PUBLISHED
MAY 11, 1943.
BY A. P. C.

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METHOD OF PRODUCING METALLIC COATINGS

Filed May 27, 1939

Serial No.
276,257

Fig. 1

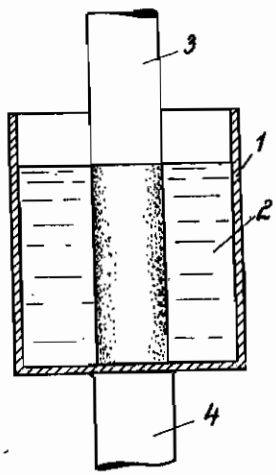


Fig. 2

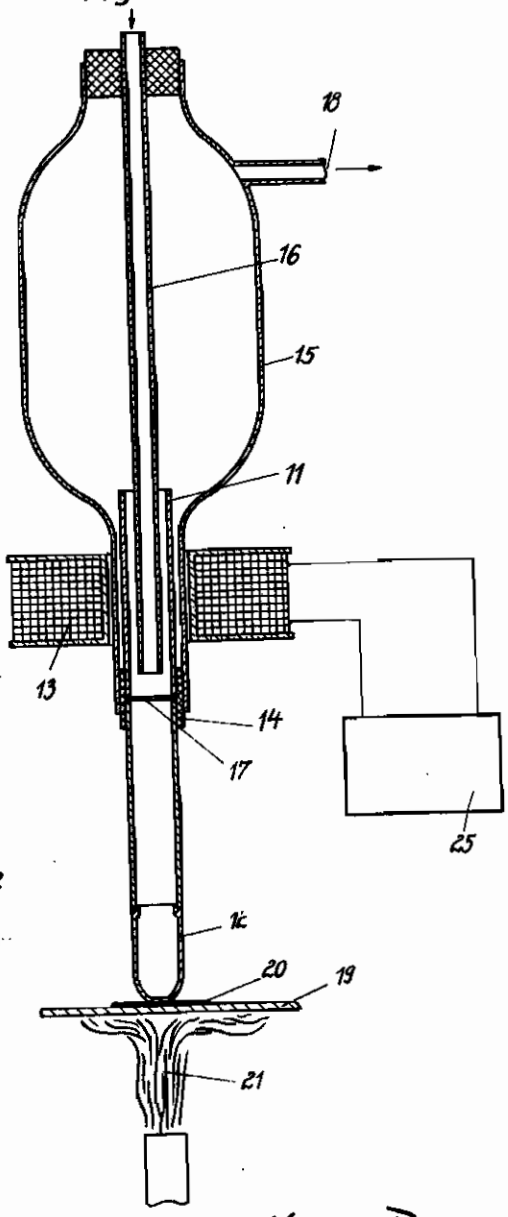
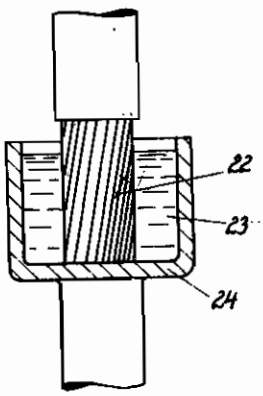


Fig. 3



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Published May 11, 1943 Serial No. 276,257

ALIEN PROPERTY CUSTODIAN

METHOD OF PRODUCING METALLIC COATINGS

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Application filed May 27, 1939

This invention relates to a method of producing metallic coatings on bodies consisting of any materials. The object of the invention is to provide a metal support with an adhesive metallic coating. In the case of bodies made of different materials it has hitherto not been possible to provide them with surface layers consisting of any desired metal, since the metals do not always adhere in a uniform manner but in some cases only to a slight extent or not at all depending upon the nature of the body to be provided with the coating. This fact makes it difficult, for instance, to produce soldered joints between bodies consisting of certain metals to which the layer adheres only to a very slight extent.

The invention provides means, whereby the production of adhesive metallic coatings on any desired bodies is made possible for different purposes; for instance, for the production of soldered joints. According to the invention the bodies to be provided with a coating are immersed in molten metal and set in rapid mechanical vibrations. It has been found that also very good adhesive coatings may be produced when using bodies and coating metals with which it has hitherto been impossible to produce adhesive coatings. The effect of the method is due to the fact that the surface of the bodies is rendered to a considerable extent absorptive with respect to the coating metal by causing with the aid of mechanical vibrations a separation of the surface oxide layer from the metal bodies or in the case of insulating bodies a removal of the particles which cover the pores of the insulating bodies, as well as to other phenomena which have not yet been sufficiently explained.

Fig. 1 shows one form of the invention for carrying out the above method, and discloses an arrangement, whereby it is possible to provide, for instance, an insulating body with a metallic surface coating.

In a vessel 1 made of metal is contained the molten metal 2. The insulating rod 3 is immersed in a bath to such an extent as to touch the bottom of the vessel. The latter is set in rapid mechanical vibrations through a support 4 secured thereto. In this case a compact and good adhesive metallic coating which withstands also high mechanical and thermal stresses is produced on the insulating body. Of course, it is not necessary as shown in Fig. 1 to set the rod 3 in vibration by means of the vessel 1; the rod may be clamped in a suitable gripping device through which the mechanical oscillations may be imparted to the rod. Depending upon the circumstances, particularly as regards the shape of the body to be coated, the expansion of the surface thereof and the resistance of the body preference is given to the one or the other method.

