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APPARATUS FOR CONTINUOUS ANODIZING OF SHEET METAL

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*Fig. 1.*

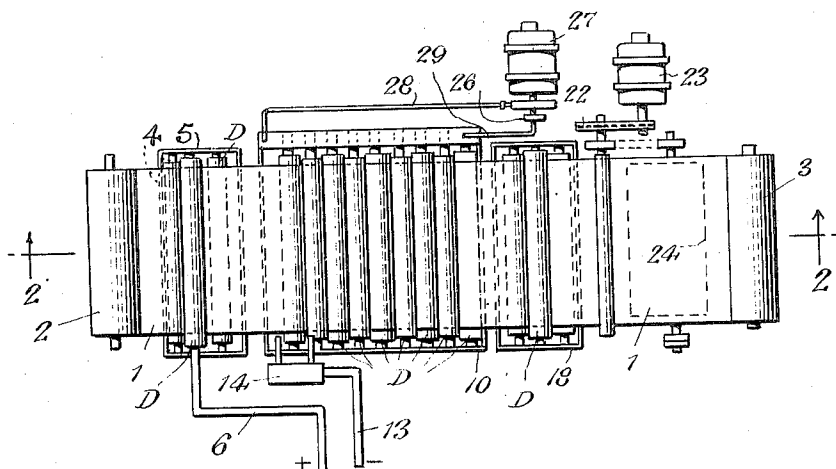
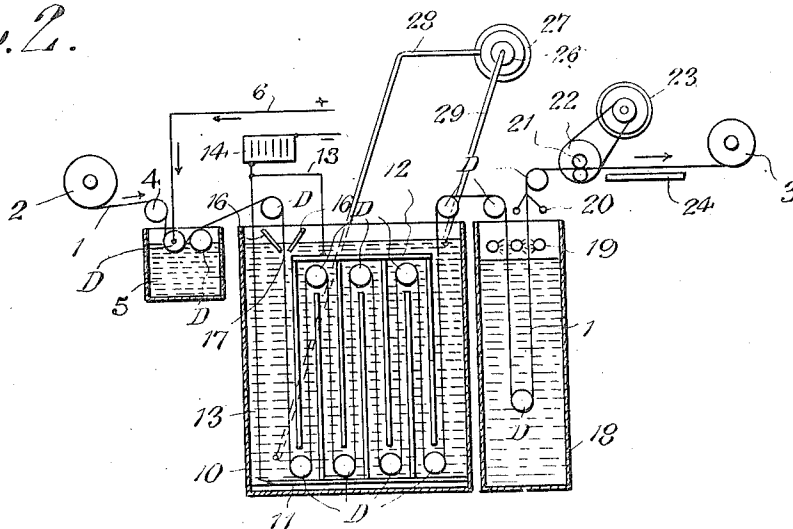


*Fig. 2.*



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APPARATUS FOR CONTINUOUS ANODIZING  
OF SHEET METALJames F. Mason and Frederick H. Hesch, Glen  
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1 Claim. (Cl. 204—206)

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This invention relates to the anodizing of aluminum and has for its object the provision of an improved apparatus for carrying out this operation. The invention provides a continuous operation for the anodizing of more or less indefinite lengths of aluminum foil or sheets and is applicable to the treatment of metal in varying thicknesses from the thinnest foil capable of being handled and of carrying the required current, to fairly thick sheets, provided they are not too thick to pass around pulleys and rolls without undue deformation. Herein, for purposes of convenience, we shall refer to all forms of metal foil and sheets simply as "sheet" material. In the continuous method of the invention, a sheet of aluminum of indefinite length from a stock roll or the like is rendered anodic over an appreciable length while passing through an anodizing bath.

In accordance with the invention, a clean, preferably dry, sheet of aluminum is passed continuously over an electrical contact to be rendered anodic and then into and through an anodizing electrolyte after which it is washed and wound into a finished roll. In one important aspect of the invention, the sheet of aluminum is passed into the anodizing solution at a place where it is electrically isolated from the cathode and there is no appreciable oxidizing action at the surface. We have found that the passing of an anodic sheet of aluminum through the surface of an anodizing solution where the voltage is sufficient to cause an appreciable flow of current causes disturbances of an electrical or chemical nature at the surface, resulting in striations across the sheet normal to its direction of travel. In accordance with our invention, we can prevent these striations by passing the sheet of aluminum into the electrolyte where it is electrically inactive at the surface.

In its more complete aspects, the invention provides a method of continuously passing a sheet of clean, preferably dry, aluminum into an anodizing bath having an inactive anodizing action at the surface and forming an anodic coating on the aluminum, washing, drying and winding the aluminum into a roll. We may use two superposed sheets with sealed edges or a single sheet folded longitudinally and having one edge sealed, as described and claimed in our co-pending application Serial No. 637,708, filed December 28, 1945.

These and other novel features of the invention will be better understood after considering the following discussion taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a plan view of apparatus embracing the invention, and

Fig. 2 is a view along line 2—2 of Fig. 1.

The apparatus illustrated in Figs. 1 and 2 com-

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prises a sheet of aluminum 1 supplied from the roll 2 which passes through the treatment apparatus and is wound into roll 3. The various rolls D which are formed of glass, stainless steel, porcelain or other inert non-corrosive material are merely free turning direction rolls used to guide the sheet of aluminum through the apparatus. The electrical contact roll 4 is preferably located near the first immersion tank 5 and is connected to a positive source of current. Roller 4 may be formed of any suitable metal and tank 5 formed of corrosion resisting material. Roll 4 is in contact with the positive power line 6 of a suitable source of direct current and the sheet 1 is rendered anodic in passing over roll 4.

