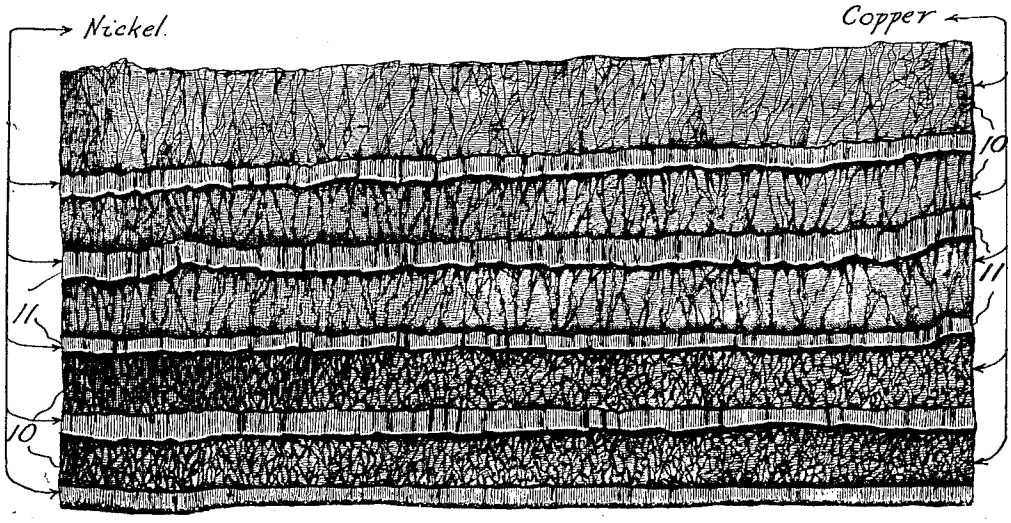
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ELECTROTYPE MATERIAL AND METHOD OF FORMING SAME.

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1,397,785. **Patented Nov. 22, 1921.**



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ELECTROTYPE MATERIAL AND METHOD OF FORMING SAME.

1,397,785. Specification of Letters Patent. Patented Nov. 22, 1921.

Continuation of application Serial No. 366,463, filed March 17, 1920. This application filed March 2, 1921. Serial No. 449,273.

To all whom it may concern:

Be it known that I, GEORGE U. ROSE, Jr., a citizen of the United States of America, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Electrotype Material and Methods of Forming Same, of which the following is a specification.

My present invention relates generally to electrotype materials and more particularly to materials from which printing plates are made, my object being the provision of a material which may be electro-deposited and which will compare favorably in strength and durability with the hardened steel plates now used, as well as a method by which the electrotype material may be strengthened for this purpose during the electro-deposition thereof.

It is a well known fact that printing plates are at the present time formed by what is known as the transfer process, each plate being made from a roller which has previously received its impression from a master plate or die. Each printing plate must be so fashioned from a roller and then hardened before use and the process, involving as it does, considerable hand work and skill, is both expensive and time consuming to such an extent that plates cannot now be finished in the required number.

The electro-depositing process of forming printing plates is known and used to a certain extent and according to this process a previously transferred plate is used for the electro-deposition of a positive plate known as an "alto," by the subsequent use of which any desired number of negative printing plates may be formed by electro-deposition. These printing plates are known as "bassos" and it is evident that this process, in which copper is universally employed, involves but a single transfer operation and can be carried out with greater speed and greatly reduced expense, as compared to the first named process in which each printing plate necessitates a mechanical transfer.

The electro-depositing is however open to the objection of limited use to those printing operations wherein but comparatively few impressions are to be made, for a plate formed by the electro-deposition of copper is not of sufficient strength to permit of its use for the printing of bank notes and the like where impressions are to be made in great numbers. In other words an electro-deposited copper plate does not compare favorably from an economical standpoint with a hardened steel plate which can only be made by the transfer process.

My invention aims to permit the formation by electro-deposition of a plate which will compare favorably in strength with hardened steel and will thus be of great advantage, and arises from a discovery that the weakness of electro-deposited copper is due to the greatly increasing crystals formed in the metal as the deposit thickens. I have found that the operation starts with the deposit of dense fine grains which if continued would produce a strong material. As the deposited metal increases in thickness however, the crystals grow to great proportions and form what are known as "trees" thus weakening the structure and causing a rough deposit which necessitates considerable and expensive machinery in smoothing the edges and back of the plate.

According to my invention, as shown in the accompanying drawing wherein the figure is a cross-section through the material thereof, the method is varied to the extent that the copper is electro-deposited in separate layers 10 to the full thickness of the material and in such manner that each new layer breaks up the growth of the crystals and thus interrupts "treeing" to such an extent that it is practically the start of an entire new operation. This may be accomplished by electro-depositing certain layers in a sulfate solution and alternate layers in a cyanid solution, but I do not limit myself to such an operation as the same result might be accomplished in a single solution by periodically varying the density of the electric current utilized.

I have also found that by interposing between copper layers, a layer of a different material instead of layers of the same material of different crystalline structure, pronouncedly better results can be obtained. For instance layers 11 of nickel can be electro-deposited between layers of copper and not only check the growth of copper crystals thus preventing excessive "treeing," but add to the tensile strength of the finished product by virtue of the relatively greater strength of the nickel.

Where, as shown in the drawing, nickel layers 10 are utilized between layers 11 of

copper, the deposits of nickel will be greatly reduced in thickness as compared to the layers of copper as it is the frequency with which the nickel layers occur, rather than their individual thicknesses, which gives the desired result, and the deposit of nickel is slow and expensive as compared to that of copper.