As already above mentioned, the method according to the invention may also be employed to a great advantage for the production of soldered joints between bodies of any desired metals, particularly of easily oxidizable metals. In these bodies it has hitherto been always difficult or impossible to produce resistant soldered joints, since there is always a more or less fine oxide layer on the surface of the body, preventing the solder from adhering to the surface. However, if the joint of the bodies is set in rapid mechanical vibrations as this is the case with the method according to the invention, then the fine film of oxide is separated from the surface of the body so that the solder may come into direct contact with the metallic surface of the body and firmly adhere thereto.

The novel method is adapted for use in the production of soldered joints for various metals and alloys; thus, for instance, for soldering aluminum in an advantageous manner, which has been hitherto only possible by the use of expensive special solders. The method may also be employed to advantage for soldering aluminum alloys, iron alloys, as well as highly refractory metals.

The mechanical vibrations may be imparted to the bodies to be soldered in different ways. It is particularly advantageous to set any body, for instance, a tube in vibration and to bear the body to be soldered during the soldering process or during the application of the solder to its surface against the tube so as to impart the vibrations of the tube to the body to be soldered. This may be accomplished, for instance, by the arrangement shown in Fig. 2.

In this figure 11 denotes a nickel tube, to the lower end of which is hard-soldered a copper extension tube 12 closed at the lower end thereof. A solenoid 13 energized by high-frequency currents supplied by a high-frequency transmitting device 25 is arranged near the upper end of the nickel tube 11. By the action of the solenoid 13 the tube 11 together with its extension 12 is set in mechanical vibrations. The upper portion of the nickel tube is cooled in order to dissipate the heat developed by the magnetic losses. To this end, a glass body 15 is placed over the tube 11, a glass tube 16 of a smaller diameter being inserted in the tube 11. Between the neck

of the glass body 15 and the tube 11 is arranged a rubber ring 14. The tube 11 is closed at the lower end thereof by a nickel plate 17. The cooling water passes into the nickel tube 11 through the upper opening of the tube 16, reverses its direction of flow at the plate 17 and flows through the hollow space of the glass vessel 15 and through the connecting branch 18 back into the water cooling system (under circumstances to the re-cooling system).

19 denotes an aluminum sheet, a portion of which is provided with a tin coating 20 in order to unite it with another aluminum part or a body of another metal. The coating is applied to the aluminum sheet in the following manner:

Heat is applied to the aluminum sheet, for instance, by means of a Bunsen burner 21 and the sheet upon further application of heat is then pressed against the rounded-off end of the copper tubular extension 12 which is as already mentioned set in mechanical vibrations. At the same time, the solder is applied to the surface of the aluminum sheet 19 and distributed over the portion of the surface to be coated therewith by means of the tubular extension 12, heat being continuously applied thereto. This is continued until a uniform coating of the solder is produced.

Of course, the soldering process may also be effected with the aid of the usual soldering copper. In this case, the parts to be soldered are so pressed against the vibrating tube that the vibrations are imparted to the parts to be soldered in a reliable manner. The joint is treated as usual with the soldering copper, it being always essential that the parts at the joint be set in mechanical vibrations. In the embodiment shown the soldering copper may be approached to the joint to be soldered laterally of the arrangement. However, the entire arrangement may also be operated in the inverted position so that the tubular extension 12 points in the upward direction; the soldering may then be effected from above by means of the soldering copper.

It is also possible to insert the solder between the two parts to be united, to press the two parts against the vibrating tubular extension and to apply heat thereto. In this manner very durable joints may be obtained.

The method according to the invention may also be employed in coating wires or bundles of wires with tin, for instance, in the manufacture of cable terminals. In this case, as shown in Fig. 3, the wires 22 are immersed in a container 24 filled with molten tin 23, the container being set in vibrations as described above.

The vibrations are then transmitted from the container to the molten solder and then to the wires to be coated. To impart the vibrations from the container to the wires in a more effective manner, it is preferable to press the wires when immersing them in the molten solder against any point of the vibrating container; for instance, against the bottom.

Of course, it is also possible to set the wires in mechanical vibrations by securing them, for instance, in a tube or to another metal support which vibrates. If another aluminum sheet is to be soldered to the aluminum sheet 19 it may be treated in the same manner, and the coated surface portions may be arranged one upon the other and united with one another by the application of heat.

Depending upon the thickness of the material of the parts to be united, the most favorable action may be obtained with the aid of different frequencies of the mechanical vibrations. In the case of mass production, for which the method according to the invention is very suitable the most favorable frequency may be adjusted, for instance, for a number of work pieces with respect to a reference test piece and the individual pieces may be soldered one after the other. In general, the most favorable frequencies do not lie as numerous tests have shown within the range of the audible frequencies, which is an advantage, since the soldering devices operate noiselessly.

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