UNITED STATES PATENT OFFICE.

HENRY L. BREVOORT, OF BROOKLYN, NEW YORK; GERTRUDE L. BREVOORT, EXECUTRIX OF SAID HENRY L. BREVOORT, DECEASED, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE ELECTRO WATERPROOFING AND DYE FIXING COMPANY, OF NEW YORK, N. Y.

ART OF FIXING DYES IN FABRICS.

SPECIFICATION forming part of Letters Patent No. 558,718, dated April 21, 1896.

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To all whom it may concern:

Be it known that I, HENRY L. BREVOORT, a citizen of the United States, residing in the city of Brooklyn, county of Kings, State of New York, have made a new and useful Improvement in the Art of Fixing Dyes in Fabrics, of which the following is a full and accurate description.

My invention consists in fixing dyes in cotton, wool, silk, and other fabrics by the use of metals and a current of electricity derived either from a battery or from a dynamo.

It is well known that natural dyestuffs—such as logwood, madder, fustic, hypernic, and the like—have to be treated with a mordant to fix them upon the goods subjected to the dyeing process. The action of the mordant is to form insoluble "lakes," as they are called, in the goods, thus leaving the goods dyed at those portions where the mordant and dye have formed such insoluble lakes.

My invention relates to the fixing of that class of dyes in which the coloring principle is in solution in the liquid to which the cloth is subjected, and which coloring principle requires a mordant to fix the same in the goods. In the practice of my invention I fix such colors by subjecting the goods to a current of electricity after they have been run through the solution containing the coloring principle, the goods being between a metal plate or roller on the positive side and having on the other or negative side a conductor, which may be of the same metal or some other metal, or may be a carbon plate or roller. The metal must be connected with the positive current—to wit, that current which would emanate from the negative element of the battery or which would be the positive current coming from a dynamo. The goods are first saturated with the solution containing the dye and are then placed between the metal plate or roller located on the positive side of the goods, and a suitable conductor is then placed on the other or negative side. The current is then passed through the goods and the water in or on the fibers is decomposed and oxygen is liberated on the positive plate or roller and hydrogen on the conductor on the negative side. The nascent oxygen thus liberated forms an oxid of the metal on the positive side, and this oxid enters into chemical combination with the coloring principle contained in the goods, thus fixing the color as though a mordant had been employed in the old way.

With different metals different colors or shades can be produced, and different degrees of color can be obtained by varying the concentration of the dye liquid and by the length of time the goods are treated. Thus if logwood is employed in a dilute state and a tin plate or roller be employed on the positive side, the goods where the current acts on them will be turned light blue, a more concentrated solution of the dyeing solution will turn them a darker blue and still darker with a greater concentration, and so on till the greatest concentration is reached, which gives the darkest color. Of course the metallic plate or roller on the positive side must be insulated from the conductor, which may be carbon or the like metal, on the negative side, the goods being treated serving to separate the plates.

As to the amount of current used, it will depend upon the thickness of the goods, the size of the machine, and the rapidity with which the operation is to be performed. If rapidly-rotating pressure-rollers are used, the current must have a higher electromotive force and be greater in quantity than if more slowly-moving rollers or less pressure be used.

It is impossible to state the proper electromotive force and quantity of current to be used in all cases. Each specific material, the thickness of the material, and the dye employed alter the required quantity and force of current necessary to effect the fixing of the color. The current strength and quantity are also altered by the pressure between the metal used and the conductor on the negative side. The greater the pressure the less the current, and vice versa. If the pressure is great, the period of exposure to the action of the current is reduced. If the pressure is less, the period of exposure to the current must consequently be greater. So great a

pressure should not be employed as to squeeze out all the liquid containing the dyeing principle. Any engraved plates or rollers may be used for this operation. The plate or roller on the positive side should have its surface from time to time wiped in order to remove the excess of oxid, and also arrangements should be made to absorb the coloring liquid running off from the lower roll, if the rolls are used. When rolls are used, the oxid may be wiped off by a wiping arrangement bearing permanently on the surface of the roller connected with the positive current.

My invention differs wholly from the operation described by Goppelsroder, in which he submitted cloth between conducting-plates to the action of a current of electricity, the cloth having in it a solution of an anilin salt and the other materials necessary for the production of anilin-black. The operation in his case consisted in oxidizing the anilin salt by the nascent oxygen liberated by the current, and thus forming the coloring-matter in the goods by the operation of the said nascent oxygen, as is done in other anilin processes by the oxidation of the anilin with arsenious acid or with nitrobenzole.

