United States Patent [19]

Whitman

[11] **3,816,213**

[45] **June 11, 1974**

[54] **PROCESS AND AGENTS FOR OPENING PAPER CONSTRUCTIONS**

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[22] Filed: **Oct. 26, 1971**

[21] Appl. No.: **192,607**

Related U.S. Application Data

[62] Division of Ser. No. 28,051, April 13, 1970, Pat. No. 3,677,460.

[52] **U.S. Cl.** ..... **156/344,** 53/381, 117/76 P, 117/154, 156/247, 229/85, 252/143

[51] **Int. Cl.** **B43m 7/00**

[58] **Field of Search** ..... 117/11, 44, 46, 154, 76 P, 117/66; 229/66, 85, 51 TS, 51 WB; 206/84; 8/14, 114.6; 252/90, 91, 143; 53/381; 156/247, 344, 2

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[57] **ABSTRACT**

The present process is for opening paper constructions or structures, such as the marginal edges of envelopes, by treating a portion with a sensitizing agent which comprises an alkyl sodium sulfate, thereafter applying a developing agent comprising a strong organic acid to the sensitized portion, heating the developed portion to degrade it and thereafter applying mild mechanical action to remove the degraded portion.

22 Claims, No Drawings

PROCESS AND AGENTS FOR OPENING PAPER CONSTRUCTIONS

This patent application is a division of U.S. Pat. application Ser. No. 28,051, filed Apr. 13, 1970, said U.S. Pat. application Ser. No. 28,051 is now U.S. Pat. No. 3,677,460.

DESCRIPTION OF THE INVENTION

The present invention is directed to a process for opening paper constructions and the agents to be used in said process. The process will be described in connection with the opening of paper envelopes but it will be understood that the invention is not limited to this use and may be used to sever or open other paper objects.

A principle object of this process is to open three sides of envelopes without damaging the contents thereof. The system is designed to deal primarily with business return envelopes which usually contain checks and identifying business machine cards, although tramp metal enclosures are also commonly found in such envelopes.

A number of envelope openers are on the market, but they are primarily mechanical. While these are satisfactory for opening one side of an envelope, they are not satisfactory when used to open three sides since they must usually cut off about 1/16 of an inch of the envelope to take care of misalignment in the machine. In making this deep cut, the enclosures may be damaged. The paper shavings also accumulate rapidly at the preferred opening rate of 500 envelopes per minute and this poses a disposal problem.

The present invention comprises a controlled chemical degradation of the edges of the envelopes followed by mild mechanical action to open the degraded edges with a minimum of paper scrap. The several steps of the process may be performed by manual control or they may be automated to any desired degree.

An object of the present invention is to provide a controlled chemical process for degradation of paper.

An object of the present invention is to provide a chemical process for opening three sides of an envelope without damaging the contents thereof.

Another object of the present invention is to provide agents which can be used in the degradation and opening of paper structures.

These and other objects will occur to those skilled in the art upon reading the specification and appended claims or will occur upon actual use of the invention in practice.

The present invention is an improvement over chemical degradation process described in such patents as U.S. Pat. No. 2,866,589 issued to L. F. Zacker on Dec. 30, 1958 and U.S. Pat. No. 2,801,745, issued to L. W. Piester on Aug. 6, 1957, and it relates to a process in which a controlled chemical degradation of a portion of a paper construction, such as an envelope, causes rupture and opening of the treated portions upon application of mild mechanical action.

The process in its broadest context involves application of a sensitizing agent to the portion to be opened followed by application of a developing agent. Heat is thereafter applied to release the degrading chemical from the developed sensitizing agent and mild mechanical action removes the degraded portion from the structure.

The preferred sensitizing agent comprises an alkyl sodium sulfate. The lower molecular weight alkyl compounds such as n-propyl, hexyl and dodecyl compounds are preferred over the higher weights. One example of a higher molecular weight compound is sodium lauryl sulfate which is available in the trade in "Stepanol WA" and "Duponol WAQ." The compound of choice is n-propyl sodium sulfate. It may be present to the extent of 10 percent in an isopropyl alcohol solution which may also comprise about 10 percent water. Aqueous solutions, however, may be used if weakening of the paper is not objectionable. When applied to the paper before manufacture of the envelope it has found desirable to have 2 percent of a rewetting agent and a small amount of suitable viscosity control agents in the solution. A suitable rewetting agent is nonylphenol-1θ-ethoxylate, such as "Tergitol NPX," sold by Union Carbide.

If the sensitizing agent is to be applied after the envelope is manufactured but prior to mailing, the viscosity control agents may be dispensed with. A water solution of the sensitizing agent can be also used in place of the preferred isopropyl alcohol solution.

Application of the agent after mailing calls for use of a wetting agent in place of the rewetting agent described above. Sodium dioctyl sulfosuccinate or a linear alcohol ethoxylate, such as found in "Tergitol 15—S–7," sold by Union Carbide, may be used.

