

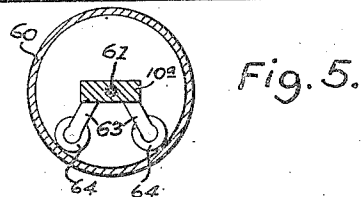
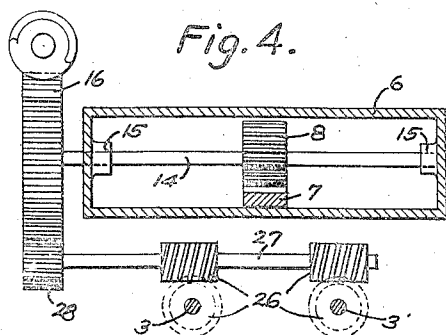
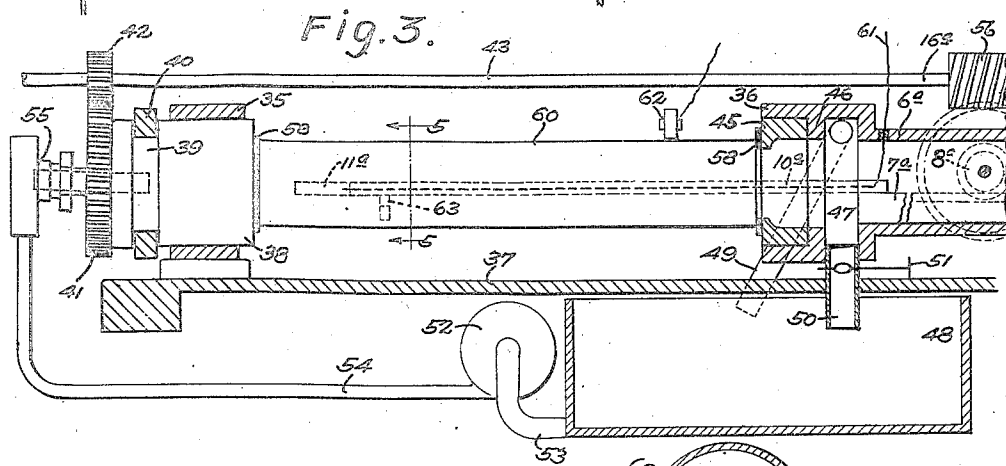
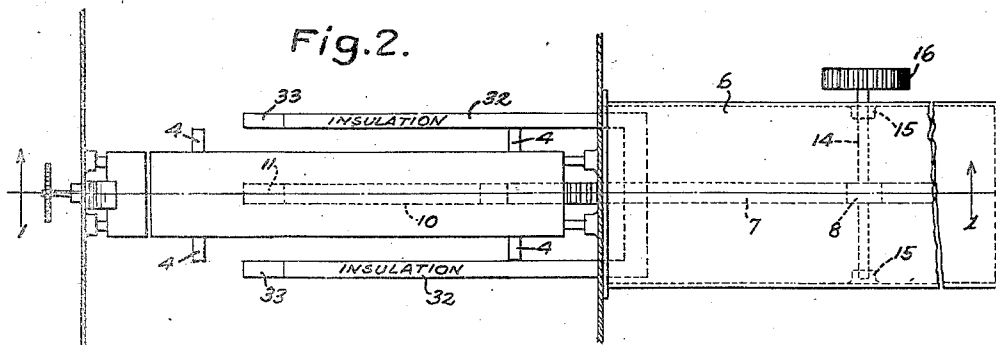
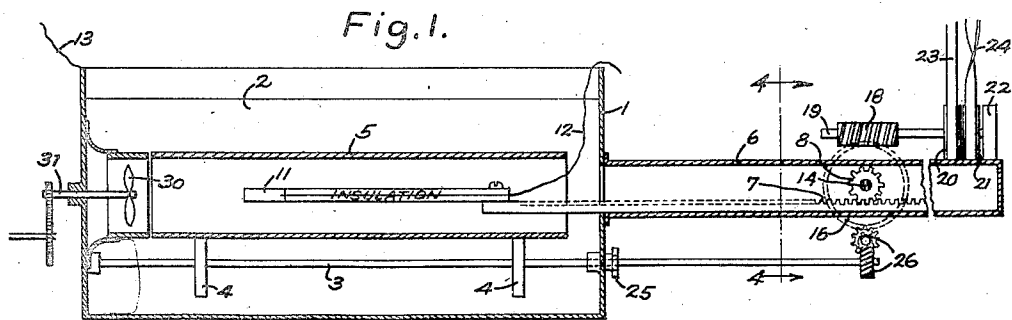
Oct. 29, 1929.