In my process I produce an oxid of the metal and cause said oxid to pass into the goods for the purpose of fixing the dyeing material by forming a lake in the fiber of the goods, the fixing of the color in my invention being wholly different from the operation above described, wherein the material in the solution—to wit, the anilin salt—is oxidized by nascent oxygen. Besides I fix the natural dyestuffs which need a mordant. The process of Goppelsroder produces anilin colors on the goods by the action of nascent oxygen and from materials which do not contain any coloring principle in the solution. In my process it is absolutely essential that a metal be used on the positive side, while in the Goppelsroder process any conductor—for instance, carbon—can be used on the positive side as well as a metal, as he merely seeks to liberate nascent oxygen on the goods at the point or place where the anilin salt is to be oxidized. Thus he described the use of a carbon pencil.

In the practice of my invention carbon cannot be used on the positive side; but a metal must necessarily be used, as the oxid of the metal is the fixing agent for the natural color, the said oxid being carried in the direction of the current from the metallic plate into the fiber. The metals which are best adapted for use on the positive side are aluminium, tin, zinc, lead, copper, iron, and brass. Bismuth and antimony do not give good results with logwood, because these metals are not capable of forming desirable salts with the coloring principle. In general those metals work best which form with the coloring principle colored salts.

From the above it will be seen that alloys may be used as well as simple metals with beneficial results. The selection of the metal to be used on the positive side will depend upon the natural dye used and the capacity of that dye to form insoluble colored salts with the oxid of the metal, and in this regard the old and well-known mordanting process will indicate the best metal to use with any certain color. In operating on small samples, where the plates used were between two and three inches in diameter, with logwood, using tin plates, zinc plates, and aluminium plates, a treatment of ten seconds was found to be sufficient to change the yellowish brown of the logwood solution into a rich blue, the current being between twenty and thirty volts and the goods being held firmly between the plates. It is impossible to more definitely lay down the amount of current required, as each case will depend upon the special circumstances attending it, the thickness of the goods, the dye used, and the amount of pressure. After the goods are thus treated the goods must be well dried in contact with ordinary air. The coloring-matter in the untreated portion of the goods, if such exists, may be removed by washing, if desired, during the finishing thereof. If the goods are to have a pattern upon their surfaces and are not to be dyed over all portions, the coloring-matter may first be printed thereon by rollers in the form of a pattern and the goods can then be subjected to the action of the current between plain rollers, and the coloring-matter will be fixed wherever the same is in the goods. Those portions of the goods where no coloring-matter exists are not affected so far as dyeing goes. The goods, after the operation, may be finished as desired. A less satisfactory result may be obtained by first treating the goods between a metal on the positive side and a conductor on the negative side with a current of electricity when the goods are wet and then subsequently immersing the goods in the dye liquid. A continuous current, in contradistinction to an alternating current, should be used in carrying out this invention. An alternating current can be used if like metallic rolls are used on both sides of the goods.

It is preferred that the dye liquid be fresh, for with fresh liquids the result is a brighter color, the old decoction being more or less oxidized. At times the color will be the brightest on the negative side. With some dyes the continuation of the treatment beyond a certain time reduces the intensity of the color. This is found to be the case with zinc plates and hypernic.

What I desire to secure by Letters Patent is—

1. The process of fixing dyes upon fabrics which consists in applying the natural dye in a suitable solvent to the fabric, placing the fabric between an anode of an oxidizable metal and a suitable cathode, and substantially in contact with the anode, passing a current of electricity therethrough, oxidizing the anode,

and combining said oxid with the natural dye to form a lake, substantially as described.

2. The process of fixing natural dyes upon fabrics which consists in applying the natural dye in a suitable solvent to the fabric, placing the fabric between and in contact with an anode of an oxidizable metal and a suitable cathode, passing a current of electricity therethrough, oxidizing the anode, and combining said oxid with the natural dye to form a lake, substantially as described.

3. The process of fixing natural dyes upon fabrics which consists in applying the natural dye in a suitable solvent to the fabric, pressing the fabric between an anode of an oxidizable metal and a suitable cathode, passing a current of electricity therethrough, oxidizing the anode, and combining said oxid with the natural dye to form a lake, substantially as described.

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Witnesses:
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