The anodizing tank 10 may be formed of non-corrosive material such as stainless steel and is filled with the anodizing solution as indicated. The guide rolls D are so arranged that the sheet of aluminum makes a relatively long passage therethrough. The cathode is divided into two parts, a lower part 11 having upwardly extending plates and an upper part 12 having depending plates all positioned between the vertically disposed sheets of aluminum. The cathode is connected by conductor 13 to the rheostat 14. By manipulating the rheostat, the proper current density may be maintained for the anodic operation being conducted. In order that the sheet of aluminum shall enter the anodizing solution at a place where the anodizing effect is nil or inactive, we mount the two electrical insulating barriers 16, such as plates of glass at a sloping position on both sides of the sheet. The sheet of aluminum may, accordingly, enter the anodizing solution without acquiring the striations normal to its length that would otherwise develop. The sheet passes through a rather narrow slot 17 between the barriers which offers such resistance to the current flow that the solution at the surface does not have active anodizing capacity.

The rinse tank 18, which may be formed of steel, is filled with fresh water. The sheet of aluminum on entering and leaving the rinse tank passes through fresh water sprays 19 which aid in scouring the surface and freeing it from the anodizing solution. As the sheet of aluminum passes upwardly, it contacts the two rubber wipers 20 which wipe off the excess water. The squeeze rolls 21 may be formed of metal with exterior layers of rubber which grip the sheet of aluminum and draw it through the system. The squeeze rolls are driven at uniform speed through the gears 22 connected to the motor 23.

When desired, the anodizing sheet of aluminum may be completely dried before being wound into the roll 3, and, to this end, we arrange the electric heating unit 24 preferably in the form of a resistance grid or coil.

In order to maintain the anodizing solution uniform as to composition, we provide the pump 26, driven by the motor 27, which has a delivery pipe 28 and return pipe 29. By means of this pumping apparatus, the solution is circulated through the anodizing tank and maintained at uniform composition. The make-up anodizing compound may be added to the circulating electrolyte to maintain uniformity of composition.

Fumes rise from the anodizing tank and we prefer to cover the apparatus with a hood or canopy and remove the gases with a suction fan. Such apparatus is not a part of our invention and is not illustrated.

In carrying out a method of the invention for the continuous anodizing of sheet aluminum and the winding of the anodized sheet into a finished roll in apparatus such as that illustrated in Fig. 1 or 2, the sheet of aluminum 1 from roll 2 is pulled through the apparatus at a continuous rate by the squeeze rolls 21. The speed of travel of the sheet is dependent upon its thickness and current carrying capacity. A foil of 0.001 inch thick should travel at the rate of around 25 feet per minute, foil of 0.002 inch thick at around 50 feet per minute, 0.004 inch thick at around 100 feet per minute, etc. A low current density of around 25 amperes per square foot may be used with such anodizing agents as sulfamic acid, while other agents, such as chromic and sulfuric acids, require higher current densities.

The anodizing tank is proportioned to permit the sheet 1 to remain therein the time required to form the desired anodic coating. In other words, the tank is proportioned with respect to the speed of travel of the sheet to accomplish the results desired. The size of tanks 5 and 18 is of no special significance and they are merely of sufficient size to accomplish other particular functions.

It is assumed that the sheet of aluminum comprising roll 2 is sufficiently clean and dry to be susceptible of the anodizing treatment. In other words, it should have been previously washed with an aluminum cleaner, rinsed and preferably dried. The tank 5 contains an anodizing solution of the same composition as the tank 10. The purpose of passing the sheet of aluminum into the anodizing solution in tank 5 is to effect a positive electrical contact with the roll 5 and this is desirable in the case of extremely thin foil. As explained above, the sheet of aluminum enters the anodizing solution in tank 10 between the glass plates 16 where the anodizing effect is very inactive and striations are thus prevented from forming on the anodic coating. As the sheet passes in fairly close contact with the relatively large cathodic surfaces arranged near both surfaces, an anodic coating of the desired texture and character is formed on both surfaces of the sheet. The anodized sheet enters the tank 18 wherein it is washed free of anodizing solution with water and passed through the wipers 20 for the removal of excess water. When drying is necessary, it is passed over the heating element 24, and wound as a finished anodized sheet into the roll 3.

The anodizing tank may contain any suitable anodizing solution, such, for example, as an aqueous solution of sulfamic acid, or oxalic acid in amounts of around 50 g. per liter, or suitable concentrations of such common anodizing acids as chromic and sulfuric acids.

The anodizing solution in tanks 5 and 10 as well as the fresh water in tank 18 should be around 120° F. for satisfactory results.

We claim:

Apparatus for the continuous anodizing of sheet metal of indefinite length which comprises a tank for an anodizing solution, power driven roller means for drawing the sheet of metal through the solution, electric means for rendering the sheet anodic, two plates of non-conducting material extending across the tank and at least the width of the sheet of metal and located where the said sheet enters the solution, said plates being spaced apart and extending both below and above the surface of the anodizing solution and converging downwardly to form a narrow slot through which the sheet of metal passes, the distance between the plates at the surface of the solution being relatively wide whereby the current density at the surface is relatively low and striations are prevented from forming on the resulting anodic coating, and a cathode below the said non-conducting plates.

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