F. A. FAHRENWALD

1,733,404

PROCESS AND APPARATUS FOR ELECTROPLATING TUBES

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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR ELECTROPLATING TUBES

Application filed March 15, 1926. Serial No. 94,721.

This invention relates to the electroplating of tubes and pipes and has for its object the provision of a process and apparatus whereby the interior of such articles can be electroplated rapidly, uniformly, and reliably. It is easy to electroplate flat articles and the exterior of tubes but hollow articles cannot successfully be plated by customary means, although tubes with an interior protective plating (of cadmium, zinc, chromium, etc.) would be extremely valuable in many industries, such as the oil industry for handling corrosive liquids which now require either a frequent renewal of apparatus or the employment of expensive alloys for the entire construction.

In the accompanying drawings I have shown certain apparatus whereby my improved process may be rapidly and convincingly performed, but while such apparatus is claimed as my invention and as being novel, useful, and valuable in itself, it will be understood that the process herein described can also be performed by the use of many other types of apparatus, and that many changes in the apparatus can be made.

Fig. 1 is a vertical sectional view through a plating tank corresponding to the line 1—1 of Fig. 2; Fig. 2 is a top plan view of the parts shown in Fig. 1; Fig. 3 is a sectional view of another type of apparatus for the performance of my process; Fig. 4 is a section on the line 4—4 of Fig. 1; while Fig. 5 is a section on the line 5—5 of Fig. 3.

For the successful performance of my invention it is essential that the exposed surface of the anode be very substantially less than that of the tube which constitutes the cathode, and that relative movement in an axial direction occur between the anode and cathode, also that the anode be accurately centered in the tube, at least on the average. The last named requirement is most easily met by a relative rotation of the two electrodes whereby any amount of eccentricity is averaged out and the best results are generally obtained by rotating the tube about its axis, although both members can be rotated provided only that an algebraic speed difference occur. It is also very desirable that a continuous forced

circulation of electrolyte be maintained, especially in case the anode be made of an insoluble substance and the strength of the solution be otherwise maintained.

One apparatus for performing my improved process is shown in Figs. 1 and 2 wherein 1 denotes a tank containing an electrolyte 2 and having submerged therein two parallel horizontal rotatable shafts 3, 3, provided with spaced rollers 4, 4 adapted to receive and support the tube 5 to be plated. Projecting horizontally from the side wall of the tank is a hollow, liquid-tight extension 6 in which is mounted a reciprocable rack 7 meshing with a pinion 8. Secured to one end of this rack is a bar 10 of insulating material adapted to enter the tube 5 and secured to the further end of this bar is an anode 11 which is substantially smaller and shorter than the tube. Current is conveyed to the anode by a conductor 12 carefully insulated from the liquid (it generally is best to run it through the bar 10 though this is not imperative) and current is conveyed from the tube in any convenient manner even by way of the tank walls and conductor 13.

The pinion 8 is carried by a shaft 14 journaled in bearings 15 in the side walls of the extension 6, and provided with a gear 16. This gear is here shown as meshing with a worm 18 carried by a shaft 19 provided with fast and loose pulleys 20, 21, 22 cooperating with straight and twisted belts 23, 24, so as to be rotated in one or the other direction. The shafts 3, 3 are shown as traversing the tank wall via packing glands 25 and geared to the gear 16 by way of the spiral gears 26, lay shaft 27 and pinion 28. At the opposite end of the tube 5 is a propeller 30 driven by a shaft 31 in the tank wall for propelling the electrolyte through the tube.

Generally the best plan is to make the anode 11 of the metal with which the tube is to be plated, although it is within my invention to make it of some insoluble substance, e. g. carbon, and maintain the concentration of the bath by the addition of ingredients at another point. It is best to move the anode rather slowly and to rotate more rapidly. It makes no difference whether the deposition

occurs while the anode is being advanced or during its retraction. Removal of a finished tube and insertion of another to be plated must occur while the anode is retracted and it is often most convenient to plate during the entire period of advance and retraction, especially when the advance and retraction occur at equal speed. If desired the exterior of the tube can be plated at the same time. This can, obviously be performed with a stationary electrode, or it can be done as illustrated in Fig. 2 wherein the rack is provided with two arms 32, of insulating material projecting along the exterior of the tube, one at each side and having anodes 33, at their ends.

