

# UNITED STATES PATENT OFFICE.

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## PROCESS OF DYEING.

SPECIFICATION forming part of Letters Patent No. 620,578, dated March 7, 1899.

Application filed July 29, 1898. Serial No. 687,183. (No specimens.)

### *To all whom it may concern:*

Be it known that I, JOHN W. FRIES, of the city of Salem, county of Forsyth, and State of North Carolina, have invented an Improvement in Processes for Dyeing Textile Materials, of which the following is a specification.

My invention has reference to dyeing or coloring textile materials; and it consists of certain improvements, which are fully set forth in the following specification.

My invention comprehends the dyeing or coloring of cloth preferably as it comes from the loom and without any previous special treatment.

More specifically considered my object is to take the gray cotton cloth in a dry condition and in long lengths and treat the same to a dyeing operation and then immediately finishing the dyed material, whereby but a single handling is required. In carrying out my invention I form the cotton cloth into a large roll, it having been previously taken direct from the loom or from a brush, and shear, if desired, and from this roll I pass the cloth through a suitable bath to give it color and stiffening. By mechanical means I force the said color through the body of the fabric and remove all excess of the dye or ink. The cloth so colored is then passed over drying-cylinders and through calendaring-rolls to give it the desired finish, after which it is again ready for shipment. This is especially intended for all characters of fabrics where a single uniform tint or color is required and obviates largely the trouble and expense which the frequent handling and many operations of the ordinary processes entail. In carrying out this process it is most important that the right character of dye or ink be employed—namely, one which shall secure the combined stiffening and immediate coloring results which are essential—and I will now refer to that portion of my invention. The process is carried on in either the cold or hot condition by causing the fabric to be passed through the ink or dye and then subjected to the action of pressure-rolls which apply sufficient pressure to the cloth to force the dye or ink into and through the body thereof and to expel the air from the interstices of the fabric. To do this, however, the dye or ink must have the proper material and consistency.

The ordinary manner of making an ink is not suitable for this purpose, and I therefore proceed as follows: To about one hundred parts, by weight, of water, which may be in the cold condition, I mix approximately ten parts of starch and one and one-half parts of caustic soda. The starch and caustic soda are separately mixed with different portions of the water, and the two solutions are then mixed while cold. This produces a whitish paste similar in appearance to ordinary starch paste. On prolonged boiling this soda-starch paste becomes a clear brown, but very stiff, tenacious, and ropy. If the ordinary boiling action be continued with the object in view of converting this stiff paste into a smooth syrupy starch-soap, there is great tendency of it becoming burned, and this is almost sure to result even with the most careful stirring. I therefore boil the mixture in a closed vessel under pressure by the employment of live steam passing through a coil immersed in the liquid or in a closed vessel jacketed with live steam, as desired. In this manner the starch mixture is readily converted into a clear brown viscous syrup, which retains its consistency, and in this condition it is most excellently adapted as the basis for imparting the body to the ink or dye. This manner of preparing the thickening or body material is new and most important. While the direct dyes may be used with this starch syrup, they are not "fast," and hence I prefer to use the basic dyes. While in ordinary use these basic dyes require a tannin and antimony or iron mordant, when used in my process and with the employment of my specially-prepared starch syrup they can be fixed in yarn or cloth without tannin, since the basic dyes would be precipitated by the soda in the starch syrup or by the lime in the water used. To the syrup so prepared I also add a quantity of acetic acid, the quantity being varied to suit the dye desired. The free acetic acid becomes evaporated in the drying process to which the yarn or cloth is subjected after being dyed and leaves the basic dyes fixed and reasonably fast in and upon the fibers of the cloth. However, as some of the basic dyes are precipitated in varying proportions by a number of salts, some of which precipitates are soluble in clear water—as, for example,