By thus varying the operation to the extent of interposing between layers of copper, other layers either of the same material having a different crystalline structure, or of a different material, preferably the latter, I am able to electro-deposit a solid, fine grained, material, independent of any other material, which in so far as printing plates at least are concerned, will compare favorably in strength and durability with hardened steel as I have demonstrated by actual use, and which will, by virtue of the material checking of the growth of the crystals, obviate much of the expensive machining now necessary with electro-deposited plates wherein copper of a given crystalline structure is utilized in one continuous operation.

It is to be understood that in speaking of the electro-deposition of either copper or nickel, I refer to the ordinary well known operations of this nature, employing generally the solutions usually employed, and using generally a current density variable within the limits now prescribed, and while my invention is capable of being readily carried out by any one skilled in the art of electro-deposition, I do not wish to be understood as limiting myself to the ordinary process of electro-depositing copper and nickel, even though these will serve the purpose. For convenience and better understanding I will give the operation as carried out to produce a plate of alternating layers of copper and nickel, as follows. After thoroughly cleaning a master or engraved plate, from which an "alto" is to be made for subsequent use in the electro-deposition of any desired number of "bassos," is first suspended in a nickel solution of nickel sulfate, nickel chlorid and boric acid, and nickel deposited at a current density of about 10 amp./sq. ft., for about ten minutes. Then at a current density of about 20 amp./sq. ft., the deposition is continued for the balance of an hour, the initial deposit of nickel therefor being about .001 inch for the "alto." The plate is then withdrawn, rinsed and immersed in a copper solution of copper sulfate and sulfuric acid and deposition proceeded with at a current density between 35 and 45 amp./sq. ft. for about two hours so as to produce a copper layer on the nickel layer of about .0045 inch in thickness. The plate is then withdrawn from the copper solution, rinsed and again immersed in a nickel solution and nickel deposited at about 20 amp./sq. ft. for one hour. This cycle of two hours in copper and one hour in nickel is repeated until the required thickness of the plate is obtained. When this has been reached, with an allowance for waste, the plate is removed and machine, the "alto" separated from the master plate and then utilized in a similar manner in the formation of any number of "bassos," the formation of each of which is carried out in a similar process except that the initial deposit of nickel will be somewhat thicker for "bassos" than for "altos," being for instance about .002 inch.

It is also to be understood that the current densities mentioned above are given by way of illustration alone and that I reserve to myself the right to vary the same at will.

It is not to be assumed, however that the material and method of forming the same as proposed by my invention, is useful alone in connection with printing plates, for it is obvious it will find wide, in fact more or less general use, in various arts where electro-deposition can be effectively utilized in place of difficult casting operations.

I am aware it is not new to electro-plate articles with alternate layers of copper and nickel where the purpose is to support and hold the nickel, but such a method is foreign to the present one, in fact it is the reverse of my invention which seeks to provide an independent electro-deposited material for the most part, at least, of copper, and of a greater tensile strength than a material formed wholly of copper of a given crystalline structure in a continuous operation, such as to enable it to compare favorably in strenth and durability to hardened steel.

I claim:

1. The herein described method for the electro-deposition of copper to a thickness usually forming "trees" and producing little tensile strength, which consists in electro-depositing the copper in a number of layers and in breaking up the growth of upper crystals between the layers whereby to check the formation of "trees" and correspondingly increase strength of the finished plate.

2. The herein described method for the electro-deposition of a material subject to "treeing" in thick deposits, which consists in electro-depositing the material in relatively thin layers to the desired thickness and in breaking up the growth of crystals between the layers, whereby to check the formation of "trees" and increase the strength of the finished product.

3. The herein described method of electro-depositing a material subject to "treeing" in thick deposits which consists in depositing a relatively thin layer of such material, then depositing on the first layer a second layer of a material having a different crystalline structure, and then alternating these de-

posits to the desired thickness, whereby no check "treeing" and increase tensile strength.

4. The herein described method of forming an independently usable material, which consists in successively electro-depositing a plurality of adhering layers of the same material and in inter-depositing between layers of the material, other layers having a different crystalline structure.

5. The herein described method of forming an independently usable material which consists in successively electro-depositing a plurality of adhering layers of the same material and in inter-depositing between layers of the material, layers of another material.

6. The herein described step in the method of strengthening electrotypes subject to "treeing" during the electro-deposition thereof, which consists in periodically checking the growth of crystals in order to avoid "treeing," as described.

7. The herein described step in the method of strengthening electrotypes subject to "treeing" during the electro-deposition thereof, which consists in periodically interrupting the normal operation and checking the growth of crystals at each interruption in order to avoid "treeing."

8. The herein described method of forming electro-deposited copper plates which consists in depositing copper in separate layers and in interdepositing relatively thin layers of nickel between the layers of the copper as described.

9. The herein described method of forming electro-deposited material which consists in depositing copper in separate layers and in interdepositing relatively thin layers of nickel at frequent intervals between the layers of copper as described.

10. An electro-deposited material consisting of alternate thin layers of nickel and thick layers of copper.

11. An electro-deposited material consisting of alternate layers of copper and nickel, the layers of nickel being relatively thin as compared to the layers of copper and located at frequent intervals throughout the thickness of the material.

12. An electro-deposited printing plate formed of a plurality of alternating layers of copper and nickel as and for the purpose set forth.

In testimony whereof I have affixed my signature.

GEORGE U. ROSE, JR.