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UNITED STATES PATENT OFFICE.

RICHARD MÜLLER, OF EILENBURG, GERMANY, ASSIGNOR TO LUFTBLEICHE G. M. B. H., OF EILENBURG, NEAR LEIPZIG, GERMANY, A FIRM.

BLEACHING PROCESS.

1,163,438. Specification of Letters Patent. Patented Dec. 7, 1915.

No Drawing. Application filed March 14, 1910. Serial No. 549,277.

To all whom it may concern:

Be it known that I, RICHARD MÜLLER, citizen of the German Empire, residing at Eilenburg, Province of Saxony, Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Bleaching Processes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to bleaching processes, and it has for its object the utilization, for this purpose, of ordinary oxygen as it exists in the atmosphere.

I have found that if ordinary oxygen or air be introduced into a dilute aqueous solution of alkaline reaction such as a dilute solution of an alkali metal or alkaline earth metal hydrate, or of a compound of an alkali metal, or alkaline earth metal having alkaline reaction, for example, a dilute aqueous solution of an alkali metal carbonate, or an alkali metal borate or silicate or of neutral alkali metal or alkaline earth metal salts in connection with any metal oxid or carbonate into which bath is immersed the article or substance to be bleached the oxygen bleaches said article or substance and that this reaction is promoted when operating at a raised temperature and under pressure. For example, if cotton is suspended or immersed in a one per cent. aqueous solution of caustic soda (sodium hydrate) and the said solution is heated under pressure so as to obtain a steam pressure of two atmospheres, and air is forced into said solution under these conditions, the cotton will be bleached to complete whiteness in a period of sixteen hours, whereas the same material to be bleached when bleached by the old chlorin method would necessitate the consumption of from ¾ to 1 per cent. of chlorin. I have also found, that the bleaching effect of atmospheric oxygen may be considerably enhanced if comparatively small quantities of another metal-compound are dissolved or suspended in the alkaline bath. For example, if the same quantity of the material as in the above example be immersed in an aqueous 1 per cent. solution of sodium hydrate, to which is added only 0.01 per cent. of manganous carbonate, and the bath be again heated under pressure until a pressure of two atmospheres is attained and air is forced into the bath under this pressure, it will be necessary to continue the process only for twelve hours at which time the material will be found to be perfectly bleached. Other examples of metal compounds which may be used in the above process instead of the manganous salt are cobalt compounds, nickel compounds and copper compounds. Cobalt oxid when used instead of manganous salt in the above process has been found by me to be an excellent transferring agent for the oxygen, the addition of ½ per cent. of cobalt oxid even carrying the oxidation to an undesired degree when employed in connection with some fibrous materials, and leading to the formation of oxy-celluloses, whereby the material to be bleached might be converted into a pulpy form having little strength of fiber.

My new process marks an important advance in the art of bleaching, differing from the bleaching methods hitherto employed by its simplicity, comparative cheapness and rapidity. Under this invention the bleaching is carried out in one operation, since it permits the hitherto separate steps of bucking and bleaching to be united in one process. A sample of cotton which, when employing the bleaching methods heretofore in vogue, will require about forty-eight hours for bleaching, will, under this process, be bleached equally well in twelve hours. When dealing with linen the conditions are still more favorable under my invention, since I have found that this material may be perfectly bleached in a single operation lasting about forty-eight hours, whereas, when employing the methods now in use, as much as two weeks are required to achieve the same result, to which must be added a very much greater expenditure under the head of wages, reagents and comparatively complex apparatus. A further important advantage of this new method, which it has in common with the far more expensive peroxid bleaching process, from which it is, moreover, distinguished by the use of free oxygen instead of the nascent oxygen evolved in the said peroxid bleaching process, lies in its great adaptability to varying conditions and the facility with which it can be controlled and regulated to suit materials differing widely in properties. This very essential and desirable characteristic

of my invention is due to the fact that the oxidizing effect may be graded off from a very violent down to a very mild reaction.

My invention is essentially distinguished from all other known bleaching processes in that it for the first time employs molecular oxygen in the absence of sunlight, as contradistinguished from nascent oxygen, such as obtained from peroxid, for example, as a bleaching agent. Another essential characteristic of my invention is that oxygen is introduced into the alkaline bath in which the fibrous material to be bleached is immersed. The molecular oxygen of the air thus introduced coöperates with the alkaline liquor to produce the bleaching effect. That such alkaline liquor in combination with atmospheric air produces this bleaching effect is a discovery which greatly simplifies the bleaching operation and permits of its ready manipulation as has been above shown.

What I claim and desire to secure by Letters Patent is:—

1. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath and subjecting the bath liquor to the action of molecular oxygen until the desired degree of bleaching is attained.

2. The process of bleaching, which consists in immersing unbleached materials to be bleached in an aqueous alkaline bath and subjecting the bath liquor to the action of air until the desired degree of bleaching is attained.

3. The process of bleaching, which comprises immersing unbleached material to be bleached in an aqueous bath of alkaline substance and forcing free molecular oxygen into the bath under pressure until the desired degree of bleaching is attained.

4. The process of bleaching, which comprises immersing unbleached material to be bleached in an aqueous bath of an alkaline substance and forcing air into the bath under pressure until the desired degree of bleaching is attained.

5. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath, heating the bath under pressure and coincidently forcing molecular oxygen into the bath until the desired degree of bleaching is attained.

6. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath, heating the bath under pressure and coincidently forcing air into the bath until the desired degree of bleaching is attained.

7. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath and subjecting the bath liquor to the action of molecular oxygen in the presence of a non-alkaline compound of metal until the desired degree of bleaching is attained.

8. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath and subjecting the bath liquor to the action of air in the presence of a non-alkaline compound of a metal until the desired degree of bleaching is attained.

9. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath containing a non-alkaline compound of a metal and introducing molecular oxygen into the bath under pressure while heating the bath.

10. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath containing a non-alkaline compound of a metal and introducing air into the bath under pressure while heating the bath.

11. The process of bleaching, which consists in immersing the material to be bleached in an aqueous bath of an alkaline metal compound and heating the bath to obtain a steam pressure of substantially two atmospheres and forcing air into said bath.

12. The process of bleaching, which consists in immersing unbleached material to be bleached in an aqueous alkaline bath, heating the bath under pressure and coincidently forcing air into the bath until the desired degree of bleaching is attained.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

RICHARD MÜLLER.

Witnesses:

RUDOLPH FRICKE,

SOUTHARD P. WARNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."