UNITED STATES PATENT OFFICE.

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PROCESS FOR THE COLORING OF MATERIAL.

1,051,456. Specification of Letters Patent. **Patented Jan. 28, 1913.**

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To all whom it may concern:

Be it known that I, LEO SCHULHOF, a subject of the Emperor of Austria-Hungary, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Processes for the Coloring of Material, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the coloring of material and with respect to its more specific features to a process for reducing and dissolving various dyes.

One of the objects of the invention is to provide a practical and efficient process for rendering dyes soluble.

Another object of the invention is to provide a practical and efficient process for the reduction of dyes.

Another object of the invention is to provide a process wherein an efficient control of the fixing of dyes is secured.

Another object is to provide a process of the kind described which shall be simple and inexpensive.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the several steps and the relation and order of one or more of such steps with relation to each of the others thereof, which will be exemplified in the hereinafter disclosed process, and the scope of the application of which will be indicated in the claims that follow.

In order to make the invention clearer it is to be noted that there are some classes of commercially important dyes which are substantially insoluble in the ordinary solvents used in dyeing, such as water, alcohol, etc. Usually, in dyeing material, either uniformly or in the manner of topical coloring, these insoluble dyes, during at least a measurable interval of time, must be rendered soluble, and while in the soluble state they are absorbed by the material to be dyed. Subsequently, and while so incorporated in the material they are returned to the insoluble form. Various means have been devised to render these dyes soluble. For example, in the case of the sulfur dyes one of the most frequently used solvents is sodium sulfid, while in dissolving the indigos, sodium hydrosulfite or a similar agent in alkaline solution is often used.

During the course of a number of experiments it has been found that the substance maltose in alkaline solution acts as an efficient solvent. The maltose may be employed alone or with substances adapted to a similar use and its action in the case of certain dyes seems to be a reduction whereby oxygen or its equivalent is extracted from the dyes and they become soluble.

The following procedures include an embodiment of the present invention, as applied to dyeing and printing.

Example 1. For dyeing.—Ten parts of indanthrene blue are mixed with ten parts of a solution containing diastase and upward of 65% maltose and the mixture heated to 140° F. This mixture is dissolved in a caustic lye solution containing one part of caustic to one hundred parts of water. Into this solution is then introduced a quantity of cotton yarn in the proportion of one part of yarn for every thirty parts of solution. The bath is kept at a suitable dyeing temperature say 140° F., until the material is sufficiently impregnated. The latter is then removed, exposed to the air, washed and dried, whereby the dye is fixed on the fiber. Although cotton yarn has been mentioned specifically in this example, it is to be understood that the process is also suitable to many other kinds of material. It is to be further understood that the process is generally applicable to the various modes of dyeing, that a treatment with any suitable oxidizing agent may replace the exposure to air and in both cases the treatment may be carried out with or without the addition of acid to the material. In some cases, where acid can be used, a more rapid oxidation may be brought about.

Example 2. For printing.—One hundred parts of indanthrene blue are mixed with one hundred parts of a solution containing diastase and upward of 65% maltose. To this mixture is added one hundred parts of a cold solution of caustic soda having a spe-

cific gravity of 30° Bé. To this mixture seven hundred parts of starch or other thickening material are added. Cotton fabric is printed with this mixture, then steamed for one hour, washed and dried, whereby the dye is fixed on the fabric. In this process the goods might first be passed through a lukewarm solution of maltose, then dried, printed and finished as usual. It is to be understood that the process is generally applicable in connection with various modes of printing, including padding, etc.

It is to be understood that any suitable maltose-containing extract with or without an enzym might be employed. The enzym diastase is here included on account of its catalytic power and experiment seems to indicate that a more efficient action is secured when such an enzym is present than when it is omitted.

Numerous experiments have proven that maltose may be also successfully employed in connection with other substances to dissolve and reduce dyes. For example, a mixture of maltose and hydrosulfite of soda possesses properties, which make it especially suitable to many kinds of dyes. Alkaline hydrosulfites alone rapidly dissolve and reduce various dyes and fixing is rapidly accomplished when they are used on account of the fact that the hydrosulfites, quickly lose their solvent and reducing properties under the action of fixing agents, whereby the dyes incorporated in the material are rendered insoluble. Maltose on the other hand, has certain properties which insure a slow fixing action and by suitably combining the two, mixtures may be obtained especially adapted to various dyes and materials. Hence it will be readily seen from the foregoing that a very efficient means of control of the fixing of dyes on material may be secured by the combined use of these two agents. This use of maltose and a hydrosulfite is applicable to the various dyeing and printing processes.

The invention is applicable to insoluble dyes and also to reducible dyes and the following classes are some of those to which it is especially adapted: (*a*) the indigo dyes including indigo and halogen, alkyl, and other derivatives thereof; (*b*) the thio-indigo dyes including thio-indigo and its derivatives and substitution products with other groups; (*c*) the anthraquinone vat dyes, which appear in the market in many combinations and under various names as indanthrene, algol, etc.; and (*d*) the sulfur dyes and their derivatives, commercial examples of which are the katigen colors, sulfur blacks and immedial colors. It will thus be seen that a simple practical process is provided wherein the objects of the invention are achieved.

It will be obvious from the foregoing that the substance maltose might be employed to reduce and dissolve various organic substances.

It is to be understood that the process may be modified to accord with the various kinds of material used, and although the thio-indiges, anthraquinone vat dyes and sulfur dyes are conspicuous groups to which the process is adapted there are other classes of dyes to which it might be also efficiently applied.

As many changes could be made in the above process and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention, which, as a matter of language might be said to fall therebetween.

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

1. The process of preparing a bath which comprises rendering a dye soluble by applying an alkali, diastase and maltose thereto.

2. The process of preparing a bath which comprises rendering a sulfur dye soluble by applying maltose thereto.

3. The process of preparing a bath which comprises dissolving an insoluble dye in maltose solution.

4. A coloring process which comprises dissolving a dye in a mixture of maltose and an alkali, introducing a material to be dyed into the solution, and fixing the dye upon the material.

5. The process of preparing a bath, which consists in dissolving a dye in a solvent comprising maltose and a reducing substance adapted to quickly lose its reducing power upon exposure to an agent adapted to render said dye insoluble.

6. The process of preparing a bath, which comprises dissolving an insoluble dye in a solvent comprising maltose and a reducing agent adapted to dissolve said dye, said reducing agent being adapted to quickly lose its solvent power upon exposure to an agent adapted to render said dye insoluble.

7. The process of preparing a bath which comprises dissolving an insoluble dye in maltose and an alkaline hydrosulfite.

8. A coloring process, which comprises applying an insoluble dye to a suitable material, in the presence of maltose and another substance capable of dissolving said dye and adapted to quickly lose its solvent

power upon exposure to an agent adapted to fix said dye upon said material.

9. A coloring process, which consists in applying a dye to a suitable material, in the presence of maltose and an alkaline hydrosulfite, and fixing the dye upon the material.

10. A coloring process which consists in applying an insoluble dye upon a suitable material in the presence of maltose, a hydrosulfite and a caustic alkali, and fixing said dye upon said material.

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

LEO SCHULHOF.

Witnesses:
J. B. L. ORME,
L. A. WATSON.