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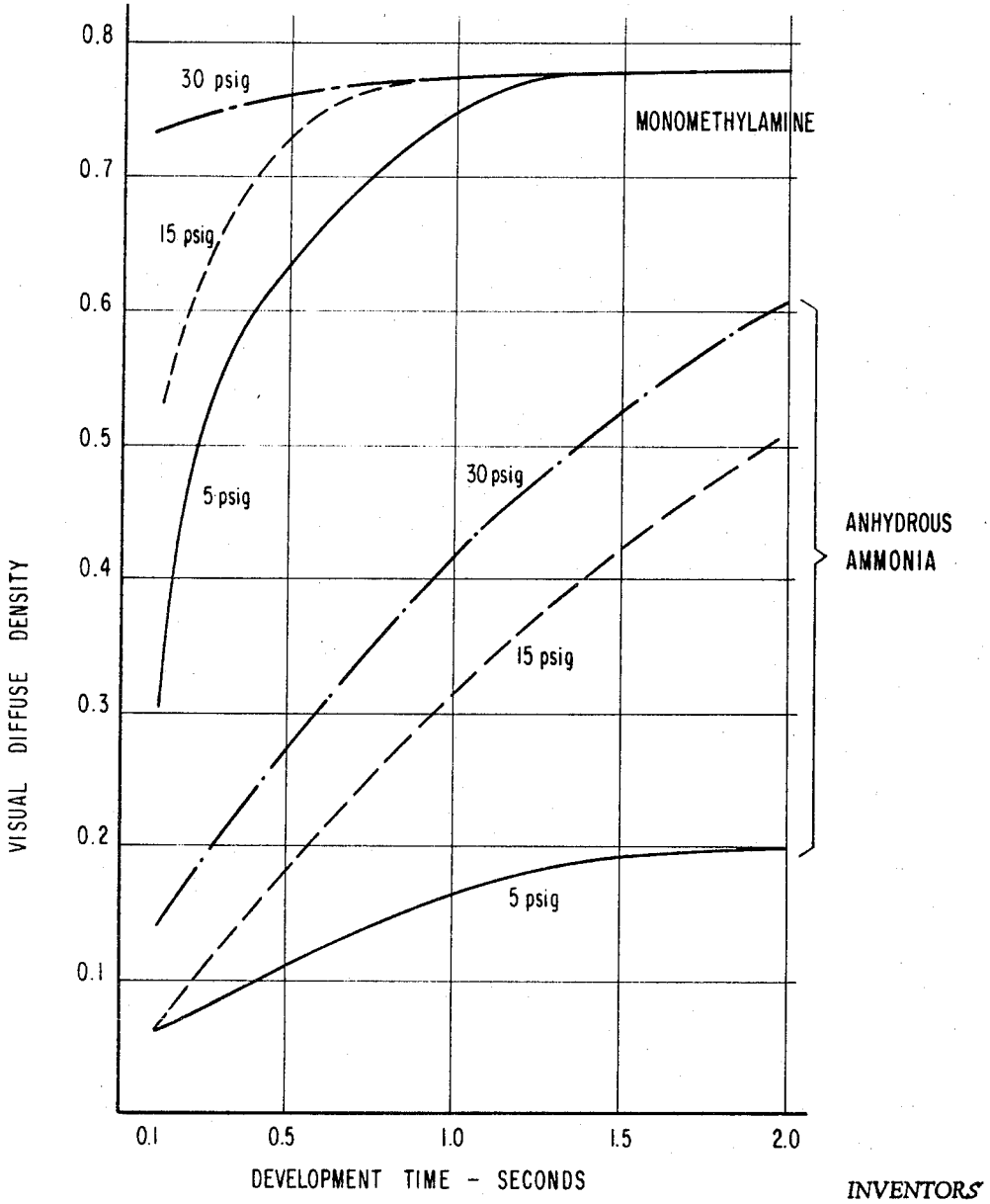

INVENTORS

FRANK W. HAINING
BERNARD I. HALPERIN
JAMES O. THOMPSON

BY Sughrue, Rothwell, Mion, Zinn & Macpeak
ATTORNEYS

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PROCESS FOR DEVELOPING DIAZOTYPE MATERIALS

Frank W. Haining, Vestal, Bernard I. Halperin, Glen Aubrey, and James O. Thompson, Endwell, N.Y., assignors to International Business Machines Corporation, Armonk, N.Y., a corporation of New York

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The present invention relates to a new process for the development of diazotype materials including papers, films and plates.

