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# UNITED STATES PATENT OFFICE.

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## PROCESS OF PREPARING ALUMINIUM PLATES FOR SURFACE PRINTING.

SPECIFICATION forming part of Letters Patent No. 590,966, dated October 5, 1897.

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*To all whom it may concern:*

Be it known that I, GEORGE R. CORNWALL, a citizen of the United States, residing at Port Chester, county of Westchester, State of New York, have invented certain new and useful Improvements in Processes of Preparing Aluminium Plates for Use in Surface Printing, of which the following is a specification.

10 In preparing the ordinary aluminium plates of commerce for use in surface printing it is found that the metal is tainted with certain impurities which prevent its successful use as a printing-surface.

15 The object of the treatment which forms the subject of this invention is to remove these impurities that are an impediment or drawback and also to render the plate more porous and sensitive to the design.

20 The first step of my process is, by mechanical or chemical action, to remove the outer shell or skin of the metal usually formed in rolling from the ingot and also to get down below any surface scratches or blemishes on the metal and present a true even surface for the design. The next step after I have removed the outer shell is to treat the plate with an alkaline solution (preferably caustic potash) of strength sufficient to dissolve any greasy material that may be on the surface or in the metal within reach of the alkali. The next step is to wash the alkali from the plate with water. The next step is to dip the plate in a bath of acid for the purpose of removing further impurities, preferably using a mixture of nitric and hydrofluoric acid, which removes certain surface dirt or impurity that the potash does not reach, also dissolving silicon, iron, copper, and their oxides or any material that may have been forced into the plate in the operation of rolling the plate, and also any earthy material that has been incorporated in the plate either in the production of the ingot or the subsequent production of the plate from the ingot. Then the acid is removed by washing in cold water. Any remaining trace of acid is then neutralized by dipping the plate in a neutralizing solution and the plate washed again.

More in detail, my process is as follows: I take, say, a sheet of aluminium of commerce which has on it and in it not only the ordinary commercial imparities, scratches, and blemishes, but the shell or skin which is caused by the rolling of the plate. The rolling has compacted the surface particles more densely than the interior. I first remove the said blemishes, scratches, and skin by buffing or rubbing down the surface, using for this purpose means which are adapted to the production of the desired grain or surface finish, according to the particular work to which the plate is to be applied. For example, for a plate which is intended for stipple or line or brush work I use a buffing or grinding disk having a felt or flannel face; and as an abradant I preferably use powdered pumice-stone slightly moistened, while for producing a plate which is intended for crayon or grained work I produce the desired surface by subjecting the plate to the abrading action of wet powdered grit of some kind rolled over the surface of the plate by small quartz pebbles or marbles, the size of which is varied according to the size or character of grain desired. In either case it is necessary and essential to my process that the abrading action should be carried on to a sufficient extent to entirely remove the outer compressed skin independent of the dulling, graining, or roughening of the surface. The point at which this result is accomplished can only be determined by actual experience—that is, by taking impressions with the plates and ascertaining whether the design remains clear after a number of impressions. If it does not do so even when the chemical cleaning process hereinafter described has been thoroughly effected, it indicates that a deeper abrasion is necessary. On further cutting away of the skin to a certain extent it will be found that a design can be produced thereon which will remain permanently clear, and yet the grain or degree of roughness of the plates may be the same as in the first case, when an imperfect result was obtained, the difference in effect being due to the fact that in the second case when the skin has been completely removed there will

be exposed to receive the design a surface of soft porous aluminium which has peculiar holding and absorbent qualities. I then subject the plate to a bath in an alkaline solution, preferably caustic potash. The strength of the solution depends on whether the solution is used hot or cold. Ordinarily at a temperature of 70° the solution may be ten pounds of caustic soda to twenty gallons of water. The plate must not be left in long enough to blister it and the length of time it should be left in depends on the strength of the solution. When the plate has become a peculiar slaty black, which will be readily recognized by any one accustomed to the operation, the treatment has proceeded far enough. The plate is then removed from the solution and washed in water to remove any alkali that is upon its surface. Next the plate is put in a solution consisting of about twenty per centum of concentrated nitric acid of commerce and eighty per centum of water, to which is added hydrofluoric acid until a marked action upon the plate is noticed. The quantity necessary for this is about one to two per cent. of hydrofluoric acid. This acid-bath removes any surface dirt or impurity which may have remained after the alkaline treatment, any foreign metallic particles, such as copper or iron, and any grit or dirt that may have been pressed into the metal by the rolls, also any oxids of aluminium and silicon. As the plate lies in the bath it is wiped until the dark surface is entirely removed and the plate has a uniform, brilliant, silvery aspect. The plate is then removed from the acid and very thoroughly washed in water, preferably using hot water. Any acid remaining on the plate is neutralized by then washing the plate in a solution of alum, lime-water, or any other suitable neutralizing material. Then the plate is washed in clean water, and upon drying the plate is ready for the design.

The above-given ingredients and proportions may be varied according to the result desired. In particular I may substitute for the hydrofluoric acid a small proportion of hydrochloric or a small proportion of sulfuric acid, and for the caustic potash caustic soda or other alkaline material. Preferably the reagents used are those first given above.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The process of preparing aluminium plates for surface printing which consists in removing the outer compressed, or denser layer or surface of the plate, so as to leave the open-grained interior of the plate exposed to form the printing-surface, substantially as set forth.

2. The process of preparing aluminium plates for surface printing which consists in first removing the outer compressed skin or surface, then subjecting the plate to the action of a caustic alkaline bath and subsequently to an acid-bath, and removing all resulting salts from the surface of the plate, substantially as set forth.

3. The process of preparing aluminium surface-printing plates consisting in first abrading the surface to remove the hard compressed shell and at the same time give the plate the desired finish; then treating the plate in an alkaline and then in an acid bath to remove the impurities, substantially as set forth.

4. The process of preparing aluminium surface-printing plates consisting in first removing the hard compressed shell or skin of the plate and giving it the desired finish and then chemically dissolving out the impurities without impairing the surface finish, substantially as set forth.

5. The process of preparing aluminium surface-printing plates which consists in exposing the plate in a caustic alkaline bath, and subsequently in a bath containing nitric acid and a small proportion of hydrofluoric acid, and removing the resulting salts from the surface of the plates, so as to leave the latter exposed to form the printing-surface.

6. The process of opening up the grain and purification of aluminium surface-printing plates, consisting in exposing the same in a caustic alkaline bath and subsequently in a bath containing nitric and hydrofluoric acids, and removing the resulting salts from the surface of the plate, substantially as set forth.

GEO. R. CORNWALL.

Witnesses:

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