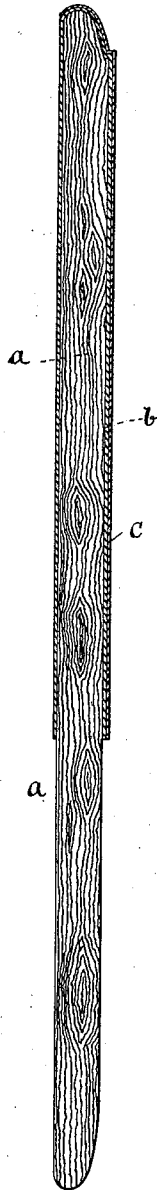


R. WAITZ.
Metallizing Fibrous, Cellular, and Porous Substances
No. 225,186. Patented Mar. 2, 1880.



Witnesses.
L. J. Connor.
M. E. Whitney.

Inventor.
Richard Waitz
by Crosby & Angory attys

UNITED STATES PATENT OFFICE.

RICHARD WAITZ, OF BOSTON, MASSACHUSETTS.

METALLIZING FIBROUS, CELLULAR, AND POROUS SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 225,186, dated March 2, 1880.

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To all whom it may concern:

Be it known that I, RICHARD WAITZ, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Metallizing Substances having a Fibrous, Cellular, or Porous Nature, of which the following description, in connection with the accompanying drawing, is a specification.

This invention relates to certain modes and processes of or for incorporating with organic, cellular, fibrous, or porous substances or coating or covering such substances with a metal, to thereby improve the durability of the said substances, lessen their liability to become decayed, increase their water-repellent qualities, and lessen their liability to be bored by worms, &c., in salt-water, and to make a suitable base whereby any of the said substances may be further coated with any metal capable of being applied by electroplating, which latter plating may be burnished or otherwise treated in any usual or well-known manner, to add to its beauty, &c.

The invention consists in a process of metallizing substances of a fibrous, cellular, or porous structure, by depositing in and upon the pores and fibers of said substances metals, (the baser as well as the noble metals,) in a more or less pure metallic state, from their compounds, by means of a salt of a metal having a greater affinity for the acid combined with the metals to be deposited than the latter have.

It also consists in a process of plating upon wood or similar substances of a fibrous, cellular, or porous structure adapted to receive a continuous coating of metal, by first metallizing said substances or depositing metal in a finely-divided state in and upon the pores and fibers thereof, and then depositing thereon a solid continuous coating of metal, which attaches itself firmly to the metal first deposited.

It further consists in wood or similar substance of fibrous, cellular, or porous structure having a firm continuous coating of metal upon its surface, and also having metal deposited or incorporated in the fibers and pores thereof and firmly united with the surface-coating.

The materials or bodies preferably used by me in connection with my invention, as here-

in described, are wood, paper, leather, or similar substances.

My invention for impregnating or coating any of these organic substances or bodies hereinbefore mentioned with a metal separated from its salt may be carried out or practiced in several ways, which, by experiment, I have found practicable to an eminent degree, and among which are the following, they being the best ways now known to me, viz: First, the organic fibrous, cellular, or porous body or material to be metallized may be coated with or be immersed in a solution of salt of one metal, (the desired metal,) and then in a solution of a salt of a different metal, care being taken to use in the first solution an acid which has more affinity for the second metal than for that with which it was first combined. The acid of the first solution will be taken up by the second, and the metal of the first solution will be left in or upon the fibrous, cellular, or porous substance or body treated, and the depth of penetration of the free metal so left into the body of the substance treated may be made more or less, according as the substance is treated or immersed in a vacuum-chamber, or under pressure, or aided by heat; or, second, the fibrous, cellular, or porous body to be treated may be immersed in a solution of a salt of one metal, and in water may be subjected to the action of a piece of metal which has more affinity for the mineral acid employed in creating the first salt of metal, where it will act to take the mineral acid from the said salt of metal, leaving upon or in the substance being treated free metal, which was a constituent of the salt of metal first applied. A solid continuous coating of metal is then applied by galvanic deposition or electrolysis, which coating attaches itself firmly to the metal first deposited.

I will exemplify, by a detailed statement, my method of proceeding, under one form of my invention, to impregnate or coat, say, the substance wood with metallic silver. The wood will be immersed in or brushed over with a solution of nitrate of silver, and, preferably after being dried, it will be coated with or immersed in a solution of sulphate of iron or chloride of tin, which sulphate or chloride will, by reason of its stronger affinity for

the nitric acid forming the nitrate of silver, leave the silver in a more or less pure metallic state upon the wood.

Under this first plan or mode of exemplifying my invention I am not aware of any salt of metal which, applied in the presence of a salt of zinc or iron, will reduce to metallic state either the zinc or iron from its solution.

Under the second exemplification of this invention I will suppose, as before, that the substance wood is to be coated with metallic silver. The wood will be treated, as before stated, with the nitrate-of-silver solution, and dried, after which it will, in water, be subjected to the presence of metallic zinc, iron, or copper, and, in consequence of the affinity of these last-mentioned metals for nitric acid, will leave the silver upon the wood in a more or less pure metallic state.

If wood is to be coated with metallic copper, the copper—say in the state of sulphate or nitrate—will be applied to the wood as before described, and dried, and in water be subjected to the presence of metallic zinc, tin, iron, lead, or nickel.

To coat wood with iron, the iron, in the form, say, of a sulphate, is applied to the wood, and is subjected in water to the presence of metallic zinc.

To coat wood with the metal tin, the tin, in the form, say, of a protochloride, is applied to the wood, and in water is subjected to the presence of metallic lead.

