This invention is concerned with treatment of materials incidental to dyeing, and more specifically speaking, with certain chemical reactions subsequent to application of the dyes whereby the colors are fully developed and set.

In dyeing textile materials such as cotton, linen, silk, rayon or fabrics woven from them, with certain vat dyes, it is the custom to subject the materials, immediately after application of the dyes, first to a chemical reducing agent, and thereafter to air or other oxidizing agent for the purposes stated above.

The object of my invention is to enable control of the reaction of such chemical agents upon the dye with a view toward predetermining more uniform results as to color and set than possible by attainment with previous methods. This desideratum I attain as hereinafter fully explained, by subjecting the fresh dyed materials to an atmosphere of a suitable gas capable either of modifying the action of the agents employed in reducing and oxidizing the dye, or of remaining neutral, i.e. non-oxidizing in contradistinction to air.

The illustration herewith shows, more or less diagrammatically, a longitudinal sectional view of a novel apparatus convenient to the practice of my new method. This apparatus will be observed as having the form of an enclosure comprising three sequential subdivisions 2, 3, 4, which are set apart by vertical partitions 5, 6. The subdivisions 2 and 4 I employ as vats respectively for solutions of the reducing and oxidizing solutions; while the intermediate subdivision 3 serves as a chamber for a gaseous agent by which the action of the solutions aforesaid is modified or controlled. The chamber 3 communicates with the end subdivisions 2 and 4 over the tops of the partitions 5, 6; and auxiliary partitions 7, 8 extending downward from the roof 9 of the structure into the solutions, cooperate in establishing fluid seals to prevent escape of the gas from said chamber. Immediately after application of the dye to the textile material M—which may be either continuous yarn or cloth, it is passed over a guide roller 10 and down into the reducing solution in the subdivision 2, thence about guide rollers 11 and upward at the inside of the auxiliary partition 7 to squeeze rollers 12 above the partition 5 for direction into the chamber 3. In traversing the latter, the material traces an undulatory course defined by spaced transverse upper and lower rollers 13, 14. The material M leaves the chamber 3 over a guide roll 15 at the top of the partition 6, passing downward into the oxidizing solution in the subdivision 4, thence about guide rolls 16 beneath the auxiliary partition 8, and finally upward and out of the apparatus over a guide roll 17. The gas is introduced into the chamber via a pipe 18 at the top, a separately controlled branch 19 being also provided for injection of steam or water for the purposes of cleaning. A steam or hot water pipe 20 in the bottom of the chamber 3 serves as a convenient means to heat the gas when necessary or advantageous. The apparatus is further equipped with outlet pipes 21, 22, 23 by which the respective subdivisions 2, 3, 4 may be readily drained from time to time.

As a concrete example in connection with the use of indanthrene and algol colors, I may employ a solution of hydro-sulphite and alkali in subdivision 2, a solution of a bichromate or peroxide in the subdivision 4, and ordinary illuminating gas in the chamber 3. Consequent upon retainment of the material M in the gaseous atmosphere within the chamber 3, for a substantial time period, the reducing solution is given an opportunity to thoroughly react with the dye until the color is fully developed. Such regulation of the reduction is therefore also influential upon the results obtained in the final oxidizing step. By heating the gas to a temperature of about 140° F., I have found that the reduction may be greatly facilitated. On the other hand, if found desirable under certain conditions of practice, a neutral gas like nitrogen or hydrogen may be employed to retard the action of the reducing agent. Again, if more convenient, reduction may be effected by a reducing gas (such as hydrogen-sulphite) alone without necessitating initial passage of the material M through a reducing agent in solution.

From the foregoing it will be apparent that the practice of my new method of dyeing is subject to considerable diversification depending entirely on the nature of the material M being treated, as well as upon the kind and the specific characteristics of the dyes initially employed. The apparatus herein specifically
described is of course to be considered as typical of others capable of being evolved within the scope of the appended claims.

Having thus described my invention, I claim:

1. The method of treating materials incidental to dyeing which consists in subjecting the freshly dyed materials for a time to an atmosphere of non-oxidizing gas capable of controlling or modifying the action upon the dye of a reactive chemical agent previously applied.

2. The method of treating materials incidental to dyeing which consists in subjecting the freshly dyed materials for a time to an atmosphere of heated non-oxidizing gas capable of controlling or modifying reaction upon the dye of a chemical agent previously applied.

3. The method of treating materials incidental to dyeing which consists in subjecting the freshly dyed materials for a time to an atmosphere of non-oxidizing gas capable of controlling or modifying the action upon the dye of different reactive chemical agents previously applied.

4. The method of treating materials incidental to dyeing which consists in subjecting the freshly dyed materials for a time to an atmosphere of ordinary illuminating gas to control or modify the reaction upon the dye of a reducing agent previously applied.

5. The method of treating materials incidental to dyeing which consists in subjecting the freshly dyed materials for a time to an atmosphere of heated illuminating gas to control or modify the reaction upon the dye of a reducing agent previously applied.

6. The method of treating materials incidental to dyeing which consists in subjecting the freshly dyed materials for a time to an atmosphere of ordinary illuminating gas to control or modify the reaction upon the dye of reducing and oxidizing agents previously applied.

7. The continuous method of treating textile materials incidental to dyeing which consists in passing the freshly dyed materials through an atmosphere of ordinary illuminating gas immediately after subjecting to a reducing agent and before submission to an oxidizing agent for the purpose of controlling or modifying the action of said agents upon the dye.

In testimony whereof, I have hereunto signed my name at Wilmington, Delaware, this 29th day of Sept., 1926.

JOHN MACADAM.