those from the use of common salt—they are of no use in this process. Other precipitates from these basic dyes are soluble in sulfuric or hydrochloric acid; but as these acids are dangerous to use, are liable to tender the goods, and are difficult to evaporate these substances are not suitable. However, if we employ acetate of iron, acetate of lime, or calcium chlorid these can be used with a number of the basic dyes, and their precipitates will be soluble in an excess of acetic acid, said excess being evaporated in the process of drying and the precipitate left in and upon the fiber in a form insoluble in clear water and in soap. Among these basic dyes which can be employed in this manner with satisfactory results are naphthindone, methylin-done, indoine, bengaline, indol blue, garnet red, Bismarck brown, chrysoidine, auramine, and emerald green, and these all work well with this method of making the dye or ink. They can be mixed in any desired proportions to secure the proper density of color, and these various dyes may be intermixed to give an infinite variety of shades. As there is a lack of good basic black dye, a very fair substitute for this may be secured by employing four parts of naphthindone, one part each of Bismarck brown, chrysoidine, and emerald green, and the tone of the black soap produced may be changed by varying the proportions. As each finisher would make his dyes or inks to suit the work in hand, it is not practicable to set out all the possible proportions and ingredients which might be used; but a satisfactory example may be given as follows: for the black, one hundred and fifty parts of starch syrup as prepared above, fifty parts acetic acid, fifty parts calcium chlorid, (five per cent. solution,) .750 parts naphthindone, .375 parts Bismarck brown, .375 parts chrysoidine, and .375 parts emerald green.

It is evident that the calcium chlorid may be replaced by the acetate of lime or acetate of iron, as hereinbefore pointed out.

It will be observed that in an ink or dye employed in the manner herein described it is essential that it shall have not only the consistency necessary to be capable of being treated by the rolls in such a manner as to mechanically force it through the fabric by pressure, but it shall also have the necessary capacity for imparting the desired stiffness and body to the fabric in its finished condition.

The process of coloring fabrics in this manner secures a material saving in the dyestuff required, because the yarn or cloth takes only as much of the ink as is necessary to impregnate it and there are no half-spent liquors to be wasted. The pressure of the rolls re-

moves all superfluous dye and impresses a more uniform color than is possible by the ordinary piece-dye processes. Furthermore, the continuous and practically single operation of dyeing, drying, and calendering greatly reduces the labor cost of the finished article.

I have not illustrated any apparatus for carrying on my improved manner of dyeing or coloring the fabrics; but such apparatus suitable for the purpose is clearly and fully set out in a pending application of mine, Serial No. 687,221, filed July 29, 1890.

While I employ my improved process more particularly for dyeing the fabric in the web, it is to be understood that, if desired, I may dye yarn in a warp or skein by suitable modification in the handling thereof.

What I claim as new, and desire to secure by Letters Patent, is—

1. As a new compound for dyeing textile materials a mixture of a viscous starchy paste composed of starch and caustic soda in semi-fluid condition, acetic acid, a substance such as acetate of lime capable of precipitating the basic dyes, and a basic dye, the whole forming a viscous material in the cold condition capable of producing insoluble precipitates of the dyes and stiffening the textile material treated upon the application of heat.

2. The process of producing a dye for textile materials which consists in dissolving starch and caustic soda separately, then mixing the solutions while cold, then boiling the mixture under pressure by steam heat until it becomes of a clear syrupy or viscous consistency, adding to this syrup acetic acid and a substance such as acetate of lime capable of precipitating the basic dyes while cold, and adding thereto suitable basic dyes soluble in an excess of acetic acid.

3. The process of dyeing a textile material consisting in applying thereto a dye-ink composed of a viscous or syrupy solution composed of starch and caustic soda, acetic acid, a substance such as acetate of lime capable of precipitating the basic dyes, and a basic dye, forcing the same into and through the textile fiber and expelling the air, removing the excess of the dyeing ink, heating the textile material so treated to cause the acetic acid to be evaporated and the insoluble dye precipitate to be formed upon the fabric and the fabric also stiffened at the same time by the drying of the starchy ingredients.

In testimony of which invention I hereunto set my hand.

JOHN W. FRIES.

Witnesses:

A. F. PFOHL,  
LEDoux SIEWERS.