To coat wood with the metal lead, the lead—say as a sulphate or chloride—is applied to the wood, and in water is subjected to the presence of metallic iron.

To coat wood with the metal zinc; the said metal, in the form, say, of a sulphate or other salt of zinc, is applied to the wood as before described, and in water is subjected to the presence of metallic tin or lead.

To coat wood with the metal nickel, the nickel—say as either a sulphate or a chloride—is applied to the wood, and in water is subjected to the presence of metallic zinc.

To coat wood with the metal gold, the gold—say as a chloride—is applied to the wood, and in water is subjected to the presence of metallic tin, and, in fact, either of most of the metals.

As so far described, the specification has mentioned specifically the substance wood; but I will say that other fibrous, cellular, or porous substances, such as paper, cloth, leather, and even argillaceous compounds of a porous nature, may be treated in a like manner to coat them with metal.

The methods of impregnation may be various—as, for instance, if the substance admits of it, the metal salts may be introduced by mere immersion in the solution, or it may be aided by pressure; or any well-known mechanical means may be used for forcing the solution of the salt of metal desired into the pores, fibers, or cells of the substance being treated, either superficially or throughout, and the process,

the substance admitting it, may be aided by heat.

It will be noticed from the foregoing description that my invention does not consist, mainly, in any new chemical reaction. Any of the substances metallized as hereinbefore described may be plated with any other metal which, by usual well-known methods, may be formed by electroplating, a battery being employed or not, and the electroplated substance may be burnished or treated or finished in any way common to other electroplated wares.

In plating upon the metallized substance the metal is not deposited in spots here and there, but forms a solid continuous coating, which adheres strongly to the surface of the substance and attaches itself firmly to the metal deposited in the fibers or pores. A plating of any desired thickness may be secured.

It is evident that other means than those I have described may be used for metallizing the wood or similar substance before the application of the electro-deposit, although I regard those described as preferable. For example, the metallizing would be effected by dry hydrogen, a solution of a nitrate or sulphate of, say, tin, iron, zinc, copper, nickel, silver, gold, or platinum being applied, and, after drying, subjected to the action of the hydrogen in a receiver.

The metallization by the aid of dry hydrogen does not, however, in itself form a part of this invention, but only when employed in connection with the subsequent application by galvanic action or electrolysis of a solid continuous coating upon wood or similar substance, as before described.

The substances hereinbefore referred to, when metallized and subsequently electroplated, may be employed in various branches of the mechanic and industrial arts as a new material, which, though non-metallic, possesses metallic properties, and which is lighter in weight and cheaper to produce than if composed entirely of metal.

The special uses to which this new material may be employed are too numerous to be mentioned, and need not herein be specifically set forth.

In this my invention I do not aim to produce a double salt upon the wood, as would be the case if I should, for instance, treat the wood with a solution of chloride of zinc containing one pound of salt to seventy pints of water, and, after the wood was dried, apply to it a solution of perchloride of iron containing one-half pound of the salt in seventy pints of water; but my aim and object is to employ only such salts of metal as will, in the presence of other salts of metal, or metal itself, or other well-known chemical reagents, leave the metal of the first salt of metal in a more or less pure metallic state in or upon the material being treated, so that the said deposit so left will not be soluble in water.

In the drawing accompanying this specification I have shown a brush-handle, a, composed

of wood, the surface of which has been coated with metallic iron by separating the iron from the sulphate of iron in water and in the presence of metallic zinc, and which I then electroplated with copper, as at *b*, and subsequently nickel-plated, as at *c*.

Prior to my invention, J. P. Becker, in English Patent No. 1,274 for the year 1857, proposed to silver silk, wool, &c., and mentioned wood and many other substances of a fibrous or porous structure.

Becker described substantially the following process, viz: He proposed, first, to immerse the substance in a solution of gallic acid, after which the substance was to be allowed to drain or dry; second, the substance was then dipped for a second in a solution of twenty parts of nitrate of silver in one thousand parts of distilled water, and this alternate dipping into the two fluids and draining was to be continued until the blackened appearance of the material was followed by a light silver tinge, when the substance was to be immersed in a compound fluid, as follows: first, caustic lime, grape-sugar, and racemic acid, (or, instead of racemic acid, carbonic oxide of soda or potassium or gallic acid,) and distilled water; and, second, nitrate of silver, liquid ammonia, and distilled water, the two fluids before use being thoroughly mixed and filtered, and then it was proposed to boil the said substances being silvered in a solution of salts of tartar and water.

The said Becker process differs materially from my process, and would not permit the surface or body of the substance being treated to be impregnated by the metal of the metallic salt. It would fail to produce an adherent or

continuous metallized surface, or such a metallized surface as could be practically electroplated.

I claim—

1. The process of metallizing substances of a fibrous, cellular, or porous structure, which consists in impregnating or coating the substance with a salt of the desired metal, and then depositing the latter in a metallic state (more or less pure) in and upon the pores and fibers by means of a metal or salt of a metal, substantially as described.

2. The process of plating upon wood or similar substance of a fibrous, cellular, or porous structure adapted to receive a continuous coating of metal, which consists in first depositing metal, in a finely-divided state, in and upon the pores and fibers of the substance to be plated, and then depositing thereon, by galvanic action or electrolysis, a solid continuous coating of metal, which attaches itself firmly to the metal first deposited, substantially as described.

3. Wood or similar substance of fibrous, cellular, or porous structure having a firm continuous coating of metal upon its surface, and also having metal deposited in the fibers and pores thereof and united firmly with the surface-coating, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RICHARD WAITZ.

Witnesses:

G. W. GREGORY,
N. E. WHITNEY