In case it be not necessary to plate the outside of the tube and especially in case the tubes to be plated be uniform in length and size, the apparatus shown in Fig. 3 can be used. Two spaced coaxial bearings 35 and 36 are carried by a base 37. Rotatably and slidably mounted in the bearing 35 is a hollow cylindrical headblock 38, provided with a groove 39 and ring 40 by which it can be advanced and retracted and with a gear 41 meshing with a pinion 42 on the drive shaft 43. Journaled in the bearing 36 is a cylindrical tail-block, 45, but this is not slidable, being bottomed against a flange 46. Beyond the flange 46 is a chamber 47 from which two pipes lead to a reservoir 48, one pipe 49 communicating with the top of the chamber and the other pipe, 50, with the bottom thereof, the latter having a valve 51 therein. A pump 52 has its intake 53 connected with the bottom of the reservoir and its discharge 54 connected to the head block 38 through the swivel joint 55.

Beyond the chamber 47 is an extension 6^a having a rack 7^a and pinion 8^a therein, the rack carrying a bar 10^a of insulating material having at its end an anode 11^a. The pinion is connected to a worm gear 16^a driven from the shaft 43 by a worm 56.

The faces of the head and tail blocks are provided with rubber washers 58 which make tight contact with a tube 60 clamped between them. The valve 51 being closed and the pump 52 operated the tube becomes filled with plating solution from the reservoir 48 and current is passed through it from the wire 61 through the bar 10^a to the anode 11^a and from the tube by a rolling contact 62 thereon. The continued operation of the pump causes electrolyte continuously to overflow through the pipe 49, and when it is desired to remove the tube the anode is withdrawn, the pump stopped, the valve 51 opened, and the head-block 38 retracted. In order to help support the anode bar it may be provided with arms 63 having rollers 64 which engage the tube walls.

While I have described the electrode 11 as anode, I do not thereby limit myself against such temporary or periodic reversals of po-

larity as may be desirable for the purpose of degasifying the surface to be plated.

It will be understood that the mechanical arrangements herein shown and described are intended to illustrate the principles of my invention rather than to limit me to details and that I acknowledge no limitations except those of the prior art.

Having thus described my invention what I claim is:

1. The process of electroplating the interior of a tube which contains the step of electrolyzing a solution of plating metal in contact with the entire tube interior as cathode, and simultaneously impressing upon the tube and anode two independent movements, one a gradual axial movement of one relatively to the other and the other a gradual movement of rotation of the tube around the anode.

2. In the process of electroplating the interior of a tube the steps which consists of electrolyzing a plating liquid between the entire tube interior as cathode and an anode which is short as compared with the length of the tube, moving the anode gradually through the tube during the electrolysis, and meanwhile producing a gradual relative rotation between the tube and anode about the tube axis.

3. Apparatus for electroplating the interior of tubes comprising, in combination, means for supporting a tube, an anode, means supporting said anode in line with the interior of a tube supported by said first means, said anode being smaller and shorter than said tube, means for supporting a plating solution in contact with the tube interior, means for impressing a difference of electrical potential upon said tube and anode, and means for producing relative circumferential and longitudinal movement between said tube and anode during the plating operation.

4. Apparatus for electroplating the interior of a tube comprising, in combination, means for supporting a tube and rotating it about its axis, an anode smaller and shorter than the tube, means for supporting said anode and for producing relative lengthwise movement between the tube and anode along the axis of the tube, means for confining a plating solution in contact with said tube and anode, and means for impressing a difference of electrical potential upon said tube and anode.

5. The process of electro-plating the interior of a tube which contains the steps of continuously passing a moving stream of plating solution through such tube in contact with the walls thereof and simultaneously electrolyzing such solution between such tube as cathode and an anode which is short as compared with the length of the tube, and moving such anode gradually through the tube during such electrolysis while producing a relative

rotation between the tube and anode about the tube axis.

6. In the process of electro-plating the interior of a tube, the steps which consist of filling the tube completely with a plating liquid and electrolyzing such liquid between the tube interior as cathode and an anode which is short as compared with the length of the tube, moving the anode gradually through the tube during the electrolysis, and meanwhile producing a relative rotation between the tube and anode about the tube axis and a progressive movement of the plating liquid through the tube.

15 In testimony whereof I hereunto affix my signature.

FRANK A. FAHRENWALD.

CERTIFICATE OF CORRECTION.

Patent No. 1,733,404.

Granted October 29, 1929, to

FRANK A. FAHRENWALD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 86, claim 2, for the word "consists" read "consist"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of December, A. D. 1929.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)