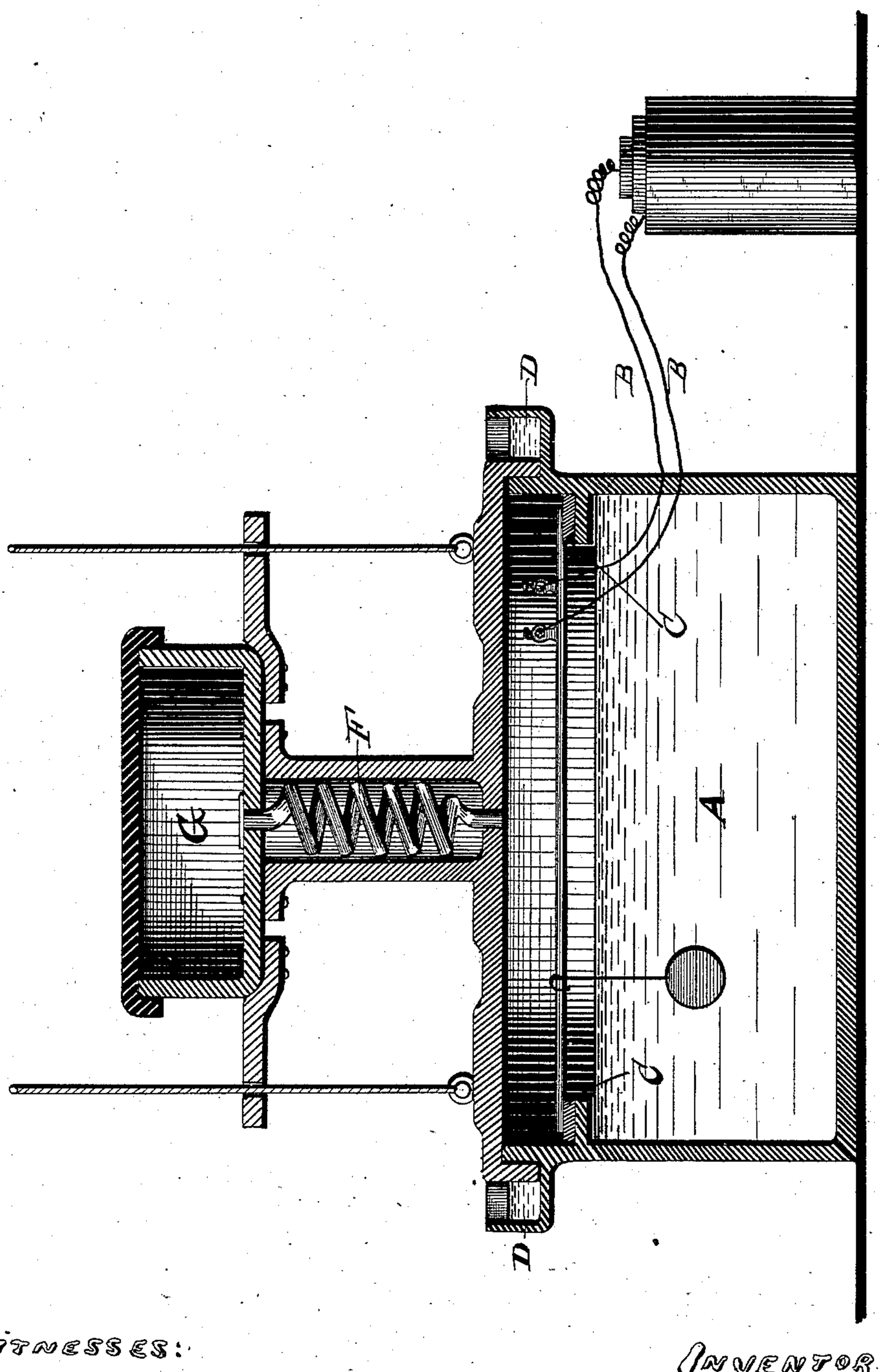
(No Model.)

W. H. WALENN.

PROCESS OF AND APPARATUS FOR ELECTRO DEPOSITING COPPER, BRASS, &c.

No. 300,035. Patented June 10, 1884.



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UNITED STATES PATENT OFFICE.

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PROCESS OF AND APPARATUS FOR ELECTRO-DEPOSITING COPPER, BRASS, &c.

SPECIFICATION forming part of Letters Patent No. 300,035, dated June 10, 1884.

Application filed November 8, 1883. (No model.) Patented in England April 4, 1882, No. 1,639.

To all whom it may concern:

Be it known that I, WILLIAM H. WALENN, of Islington, in the county of Middlesex, England, civil engineer and electrician, have invented certain new and useful Improvements in the Process of and Apparatus for Electro-Depositing Copper, Brass, Bronze, and other Metals and Alloys, whereby said metals and alloys are deposited in a homogeneous, soft, and ductile condition, perfectly adherent to the metal beneath, and capable of being worked, shaped, and hammered without separating or injuring the coating or exposing the metal beneath.

The solvent solution containing cyanide of potassium, neutral tartrate of ammonia, and ammonio cupric oxide is rendered fixed and constant under continued boiling, waste by evaporation is avoided, the evolution of gas from the cathodes during deposition is entirely stopped, and the electro-motive force required is very materially reduced. Parts of this invention are applicable to other purposes; and I hereby declare that the following is a full, clear, and exact description of the same.

