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PHOTOGRAPHIC DIAZOTYPE DEVELOPING
COMPOSITIONBenjamin W. Colman, Berkley, Mich., assignor to
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poration of MichiganNo Drawing. Application April 16, 1952,
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4 Claims. (Cl. 95—88)

1

This invention relates to a developer for dry process reproduction of diazo-dye type coated papers and related reproduction materials, including cloth, film and plastics among others, and more particularly to a developer containing a relatively small concentration of ammonia gas and an agent capable of reducing the volatility of the ammonia gas under normal conditions.

In the dry reproduction process, a reproduction machine is used which usually contains an exposure unit and a developing unit. The diazo-dye coated reproduction material, usually paper, is subjected to a light source which "burns out" the dye coating except in non-exposed areas. The light-subjected paper is then passed through the developing unit where the retained dye is developed upon contact with ammonia gas. The developing unit includes a vapor chamber in which ammonia gas is liberated from a solution of ammonium hydroxide by heating. The ammonia gas expands and contacts the dye-coated reproduction material as it passes over the vapor chamber, reacting with the dye to produce an image on the material.

This invention has for its objects the reduction of the volatility of ammonia gas in water solution, and the liberation and activation of the ammonia gas from water solution, when heated. If dilute ammonium hydroxide alone, or for that matter even concentrated ammonium hydroxide, were heated to vaporization, the ammonia gas would be liberated by heating or boiling the water and in that process disassociation would take place with some difficulty between the ammonia gas and the water. In the instant invention, it is seen that an important function in this disassociation occurs, and that is that the agent to be described below stimulates the disassociation of the ammonia gas from the water solution more efficiently and more effectively, so that more ammonia gas is liberated from a dilute solution of this invention than would be liberated from more concentrated ammonium hydroxide solutions. It is believed that the activation of the disassociation of ammonia gas occurs by means of an effervescence of the agent to be described below, when the solution is heated.

An excellent developer embodying the invention can be formulated as follows:

	Per cent by volume
Concentrated 26° Baumé ammonium hydroxide	30
Water	50
Hydrogen peroxide of 5% concentration	20

2

Tests made with this developer in Ozalid and Paragon Revolute machines indicate excellent development of the dye-coated reproduction materials together with a substantial reduction of fumes and volatility of the ammonia gas, which latter aspect constitutes one of the principal, if not "the" principal objection to the use of ammonia gas dry process reproduction equipment.

Tests also indicate that the speed of development of the developer solutions of this invention, compared with that of dilute ammonium hydroxide of the same concentration, is considerably better, and this improvement is derived from the inclusion of hydrogen peroxide in the solutions.

Tests further show that the developer solutions of this invention have reduced volatility, and this is believed to be derived from the inclusion of hydrogen peroxide in the solutions. One test in an Ozalid Ozamatic machine, a desk-size unit, was performed to check the flue gases for ammonia. A sheet of sensitized diazo-dye coated paper was placed over the vent tube of the machine, while in operation. The exhaust fan was removing 210 C. F. M. from the vaporization chamber. The sensitized paper was held at the vent tube for more than two minutes without a sign of development on the dye-coated paper. This indicated that there were no ammonia gases, of any appreciable quantity, being emitted from the machine.

It is believed that the hydrogen peroxide in the developer solution generates an effervescence in the solution when heated, thus causing a greater and more effective liberation of ammonia gas from the solution. If this is true, then the amount of ammonia gas released from a dilute solution with the stimulating aid of hydrogen peroxide, on the basis of equivalent development of the dye-coated papers, may be substantially the equivalent amount of ammonia gas released from concentrated ammonium hydroxide—with which it was compared—when heated under the same conditions in the vaporization chamber of a machine.

Various concentrations of the ingredients of the developer solutions of this invention have been tried, and the following range of compositions will give satisfactory development and a reduction in ammonia gas volatility for the numerous types and sizes of equipment, as well as for the variety of reproduction materials and coatings requiring ammonia gas as the developing agent.

The range of compositions which will perform the functions of a satisfactory developer for am-

monia gas dry process reproduction equipment, keeping in mind the many variables in materials and equipment, is:

	Per cent
Concentrated 26° Baumé ammonium hydroxide.....	5 to 60
Water.....	5 to 90
Hydrogen peroxide of 5% concentration	5 to 60

Percentages here given are by volume.

The following formulations, falling within the limits above given, have been found satisfactory (by volume):

	Per cent
Conc. 26° Baumé ammonium hydroxide...	40-30
Water.....	40-60
Hydrogen peroxide (5% conc.).....	20-10

The concentration of the hydrogen peroxide may be varied, depending upon the concentration of ammonium hydroxide in the solution, from as little as 1% to as high as 20%. The correlating factor seems to be that the larger the volume of concentrated ammonium hydroxide, the more hydrogen peroxide should be used. This can be achieved either by increasing the amount of dilute hydrogen peroxide or by employing a smaller measure of more concentrated hydrogen peroxide. These adjustments are best left to the individual requirements, which to some degree are controlled by machine size, capacity, belt speeds, efficiency of vaporization chamber heat control, and other factors subject to variation in the equipment.

Certain machine conditions, such as vaporization chamber operation temperatures, blower exhaust capacities, vaporization chamber volumes, developing belt speeds, etc. may require adjustment in the composition of the developer solutions of this invention. But any person skilled in the use and operation of these machines will be able to vary the amounts of each element

specified herein to achieve the desired results, whether it be in the direction of improved development or reduction in ammonia gas volatility.

Another important element in this invention is the fact that no solid materials are used in the formulation, and testing has shown that no deposits are left on the heating elements or portions of the equipment.

Having described my invention in its simplest terms, it is to be understood that the details of the foregoing specification may be changed and varied in greater or lesser degree without departing from the essence of my invention.

I claim:

- 15 1. A reproduction developer of the class described consisting of from 10% to 60% concentrated 26° Baumé ammonium hydroxide, 5% to 85% water, and 5% to 60% hydrogen peroxide of 5% concentration, by volume.
- 20 2. A reproduction developer of the class described consisting of 30% concentrated 26° Baumé ammonium hydroxide, 50% water, and 20% hydrogen peroxide of 5% concentration in water solution, by volume.
- 25 3. A reproduction developer of the class described consisting of 40% concentrated 26° Baumé ammonium hydroxide, 40% water, and 20% hydrogen peroxide of 5% concentration in water solution, by volume.
- 30 4. A reproduction developer of the class described consisting of 30% concentrated 26° Baumé ammonium hydroxide, 60% water, and 10% hydrogen peroxide of 5% concentration in water solution, by volume.

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References Cited in the file of this patent

- Redgrove et al.: "Hair-Dyes and Hair Dyeing Chemistry and Technique," Chemical Publ. Co., N. Y., 1939, pp. 134-135.