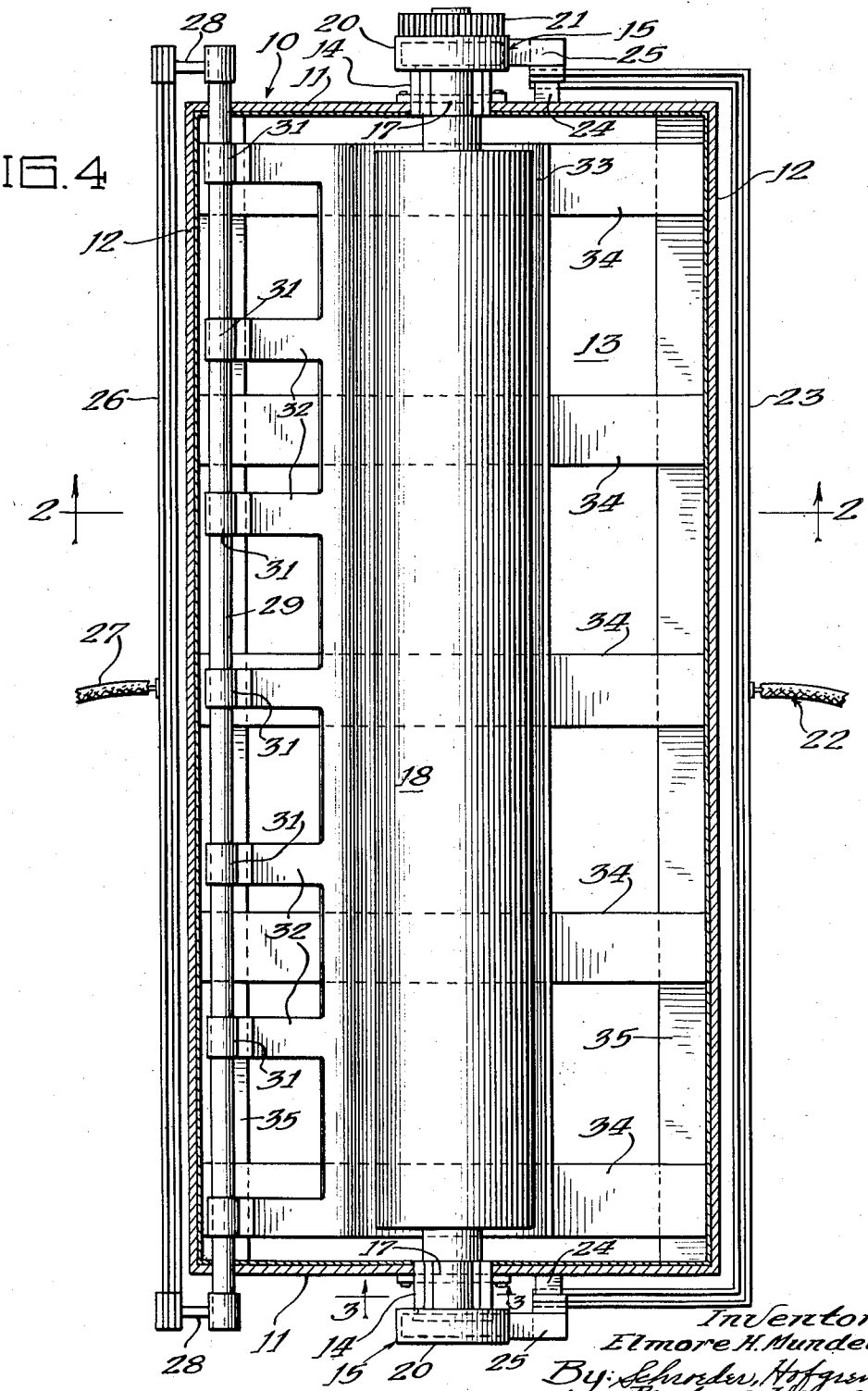
FIG. 4



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METHOD OF COPPER PLATING

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1 Claim. (Cl. 204—52)

This invention relates to an apparatus and method for copper plating a rotogravure cylinder, and in particular it relates to the copper plating of rotogravure cylinders using an insoluble anode.

The principal object of the invention is to improve the copper plating of rotogravure cylinders so as to reduce the cost both of the electroplating equipment and the expense of processing a rotogravure cylinder.

It has been common practice in the past to copper plate rotogravure cylinders by rotating them while partially submerged in an electroplating bath. Insofar as applicant is aware the apparatus has always included a copper anode which is spent during the plating process; and in order to support the copper bars forming the anode with a material which would not contaminate the electrolyte, the copper bars were customarily supported upon a chemical lead slab.

There were a number of objections to the customary electroplating process. In the first place, it is essential to the production of a copper film of even thickness that the spacing between the anode and the adjacent cylinder surface be substantially equal throughout the length of the cylinder. In view of the fact that the copper bars forming the anode entered into the electrolytic action, and the electrolysis did not proceed evenly, it was very difficult to keep the required uniformity of spacing between the anode mass and the cylinder. Unevenness in the spacing which developed with anode corrosion resulted in uneven plating of the cylinder. Since the cylinder surface must be very true and even, any unevenness in plating had to be corrected by grinding the plated surface. Thus, the time and expense of preparing a finished rotogravure cylinder was greatly increased by reason of the use of a copper anode.