The first part of my said invention relates to electro-depositing copper, brass, bronze, and other metals and alloys upon iron, zinc, and other electro-positive metals, so that the deposit is rendered soft, ductile, and inseparably adherent to the metal beneath. The solution employed is preferably composed of thirty-two ounces avoirdupois of cyanide of potassium, (seventy per cent. of real cyanide,) and one ounce of neutral tartrate of ammonium in each imperial gallon of liquid. It is then charged with the metal or alloy to be deposited by electrolytic means—that is, by subjecting it to the action of a strong electric current by means of a large dissolving plate or anode, and a wire or small receiving plate or cathode, until about three ounces per gallon of the metal or alloy is dissolved, or near that amount. The solution is then made complete by adding cupric ammonide, otherwise termed "ammonio cupric oxide," as hereinafter described. According to the present invention, the solution is to be used at a boiling temperature, or as near thereto as it is possible to keep it—say from 190° Fahrenheit to the boiling-point of the solution, whether it be under pressure or not. The effect of heat upon the solution is to soften the deposit and very materially increase the rapidity of the deposit.

The second part of this invention relates to adjusting the solution exactly to produce the results desired—that is, to stop the evolution of gas from the cathode during deposition; to prevent the giving off of free ammonia by the high temperature employed, and to produce a soft, ductile, and adherent deposit that will bear stamping or other manipulation without injury. This is effected by adding ammonio cupric oxide, or "cupric ammonide," as it is more generally termed, until the solution becomes slightly green in color, or until a working-test shows that the proper quantity has been added. About twelve fluid ounces per gallon of cupric ammonide of specific gavity .960, may be stated as approximately the amount required; but practically it is not possible to state a precise numerical quantity, as it depends upon the quality of the cyanide employed, the amount of metal or alloy thrown in by electrolysis, the amount of free cyanide in the solution, and the amount of cupric oxide contained in a given quantity of the cupric ammonide. These values are constantly changing, and it is not easy to determine the quantity to be added. When the proper amount has been thrown in, the solution becomes stable and constant under a high temperature, gas ceases to be evolved from the cathode during deposition, ammonia is no longer given off, and the coating deposited presents the qualities which are characteristic of my present invention and peculiar to my improved process. The cupric ammonide is prepared by dissolving cupric oxide in strong water of ammonia of the specific gravity .880 to saturation. It is, however, extensively used in the arts in England, and I have found no difficulty in purchasing it in large quantities. In preparing it, I prefer to use the brown-black deposit, formed by boiling the precipitate thrown down by caustic potassa from a solution of sulphate of copper. This solution so treated can be worked with one cell of Smee's battery, in place of six or more, heretofore used, and the relative areas of the anode and cathode

may be equal. The result is a soft adherent coating even on porous cast-iron, which will not result from any cold solution. A copper coating from this heated solution upon thin iron plates is so adhesive and ductile that they may be stamped in any shape, or repoussé-work may be executed on them without injuring the coating or the exposure of the metal beneath, and they may be hammered to destruction without separating the coating from the coated metal. The preparation of these plates by this process for the market forms a prominent feature of this invention.

According to this invention the above solution is worked in a closed vessel under a known pressure, the pressure being produced by heating the solution or otherwise. The pressure may be regulated by any known means—as, for instance, an ordinary safety-valve and pressure-gage. A high pressure is not recommended. A single atmosphere will, in general, be found to be more than sufficient; but the inventor reserves to himself the right to use any pressure that may be found convenient. This method presents substantial advantages in working this or other solutions, especially those which contain volatile ingredients or are heated. Waste by evaporation is prevented, and the deposit is rendered compact, of uniform thickness over the entire surface of the cathode, and of uniform quality throughout. The working of electro-depositing solutions at or near the boiling-point produces valuable results, and the discovery that cupric ammonide in proper proportion will enable ammonio-cyanide solutions to bear boiling without decomposition is most important. Its application is capable of being very much extended and of producing results long sought but never hitherto obtained.

The third part of my invention relates to the method of applying heat and pressure and the apparatus designed by me for the purpose. This is illustrated by the accompanying drawing, which forms a part of this specification. It is a sectional elevation of the depositing-tank and its appurtenances. The tank A may be made of any suitable material and of any size which may be deemed convenient. The conducting-wires B pass through into the tank, but are insulated from it and connect the solution with the source of electricity. All rods or wires used for suspending anodes or cathodes have their bearing upon slabs C of non-conducting material supported upon inside shelves. The tank is closed by a counterbalanced cover, E, dipping into a water-seal, D, and being provided with slinging chains and pulleys to remove and replace it. A condensing-worm tube, F, is inclosed in a larger tube, F′, which extends upward from the top of the cover. The condensing-worm tube connects with an aperture in the cover at its lower end, and its upper end opens into a box or vessel, G, supported on flanges *a* at the upper end of the large tube F′. The box or vessel is intended to contain suitable materials for condensing, absorbing, or combining with the gases or vapors evolved, and the liquid produced by such condensation or absorption flows back down the worm-tube into the tank.

Having thus described my invention, what I claim is—

1. The electro-depositing solution herein described, consisting of cyanide of potassium and neutral tartrate of ammonium in the proportion of thirty-two ounces of the former and one ounce of the latter, charged by electrolysis with the metal or alloy to be deposited, and perfected by the addition of cupric ammonide, substantially in the proportions and for the purpose described.

2. The herein-described process of electro-depositing metals and alloys by subjecting them to the action of an electro-depositing solution in a closed vessel under a pressure exceeding that of the atmosphere at a temperature of from 190° Fahrenheit up to the boiling-point of the solution, substantially as and for the purpose set forth.

3. The depositing-tank A, having cathode-supporting shelves provided with slabs of non-conducting material and dipping into a water-seal, a counterbalanced cover having an upwardly-extending tube, a condensing box or vessel at the upper end of said tube, and a condensing-worm forming a connection between said condensing-box and the tank A, substantially as and for purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM HENRY WALENN.

Witnesses:

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