April 1, 1941. E. G. WIDELL 2,236,861

CATAPHORETIC COATING APPARATUS

Filed Jan. 29, 1938

Fig. 1

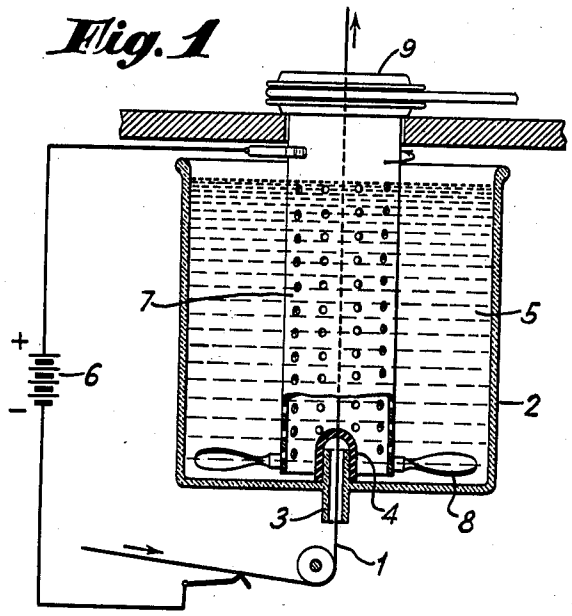
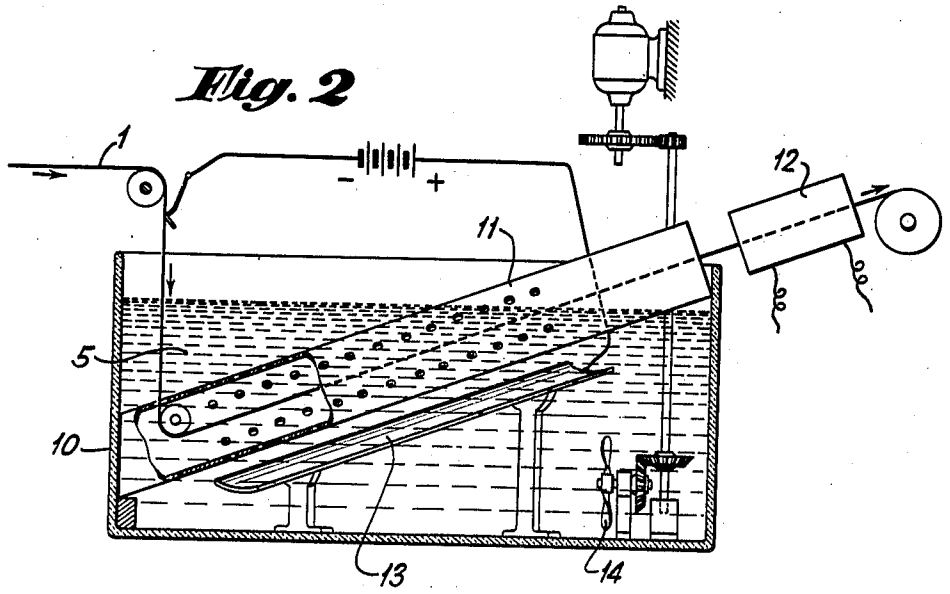


Fig. 2



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CATAPHORETIC COATING APPARATUS

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Application January 29, 1938, Serial No. 187,632

1 Claim. (Cl. 204—300)

My invention relates to means for cataphoretically coating metal, particularly apparatus for depositing electron emissive compounds on cathodes.

Electron emitting material may be cataphoretically deposited on a metal cathode core by dispersing finely divided particles of the material, such as barium carbonates, in a suspending medium from which the charged particles may migrate to the core. For rapid deposition of a smooth adherent coating on the core the particles should be crystalline and larger than colloidal particles. Crystalline particles tend to settle, which makes uniform coating of cathodes difficult in continuous factory production. Stirring or agitating the suspension to prevent settling of the particles produces convection currents in the solution which cause the coating to be uneven.

An object of my invention is to provide cataphoretic coating apparatus which may be used in continuous factory production for uniformly coating large quantities of cathodes, and which is easy and inexpensive to operate.

A better understanding of my invention may be obtained by referring to the description of preferred embodiments in the following specification and accompanying drawing in which Figures 1 and 2 show means for stirring the suspension of coating material and for depositing the material on cathode cores.

