No. 769,059. Patented August 30, 1904.

UNITED STATES PATENT OFFICE.

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OXIDIZING SULFUR DYE.

SPECIFICATION forming part of Letters Patent No. 769,059, dated August 30, 1904.

Application filed December 23, 1903. Serial No. 186,329. (No specimens.)

To all whom it may concern:

Be it known that I, HENRY JAMES COOKE, a subject of the King of Great Britain, residing in the city of New York, borough of Brooklyn, and county of Kings, in the State of New York, have invented new and useful Improvements in Oxidizing Dyes on the Fiber, of which the following is a specification.

This invention relates more particularly to the oxidation of the fiber of the so-called "sulfur dyes" in order to develop some property of color, fastness, or the like which is not possessed to the same extent, if at all, by the unoxidized colors. The dyestuff known as "pyrogen blue" may be taken as an example of these sulfur dyes; but the treatment of others of them amenable to the hereinafter-described oxidation is also included in the invention.

Heretofore sulfur dyes have been oxidized on the fiber by the action of such oxidants as the bichromates and peroxids, and it has also been proposed to subject the dyed fiber to a mixture of atmospheric air and steam in the presence of alkali at a temperature above the boiling-point of water in order to oxidize the sulfur dye thereon.

In accordance with the present invention the sulfur dye is oxidized in the presence of the fiber by means of ozone produced by the action on air of finely-divided essential oil or mixture of oils, such as turpentine, oil of pine, oil of cedar, which oils are able, as is known, to convert the oxygen of the air into ozone.

Most advantageously the dyed fiber is charged with such oil and at the same time exposed to air with or without a continuance of the exposure to air after the charging operation is complete; but the dyed fiber may be charged with the finely-divided oil without any (or with only inconsiderable) exposure simultaneously of said fiber to air, and generally the oxidation of sulfur dyes in the manner set forth above is within the scope of the invention.

The invention also includes the parts, improvements, or combinations hereinafter set forth.

The new process has the advantage over the prior state of the art with respect to rapidity, certainty, uniformity, convenience, and economy of working (or in one or more of these respects) or in reference to the particular character of the effect in color, tint, shade, fastness, tendering the fiber, or the like.

To give an example, it has advantage over the process of subjecting the dyed fiber to air and steam at above 212° Fahrenheit in the presence of an alkali in that the new process is more rapid, certain, and uniform and does not require a temperature above 212° Fahrenheit. It can, indeed, be performed at ordinary atmospheric temperature, although it is considered an advantage and special improvement to warm the air.

The use of the process as the sole oxidizing operation or in connection with other known or suitable oxidation is included in the invention.

The effect of the finely-divided essential oil in the new process is due to the formation of ozone on and in intimate contact with the previously-dyed fiber, and as I believe myself to be the first to subject sulfur dyes on the fiber to the action of ozone, both in a general way and by treating the same with an ozone-developing substance, I intend to cover such general processes in appropriate clauses of my claim. Moreover, there are dyes other than sulfur dyes which have been or can be oxidized on the fiber with beneficial effect and to which, as I believe, the process set forth above can be applied for that purpose, and the expression "herein-specified dyes" in my claim, while primarily and especially intended to apply to sulfur dyes, is intended secondarily and by extension to apply also to oxidizable dyes in general to which said process may be applicable.

The following is a description of what is considered the best mode of carrying the invention into effect, it being understood that it is given by way of example and that modifications can be made within the limits of the invention so long as the substance of one or more of the hereinafter-written clauses of claim is taken. The fiber previously dyed

