UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN METHODS OF BLEACHING, COLORING, AND ORNAMENTING AGATE AND OTHER STONES.

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To all whom it may concern:

Be it known that I, AUGUST DREHER, of Obertiefenbach, in the Principality of Birkenfeld and Empire of Germany, have invented a Method of Bleaching Agate and other Stones of Similar Geological Formation, producing one or more white or colored layers in the same, and the method of producing ornamental designs on the surface or surfaces of agate or other similar stones in various colors, of which the following is a specification.

My invention relates, first, to the bleaching of agate and other stones of similar geological formation, regardless of the size of the same.

Up to the present time it was impossible to bleach agate stones unless the same were cut and ground into thin plates, which were then very imperfectly bleached; whereas, by using the present invention, stones of any requisite size and form can be bleached or provided with one or more layers of pure white or other desired color.

Agate stones, as imported from South Brazil, or stones of similar geological formation, are cut or chiselled into vases, medallions, and similar objects of art, or the same can be submitted to my process in a raw state and afterward cut or otherwise operated. The stones or the articles formed from the same are placed in a bath consisting of nitric acid (NO_5) or other similar chemical compound, whereby the iron particles and other impurities in the stone are removed. After remaining a suitable time in this bath—*id est*, according to the size of the articles to be treated—the same are removed and thoroughly dried.

After the stones have been well dried they are placed in a crucible and subjected to high temperature until every trace of nitric acid or other suitable chemical compound has been thoroughly burned out.

It is of the greatest possible importance that no nitric acid remains in the stone, for the reason that any trace of nitric acid prevents the chemical products used in the subsequent baths from penetrating the stone.

After the nitric acid has been burned out of the stone, the objects of art, &c., are placed in a bath containing a solution of about two hundred grams caustic potash or similar caustic preparation in about one liter of water.

The articles remain in this solution until they are thoroughly saturated, after which the said articles or the stones are well washed in pure water.

If the articles are required to have a perfectly pure white color I use the following process.

Instead of caustic potash, I dissolve about two hundred grams of caustic soda (natron oxide) in about one liter water.

The articles remain, as above mentioned, in this bath until they are thoroughly saturated with the solution, after which they are, as mentioned above, well washed.

After the stones or articles have been treated with caustic potash, caustic soda, or similar caustic preparation, they are placed in a bath of nitric acid or other similar compound, which must be kept cool. After remaining a suitable time in this bath, the articles are removed and well washed. After this they are placed in an oven and subjected to gentle heat until the stones or other articles are perfectly dry.

The stones or articles are now well burned in a crucible. During this part of the process the articles change their color and have either a semi-transparent or a pure milky-white color.

If it is desired to produce a second layer in any special color, the articles are placed in the color or other mixture until the said layer has been formed. They are then again subjected to the latter part of the process, after which a third color can be used, as may be desired, and so on.

If round articles are submitted to this process many concentric rings of various colors can be produced. The pores of the outer layer are open, so that the articles can be given any requisite color, whereas the inner layer of the interior of the stone or articles of art remain either a semi-transparent, pure milky-white, or other desired color.

If the statuettes, vases, medallions, &c., are now provided with a colored super or exterior layer of black or other color, the articles can

be engraved, thus producing the most beautiful portraits, figures, landscapes, or other ornaments.

The second part of my invention relates to the decoration of the exterior surfaces of agate stones and stones of a similar geological formation in white or any other desired color. The South Brazilian agate stones, or stones of similar geological formation, are cut into sheets or plates, left in the raw state, or cut into various forms of objects of art.

The stones, &c., can be treated in a similar manner to that described as the first part of my invention; but I prefer to use the following method: The stones or other articles are placed in a solution consisting of about two hundred grams caustic potash and about one liter of water, and remain in the same until they are thoroughly saturated. The articles are now removed and placed in a nitric-acid (NO_5) bath, where they remain until the potash solution is entirely driven out. The stones are now placed in an oven or other receptacle, thoroughly dried at a gentle heat, and afterward well burned in a crucible, after which the stones are of a fine white color.