The apparatus shown for purposes of illustration in Figure 1 for continuously coating a cathode wire 1 comprises a container 2, preferably of glass or non-metallic walls, with a tubulation 3 in the bottom of the container. The tubulation is closed at its inner end by a rubber nipple 4 having a small opening in which the cathode wire fits liquid-tight and through which strip metal such as wire is drawn upwardly through the suspension 5 containing in the desired concentration the particles of coating material, such as barium-strontium carbonates. The negative terminal of a source of voltage 6 is connected through a sliding contact to the moving wire and its positive terminal is connected to a perforated hollow cylinder 7, concentric with the wire and preferably of metal such as nickel to function as an anode. A negative potential on the cathode causes the positively charged particles to migrate to the cathode where they deposit in a smooth adherent coating. From the solution the wire is preferably drawn through a furnace to dry the coating, and then reeled on a spool.

For stirring the solution to keep the particles of coating material uniformly distributed through the suspension and for preventing convection currents in the suspension adjacent the wire, I provide according to my invention stirring paddles or fins 8 near the bottom of the container and exterior to the perforated cylinder. The fins are driven at the speed necessary to properly agitate the solution and may conveniently be attached to the lower end of the cylinder, which is journalled at its upper end and connected to a driving pulley.

With this apparatus a tungsten wire .0005 inch in diameter has been coated with .001 inch layer of barium-strontium carbonates by moving the wire at the rate of 25 feet per minute vertically through a methanol suspension 3 inches deep containing 5 grams of barium-strontium carbonates per 100 cubic centimeters, ground to a particle size of about 5 microns. The cylindrical anode was about 1 inch in diameter and uniformly perforated with one-eighth inch holes. A potential of about 25 volts was applied between the anode and wire, and the layer or coating was smooth, adherent and even.

The cylinder with small perforations throughout its length prevents the generation of disturbing eddy currents immediately surrounding the wire and yet at the same time permits the migration of carbonate particles through the perforations to the wire. Even mass rotational movement of the body of liquid within the perforated cylinder will not disturb electron material deposited on the wire because the velocity of the solution is substantially zero at the wire located along the center of rotation of the cylinder. The concentration of the material in the suspending solution, because of stirring, is uniform throughout the solution, insuring uniform deposition of the particles on the wire. While the perforated cylinder in Figure 1 has been described as of nickel and connected as the anode for cataphoretically coating wire 1, the cylinder may, if desired, be non-metallic, of "Bakelite," for example. When a non-metallic perforated cylinder is used, an anode may be placed inside or outside the cylinder, and this anode may be cylindrical, concentric with the wire and perforated like cylinder 7, or it obviously may be one or more metal rods parallel with the wire.

The wire to be coated may, if desired, be moved horizontally through the suspending solution as shown in Figure 2 with the wire drawn into and out of the surface of the solution to obviate the necessity of a liquid-tight bushing below the

surface level of the solution. Wire 1 is drawn from a reel over an idling pulley downward into the suspension 5 in tank 10 to a second idling pulley positioned at the center of perforated cylinder 11. The wire is drawn centrally through the cylinder, slightly inclined with its right hand end above the level of the liquid, and through an electrically heated drying furnace 12 on to a reel. One terminal of battery 6 is electrically connected to the wire and the other terminal may be connected to cylinder 11, if metal, or to anode 13 mounted parallel to the wire. The particles in suspension are continuously agitated by the motor driven propeller 14 to distribute them uniformly through the suspension inside and outside the perforated cylinder so that the particles are evenly deposited on the wire as it moves longitudinally along the center of the cylinder. As in Figure 1 the small perforations in the cylinder 11 prevent the generation of convection currents immediately surrounding the wire and at the same time permit the migration of the particles through the perforations to the wire.

My improved device for cataphoretically coating cathodes with a layer of electron emissive material is particularly useful in continuous factory production for rapidly coating large quantities of cathodes with a smooth and uniform coating of electron emissive material, and is easy and inexpensive to operate.

I claim:

Apparatus for cataphoretically coating a wire with a material comprising a liquid container for holding particles of said material in suspension, a perforated metal cylinder journalled to rotate about a vertical line in said container with the lower end of the cylinder adjacent the bottom of the container, stirring fins attached to the exterior lower end of said cylinder for agitating the liquid in the container, means for rotating said cylinder and attached fins, a liquid-tight bushing in the bottom of said container, and means for drawing said wire through said bushing and upward along said center line of the cylinder.

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