In general, the purpose of the invention is to provide a new method for developing diazotype materials at high speeds.

It has recently been proposed to develop diazotype materials by the use of anhydrous ammonia under pressure. However, according to the present invention, it has now been found that diazotype materials can be developed at much faster rates, sometimes exceeding ten times those achieved by use of anhydrous ammonia.

The present invention comprises developing two component diazotype materials by contacting them with lower aliphatic amines, especially monomethylamine, at pressures above atmospheric and preferably above about 5 p.s.i.g. Additional speed is obtained by increasing the pressure up to about 30 p.s.i.g., but above that level little additional advantage is to be gained. The aliphatic amine developing agent may be used in the pure anhydrous state, either alone or in admixture with other lower aliphatic amines, or may be mixed with diluent vapors, either inert or reactive. Air and water vapor are examples of diluents which may be mixed with the amine developer. Also, inert gases, such as the well known Freon gases, may be employed. For example, Freon 12 (dichloro difluoro methane), may be mixed with monomethylamine or other lower aliphatic amine developing agents to provide a highly satisfactory developer.

The present method also has the advantage that it is not limited to operation at any specific temperature, but may be conducted at ambient temperature or elevated temperatures without any disadvantage. In some cases, additional speed may be gained by operating at elevated temperatures. In the case of higher boiling lower aliphatic amines, it may be necessary to warm the amine reservoir and/or the developing chamber to provide and maintain the developer in the vapor state. The developing process may be conducted in an uncomplicated device which need only provide for the admission of the developing vapors into a chamber, where the vapors are applied to the surface of a two-component diazotype element and for maintenance of the developer vapors or gas under pressure for a brief period of time.

In most instances, development by the present method for less than 2 seconds and generally only about 1 second is sufficient to develop the diazotype element substantially completely.

The present process may be applied to standard two-component diazotype films, plates and papers. Such materials usually comprise a support of paper, transparent film or the like provided with a coating of light-sensitive diazonium salts and couplers. The composition ordinarily will also contain a pH modifying agent to maintain the composition at a pH level below that at which the coupler and diazonium salt will react. Other conventional additives to the composition include buffers, antioxidants and other materials known to the art.

The present method for developing such conventional two-component diazotype materials is a vast improvement over conventional aqueous alkaline systems and, unexpectedly, is also a striking improvement over the high pressure development of such films with anhydrous ammonia. The magnitude of the improvement is demonstrated in the following description of a preferred embodiment of the invention as compared with high pressure development with anhydrous ammonia.

EXAMPLE

For purposes of the following comparison, a MYSPH Film (Tecnifax Corporation) was used as the starting material. This film is of a conventional two-component formulation and is intended for development by aqueous ammonia according to procedures now most commonly employed in the art.

The apparatus used for developing the film included a film sample chamber and means for instantaneously adding a gaseous developing agent to the film sample chamber. The chamber had a very small volume formed by sandwiching the sample between two closely fitting surfaces so that very little dead space or volume remained. After removal of the air from around the sample, the developing vapor was admitted to the chamber under control of a fast acting valve system which permitted dwell times of 0.05 second and above for the developer.

After contact with the film sample, the developing gas was exhausted from the film chamber, air was admitted, and the sample was removed.

Using this procedure, several samples of the same film were developed by using monomethylamine and by conducting the development at various pressures. Other samples were developed with anhydrous ammonia under the same conditions of pressure and time. The optical densities, visual diffuse densities, of the resulting images were measured by using a Welch Densichron Model 10 with a No. 96 (visible) filter.