Instead of caustic potash, I also use caustic soda or other suitable bleaching preparation. Nitric acid can also be used before the caustic soda or caustic potash, if desired.

The stones possessing flat surfaces are now provided with the negative of the desired decoration or decorations in graphite or ordinary pencil or other substitute—*id est*, the lines of graphite, pencil, &c., form the boundary-lines for the decorative figures. Between these boundary-lines, or on the parts left free of graphite, pencil, or other suitable matter, I introduce caustic soda, caustic potash, or any desired color by means of a pointed stick, fine brush, or other suitable object.

The plates, sheets, flat sides of medallions, &c., are placed in a horizontal position on a firm table, suitable shelf, &c., and the caustic soda, caustic potash, or color is kept standing until the same has penetrated the stone the required depth. The lines of graphite, lead, or other suitable material prevent the soda or potash from running out and producing uneven contours.

The soda or potash can be used without the boundary-lines; but the decorations will not be so well defined.

If the articles to be treated are of other than flat form, or even by flat forms where very fine decorations are required, but especially for statuettes, vases, and other objects of art, it is desirable to thoroughly coat the same with a paste consisting of graphite or other suitable substance in combination with some binding substance—plaster-of-paris, &c.

After this paste is thoroughly dry and hard the engraver or workman carefully cuts away the same, so as to leave the parts which are to be decorated free from paste; or, in other words, he can easily engrave the design or suitable ornament in the paste.

If necessary, the paste can be hardened by placing the articles in an oven or other suitable receptacle, and exposing the same to a gentle heat; or they can be placed in the sun for this purpose.

After the articles have been so operated they are placed in a bath containing about two hundred grams caustic soda, caustic potash, or any suitable coloring-fluid per liter of water, and remain in this bath until the solution has penetrated the desired depth.

The articles are then removed and well dried, after which the same, or the plates, &c., as above mentioned, are placed in a nitric-acid bath, where they remain according to the size or thickness of the plate, object of art, &c. The articles are now removed, thoroughly dried, and burned in a crucible.

By using some coloring-matters it is advisable to omit the nitric-acid bath.

The parts subjected to the foregoing process absorb absolutely no color, or no further color whatsoever, whereas the remaining parts, after removing the graphite or other suitable paste, can be provided with any desired color, as the pores of the stone in the parts not operated on are open.

The above-described process refers specially to such objects as are to be provided with decorations, &c., in white; but other colors can be used as may be desired. For instance, if the objects are placed in a nitric-acid bath wherein iron has been dissolved, instead of the caustic-soda or potash solution, the stones will assume a beautiful red color, or the various aniline colors can be applied.

The remaining parts can be provided with a black or other suitable ground-color, or the objects can be left white, as background.

It is in all cases advisable, although not absolutely necessary, that the stones be well dried and burned after the color has been applied, as unless they are burned the color is liable to fade.

Although I have described my said processes for bleaching, producing white and colored layers, and ornamenting agate-stones or stones of similar geological formation, I wish it to be understood that I do not confine myself to the exact proportions given in the foregoing specification; but

What I claim as my invention, and desire to have secured by Letters Patent, is—

1. The process hereinbefore described of bleaching agate and similar stones, consisting in, first, subjecting them to the action of nitric acid or similar chemical; second, drying them; third, driving out the chemicals by heat; fourth, saturating them with a solution of caustic potash or soda or similar chemical, washing in water, drying, again subjecting them to the acid bath washing and drying, and, if desired, coloring the same with suitable color-mixtures, substantially as specified.

2. The process of coloring agate and similar stones, consisting in, first, bleaching the same in the manner described, then placing

them in one or more color-mixtures, then submitting them to the action of nitric acid, washing, and heating, substantially as specified.

3. The process of ornamenting agate and similar stone articles, consisting in placing a negative of the design or ornament upon the article in graphite or equivalent, fixing the design by caustic potash, soda, or the like, nitric acid, and heat, substantially in the manner specified.

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Witnesses:
CARL LYSERT,
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