UNITED STATES PATENT OFFICE.

JOHN BRACEWELL, OF NORTH ADAMS, MASSACHUSETTS.

PROCESS OF PRINTING INDIGO COLORS.

SPECIFICATION forming part of Letters Patent No. 301,475, dated July 8, 1884.

Application filed March 24, 1884. (No specimens.)

To all whom it may concern:

Be it known that I, JOHN BRACEWELL, of North Adams, in the county of Berkshire and State of Massachusetts, have invented a certain new and useful Improvement in Printing Indigo Colors, of which the following is a specification.

My improvement relates to the printing of indigo colors upon fabrics; and it consists in the preparation of the colors and fabric, and the application of the colors upon the fabric so as to render the indigo a fast color, substantially as hereinafter described and claimed.

Heretofore it has been found practically impossible to print indigo colors upon cotton and other fabrics and make even, perfect, and fast colors to a sufficient degree to produce such goods for the market by the printing process. As a consequence, "indigo prints," so called—*i.e.*, cotton goods prepared with dark indigo colors—have always been produced by dipping the fabric in indigo dye-vats, the other colors, if any, having been first printed upon the fabric with a resist in the well-known manner. In other words, the indigo colors were dyed into the goods instead of being printed on them. The disadvantages of this indigo-dyeing process are twofold; first, the goods are more expensive, because the dyeing process is slow and costly as compared to printing; and, secondly, the goods produced have the indigo color absorbed alike on both sides of the fabric, owing to the impossibility of washing its minute particles out at any reasonable cost. Printed goods, however, have a "right" and "wrong" side, so called, the colors being laid upon the former, and not penetrating through to the other sufficiently to crock light-colored garments worn beneath those made of such goods. In my process of printing indigo colors on fabrics, preferably of cotton, I first prepare a "pulp," so called, of indigo and caustic soda, either by first soaking the indigo in a lye of caustic soda and grinding the indigo, or by grinding the indigo and caustic soda together for a sufficient length of time with water. If the indigo is to be soaked in the caustic-soda lye, the latter should be preferably of 20° Baumé, and the soaking should be continued for about twenty-four hours before grinding; but these proportions and this time may be varied somewhat. If the indigo is to be ground directly with the caustic soda, I prefer to use the proportions of about twenty-five pounds of indigo, ten gallons of water, and fifty pounds of caustic soda at 70° Twaddle, and fifty-eight pounds of solid caustic-soda solution, and grind the whole together for forty-eight hours; but these proportions may be varied somewhat as well as the time of grinding. The temperature of the mixture during the grinding should be kept low, and preferably below 100° Fahrenheit. After grinding, the mixture may be kept until wanted for use.

In using the above "pulp" it may be mixed with dextrine previously prepared in the form of a paste with water, and having afterward stirred into the mixture dry caustic soda, keeping the mixture at a low degree of temperature, when it is allowed to stand for about six hours, keeping the air excluded from it. The process of preparing the blue pulp for printing which I prefer, however, is as follows: Mix three pounds of British gum, one and one-half pound of maize starch, and three and three-quarters pounds of water until homogeneous. Then add from fifteen to forty pounds of caustic soda, according to the shade of color wanted, (the lesser quantity for the darker color, and vice versa,) at 70° Twaddle, stirring it into the mixture in small portions at a time—say at the rate of three gallons of the caustic per hour. Then add the indigo pulp above described as prepared by grinding the indigo and caustic directly together, in quantity varying from thirty pounds to six pounds, according to the shade of color desired, (the larger quantity for the darker color,) and heat the whole mixture to 120° Fahrenheit, stirring it well all the time, and cool it quickly, and allow this prepared color to stand until it has acquired a gelatinous consistency. If it has been kept cold for some time, it should be warmed before using, and it must be quite thick. The preparation of this color is well known, and I make no claim to it, and it may be varied to give greater thickness or lighter or heavier shades of color, if desired.

In using the color for printing I first saturate my cotton cloth with a solution of grape-sugar or glucose, using two and one-half pounds (more or less) to the gallon of glucose; but I

prefer to use as strong a solution as the fabric will bear. I next dry the fabric thoroughly. I then prepare its glucosed surface to receive the color by breaking down the saccharine crystals formed (by drying the fabric after taking it from the glucose solution) in the filaments of fiber in the surface of the fabric, without removing the saccharine matter from said fabric to such an extent as to affect the subsequent processes or impairing its even distribution throughout the latter. This is of great and vital importance for the following reasons: When the glucose solution is made as strong as is necessary to incorporate sufficient saccharine matter into the fabric to react upon the alkali and set the color in the subsequent processes, (hereinafter described,) the saccharine crystals incase the filaments of fiber on its surface and cause the reaction (hereinafter described) to occur to a greater or less extent outside of the fiber and before the color has entered into it sufficiently. Furthermore, the saccharine crystals, when the fabric is dried directly after taking it from the glucose solution, collect more upon the fiber filaments on some parts of its surface than upon others, and the color does not enter the fibrous surface evenly all over it at the time the reaction (hereinafter described) of the glucose, indigo, and alkali takes place, and the consequence is an uneven coloring of the finished fabric. By breaking down the saccharine crystals over the surface of the fabric, as described, however, the color is allowed to penetrate into the surface evenly, and consequently bring about a substantially even reaction of the ingredients upon each other afterward in the presence of the fiber, which gives a perfectly even shade of color to the finished fabric. I accomplish this breaking down of the saccharine crystals on the surface of the fabric by passing it through the steam-box and subjecting it to the action of steam for a very short time. I have found thirty seconds to be sufficient for ordinary purposes; but the time may be varied somewhat, according to the extent to which it is necessary to break down the saccharine crystals. The fabric then will be found to have quite a different surface from that before the steaming process, it being softer and prepared to take the color evenly, while the necessary quantity of glucose still remains incorporated in it to fix the indigo color under its subsequent treatment.

I do not confine myself to the use of steam to break down the crystals on the surface of the fabric, as other known means of breaking down the crystals by heat or moisture may be used—as, for instance, a very fine spray of moisture applied to the surface of the glucose by a spraying device. After thus treating the fabric, I print the color on its prepared surface with a light pressure, just sufficient to cause the prepared glucose surface and the surfaces of the layer of color to meet and unite, as described. I next dry the printed cloth as quickly as possible by the use of a blast of heated air, and then as quickly as possible pass it through a steam-box, and subject it to heated steam for a short time, until the color is set, after which I wash it in cold water, subjecting it to the water for a short time before washing. The cloth will then be found to have received a perfectly even fast indigo color having a "right" and "wrong" side, and to be in every way equal to cotton printed goods of other colors.

I do not claim anything shown or described in the patent of Burton, No. 245,701, dated August 16, 1881, of which I am aware.

What I claim as new and of my invention is—

The described process of printing indigo color upon a fabric, which consists in preparing the fabric with a solution of grape-sugar or glucose, breaking down the saccharine crystals over its surface without removing the saccharine matter from it, and then printing a mixture of alkali and indigo upon such prepared fabric, and subjecting the same to the action of steam, substantially as described.

JOHN BRACEWELL.

Witnesses:
E. D. TYLER,
GEO. P. LAWRENCE.