The improved results obtained by development of two-component diazotype materials with a lower aliphatic amine under pressure as compared with anhydrous ammonia may be appreciated by reference to the data in the following table.

HIGH PRESSURE DEVELOPMENT

Development time (secs.)	Anhydrous ammonia			Lower aliphatic amine		
	Visual diffuse density					
	Pressure (p.s.i.g.)					
	5	15	30	5	15	30
0.5	0.11	0.18	0.275	0.63	0.725	0.76
1.0	0.16	0.32	0.425	0.75	0.775	0.775
1.5	0.19	0.425	0.525	0.775	0.775	0.775
2.0	0.2	0.51	0.61	0.775	0.775	0.775

A comparison of the results appearing in the above table is graphically presented in the accompanying drawing. In the graph, the vertical axis is calibrated for visual diffuse density measured after development of each film sample. The horizontal axis is calibrated in seconds corresponding to the development or dwell time of each sample. As indicated on the graph, the lower three plotted curves are based on results obtained by development of film samples with anhydrous ammonia according to the preceding description. The upper three curves reflect the results obtained by development of the same type of film, under exactly the same conditions, but using monomethylamine as the developer.

It will be seen by reference to the graph that the rate of development with monomethylamine is very significantly faster than that obtained by using anhydrous ammonia at corresponding pressures of from 5 to 30 p.s.i.g. (20 to 45 p.s.i.a.). The ultimate visual density reached by development with monomethylamine at the lowest pressure of 5 p.s.i.g. for 1 second is very much higher than that obtained with anhydrous ammonia development for the rel-

atively long period of 2 seconds at 30 p.s.i.g. These densities were approxmiately 0.75 for methylamine and 0.61 for ammonia.

It will also be seen that substantially complete development of the film is achieved with monomethylamine where the contact time is less than 2 seconds and, at higher pressures, after about only 1 second.

The effectiveness of gaseous monomethylamine as a developing agent has also been demonstrated with other two-component diazotype coatings and films, such as "K-tone," also manufactured by Tecnifax Corporation, and "Unit Gamma," manufactured by General Aniline and Film Company. In addition, the effectiveness of the other members of the group of lower aliphatic amines in the vapor state and under pressure has also been demonstrated. Lower aliphatic amines, such as dimethylamine, trimethylamine, and monoethylamine, have shown themselves to be satisfactory and to give comparable results when used alone or mixed with diluents as described above.

It has generally been accepted by those skilled in the art that the rate of the coupling reaction between a light-sensitive diazo salt and a coupler is determined primarily by the concentration of the reactants, the pH of the system, and the temperature at which the reaction occurs. It is, therefore, unexpected that the developing rate of such materials can be so dramatically increased by utilizing lower aliphatic amines in the gaseous state under pressure as a developing agent.

It will be obvious to those skilled in the art that various modifications may be made in the process illustratively described above without departing from the spirit or scope of the invention as expressed in the following claims.

What is claimed is:

1. A method for developing a two-component diazotype element comprising contacting said element with vapors of a lower aliphatic amine compound at a pressure above about 5 p.s.i.g. for a period sufficient to yield a visible image.

2. The method of claim 1 wherein said compound is selected from the group consisting of monomethylamine, dimethylamine, trimethylamine and ethylamine.

3. The method of claim 1 further comprising warming said lower aliphatic amine compound above room temperature to provide said vapors.

4. The method of claim 1 wherein said vapors are contacted with said element for a period of less than 2 seconds.

5. The method of claim 1 wherein said vapors are contacted with said element for a period of about 1 second.

6. The method of claim 1 wherein said compound is monomethylamine.

7. The method of claim 1 wherein said compound is dimethylamine.

8. The method of claim 1 wherein said compound is trimethylamine.

9. The method of claim 1 wherein said compound is ethylamine.

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NORMAN G. TORCHIN, *Primary Examiner.*

C. BOWERS, *Assistant Examiner.*