Another difficulty with the previously known apparatus was that the lead support for the copper bars of the anode was easily distorted by the weight of the copper bars; and furthermore there was a tendency for a non-conducting sulphate film to form on the lead, reducing conductivity between the lead and the copper and causing excessive plating time.

In accordance with the present invention an anode is employed which is not disintegrated by the electrolytic action, so that it enters into the electroplating action solely as an electric conductor member. Preferably the anode is fabricated from conventional electrotype metal. The level of copper in the electrolyte is maintained by the addition of a copper salt from time to time in accordance with the amount of copper deposited upon the rotogravure cylinder.

It has been found that an anode formed from electrotype metal has much less tendency to sulphate and disintegrate with use than have the conventional lead supports previously used for copper bars. Since the anode does not enter into the electroplating action, there is no change in the surface shape of the anode so that a very even deposition of copper on the rotogravure cylinder is obtained and very little grinding of the surface is required.

Anodes of electrotype metal have been used experimentally for many months with no sign of any deterioration of such magnitude as to alter the efficiency of the electroplating operation.

The apparatus of the invention is illustrated in the accompanying drawings in which Fig. 1 is an end elevational view of the apparatus; Fig. 2 is a section taken as indicated along the line 2—2 of Fig. 4; Fig. 3 is a fragmentary section taken along the line 3—3 of Fig. 4; and Fig. 4 is a section taken as indicated along the line 4—4 of Fig. 1.

Referring to the drawings in greater detail, and referring first to Fig. 4, the apparatus includes an electroplating tank indicated generally at **10** which has end walls **11**, side walls **12** and a bottom **13**. As best seen in Figs. 1 and 4, the end walls **11** of the tank are provided with aligned pillow blocks **14** on which are supported rotatable sleeves indicated generally at **15** which have central openings to receive the stub shafts **17** of a rotogravure cylinder **18**. The tank **10** is filled with an electrolyte **19** to a level such that the lower portion of an electrotype cylinder **18** mounted in the sleeves **15** is immersed in the electrolyte.

The sleeves **15** are provided with commutators **20**, and one sleeve has on its outer face a pinion **21** which may mesh with a gear (not shown) for the purpose of rotating the cylinder **18** on the pillow blocks **14**. A cathode lead **22** is electrically connected to a current carrying buss bar **23** which extends in parallel spaced relation to one side wall **12** of the tank and part way across the two end walls **11** upon which it is supported by means of insulating supports **24**. At each end of the buss bar **23** is a contact brush **25** which bears upon one of the commutators **20** so as to make the rotogravure cylinder **18** a cathode of the electroplating circuit.

Along the wall of the tank opposite the buss bar **23** is an anode buss bar **26** which has a lead **27** by means of which it is made a part of the electroplating circuit, and the buss bar **26** has inclined arms **28** at the ends of the tank which are electrically connected to the ends of an internal buss bar **29** which is supported in the slots **30** in the end walls **11** of the tank. A series of anode contact clamps **31** are secured to the interior buss bar **29** and, as best seen in Fig. 2, the clamps **31** support an anode **32**. As seen in Figs. 2 and 4, the anode **32** has an arcuate portion **33** which is submerged in the electrolyte **19** and which is concentric with the rotogravure cylinder **18** throughout the entire length of the cylinder. Wooden brace members **34** for the anode extend across the tank and are supported upon angle members **35** on the side walls **12**.

The principal components of the electrolyte **19** are preferably 30 ounces of copper sulphate and 10 ounces of sulphuric icid per gallon of water in the solution. The anode **32** is preferably fabricated from electrotype metal of a common type which is 94% lead, 3% tin and 3% antimony. The electrotype metal is sufficiently rigid that it will hold its shape, particularly after it is age hardened. Since it does not enter into the electrolytic action there is no effective disintegration of the anode as is the case where copper anodes are employed, and it has only little tendency to sulphate in the electroplating process.

In carrying out the electroplating operation in the apparatus here described, the sleeves **15**, which are loosely supported upon the pillow blocks **14**, are mounted upon the stub shafts **17** of a rotogravure cylinder **18** and the assembly of cylinder and sleeves is mounted on the pillow blocks **14** with the teeth of the gear **21** in mesh with the teeth of a driving gear. The cylinder is rotated at moderate speed—about 200 R. P. M.—during the plating operation, and current is supplied to the electroplating

bath so as to provide current density of 2 amperes per square inch between the anode and the cathode. The deposition of copper upon the rotogravure cylinder **18** reduces the copper in solution in the electrolyte, and the copper is replenished by adding copper carbonate to the electrolyte. Preferably the copper carbonate is added to the electrolyte at a rate which is slightly in excess of that theoretically required to replace exactly the copper plated out of the electrolyte. In practice, 10 pounds of copper carbonate are added for each 80 ounce shell plated.

The foregoing detailed description is given for clearness of understanding only and no unnecessary limitations are to be understood therefrom, as some modifications will be obvious to those skilled in the art.

I claim:

A method of copper plating which comprises immersing an article to be plated in an electrolyte containing a dissolved copper salt, establishing an electric circuit through said article as a cathode and through an insoluble anode consisting of 94% copper, 3% tin and 3% antimony, and replenishing the copper as it is plated out of the electrolyte.

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