with sulfur dye—say in the ordinary way with pyrogen blue—is placed in a chamber in such manner that air or vapor can come into contact with all parts of said fiber. For this purpose it is not necessary to rinse the fiber after dyeing. In a smaller communicating compartment is placed absorbent material, as raw cotton or mineral wool, charged with the essential oil or mixture selected—say ordinary turpentine of commerce, as this has been found the most economical to use. The large chamber is maintained at a temperature of about 140° Fahrenheit, more or less. A current of air or of live or exhaust steam is passed by any suitable means over or through the absorbent material, so as to volatilize the essential oil and take up the vapors thus produced and carry them with it to the above-mentioned large chamber containing the dyed fiber. Here the vapors condense and deposit essential oil in finely-divided form upon the dyed fiber, and the air present in the chamber is at the same time acted upon catalytically by said finely-divided oil, converting its oxygen in part into ozone, which causes the oxidation of the sulfur dye on the fiber. The current of air or steam is discontinued when the fiber has received a sufficient charge of oil—say about one pound, more or less, to each one hundred pounds of fiber—and the fiber is then allowed to remain in the atmosphere of the chamber (at about 140° Fahrenheit, more or less) until the desired oxidation has been effected.

When air is used as the medium to form and carry over the vapors of the essential oil, it can advantageously be preliminarily warmed and moistened—as, for example, by letting into it a jet of free steam. Useful results can, however, be obtained with ordinary atmospheric air.

It is not necessary to warm the air in the chamber, although this is advantageous, and the temperature can be carried above 140° Fahrenheit, if preferred. Precise figures are given only by way of example and suggestion in order to better enable others to practice the invention and not as restricting the invention thereto.

Useful results can be obtained by spraying the essential oil with an atomizer onto the dyed fiber, which is then exposed to artificially-moistened or unmoistened air—say at 140° Fahrenheit, more or less, or at other appropriate temperature. Oxygen could be used, or a mixture richer in oxygen than common air, and neither of these is intended to be excluded by the use of the term "air" in the hereinafter-written claims.

I claim as my invention or discovery—

1. The process of oxidizing the herein-specified dyes, by exposing the same on the fiber to air in the presence of the specified finely-divided essential oil, thus producing ozone, substantially as described.

2. The process of oxidizing the herein-specified dyes, by exposing the fiber dyed therewith and charged with the specified finely-divided essential oil to air, substantially as described.

3. The process of oxidizing the herein-specified dyes, by exposing the fiber dyed therewith and charged with the specified finely-divided essential oil to warm air, substantially as described.

4. The process of oxidizing the herein-specified dyes, by exposing the fiber dyed therewith and charged with the specified finely-divided essential oil to warm air in the presence of moisture, substantially as described.

5. The process of oxidizing sulfur dyes, by exposing the same on the fiber to the action of ozone, substantially as described.

6. The process of oxidizing sulfur dyes, by exposing the same on the fiber to the action of ozonized air, substantially as described.

7. The process of oxidizing the herein-specified dyes, by exposing the same on the fiber to the action of air in the presence of an ozone-developing material, substantially as described.

8. The process of oxidizing the herein-specified dyes, by exposing the fiber dyed therewith and charged with an ozone-developing substance to air, substantially as described.

9. The process of oxidizing the herein-specified dyes, by charging the fiber dyed therewith with the specified essential oil finely divided by condensation of the vapors of said oil and exposing the so-charged fiber to air, substantially as described.

10. The process of oxidizing the herein-specified dyes, by charging the fiber dyed therewith with a finely-divided ozone-developing material finely divided by condensation of the vapors thereof, and exposing the so-charged fiber to air, substantially as described.

11. The process of oxidizing the herein-specified dyes, by exposing the same on the fiber to the action of air in the presence of an ozone-developing material, this latter being applied to the fiber after the removal of the same from the dye-bath subsequently to the dyeing operation, substantially as described.

12. The process of oxidizing the herein-specified dyes, by exposing the same on the fiber to the action of air in the presence of the specified finely-divided essential oil, this latter being applied to the fiber after the removal of the same from the dye-bath subsequently to the dyeing operation, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY JAMES COOKE.

Witnesses:
ALBERT E. OBERG,
WILLIAM J. HARVEY.