The sensitizing agent may be printed onto the envelope blank prior to folding. This requires printing a band at least ⅛ inch wide to insure that the edge of the folded envelope is included on the band. A number of printing processes may be used including felt pad, flexographic letter press, and simulated gravure in flexographic.

When applied after envelope manufacture the agent may be applied by roll, spray or pad to the edges of the envelope. The paper may be coated on the inside with a water repellant composition. Use of such a coating provides a better control of the developing agent which is applied to the sensitized portion.

Application of the developing chemical is an important step in the overall process. Addition of too much retards the time cycle and is accompanied by potential degradation of the enclosures. Addition of too little will not open the envelope without serious charring occurring to both the envelope and enclosures. It has been found that satisfactory operation requires the addition of about 0.5 to 2.0 milligrams of a solution of 10 percent oxalic acid in water to each inch of envelope edge (24-lb kraft or white paper) that has been saturated with the sensitizing chemical system. Application by spray, roll or pad methods may be used. Other strong organic acids as acetic acid, may also be used in equivalent quantity.

After application of the developing agent the treated portion may be dried. It has been found possible to dry the portion satisfactorily by impinging air heated to 90° C and flowing at a rate of 1,300 ft. per minute upon the envelope edge at a 45° angle for 30 seconds. Exposures of up to one minute do not cause degradation. Use of dried edges insures better uniformity and less potential thermal damage, although the edges may be left wet, if desired.

The treated portion is then heated to hydrolyze the sodium alkyl sulfate to the free alcohol which evaporates quickly leaving behind free sulfuric acid in small quantities as well as the salt of the organic acid. The acid degrades the paper in a controlled manner. Exposure for 10 seconds to infrared radiation by holding the edges one inch from a domestic stove heating element or one inch from a quartz tube with tungsten filament rated at 80 watts per inch has proven satisfactory.

After degradation the edges may be removed by mild mechanical action. A rotating nylon filament brush has been successfully employed. It is also desireable to provide some ventilation to dispose of the removed pieces.

While the invention has been described in connection with the opening of three edges of an envelope, it will be understood that the invention may be used to open less than the three edges.

It can be seen from the foregoing that the present process provides a simple, controlled chemical process for opening paper structures without danger of damage to the contents therein and without scrap disposal problems associated with more conventional mechanical procedures.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. A process for opening a portion of a paper envelope, consisting of (1) applying a chemical sensitizing agent comprising an alkyl sodium sulfate to a predetermined portion adjacent at least one edge of said envelope, (2) applying a chemical developing agent comprising an organic acid selected from the class consisting of oxalic acid and acetic acid to said predetermined portion to release a degrading agent from the developed sensitizing agent to degrade said predetermined portion, said degrading agent comprising sulfuric acid of sufficient concentration to degrade the paper, (3) heating said developed sensitized portion, and (4) applying mild mechanical action to the developed sensitized portion.

2. A process as claimed in claim **1** in which said sensitizing agent comprises a lower molecular weight alkyl sodium sulfate.

3. A process as claimed in claim **1**, in which said sensitizing agent comprises n-propyl sodium sulfate.

4. A process as claimed in claim **1** in which said sensitizing agent comprises about a 10 percent solution of n-propyl sodium sulfate.

5. A process as claimed in claim **4** in which said solution comprises a major amount of isopropyl alcohol.

6. A process as claimed in claim **1** in which said developing compound comprises oxalic acid.

7. A process as claimed in claim **1** in which said developing compound comprises a 10 percent solution of oxalic acid.

8. A process as claimed in claim **1** wherein said sensitizing agent comprises a higher molecular weight alkyl sodium sulfate.

9. A process as claimed in claim **1** wherein said sensitizing agent is sodium lauryl sulfate.

10. A process as claimed in claim **1** in which said developing agent is acetic acid.

11. A process as claimed in claim **1** in which said predetermined portion is a zone along a plurality of edges.

12. A process for opening a portion of a paper envelope, to which a chemical sensitizing agent comprising an alkyl sodium sulfate has been applied to a predetermined portion adjacent at least one edge of said envelope, said process consisting of steps of: (1) applying a chemical developing agent comprising an organic acid selected from the class consisting of oxalic acid and acetic acid to said predetermined portion to release a degrading agent from the developed sensitizing agent to degrade said predetermined portion, said degrading agent comprising sulfuric acid of sufficient concentration to degrade the paper, (2) heating the developed sensitized portion, and (3) applying mild mechanical action to the developed sensitized portion.

13. A process as claimed in claim **12** in which said sensitizing agent comprises a lower molecular weight alkyl sodium sulfate.

14. A process as claimed in claim **12** in which said sensitizing agent comprises n-propyl sodium sulfate.

15. A process as claimed in claim **12** in which said sensitizing agent comprises about a 10 percent solution of n-propyl sodium sulfate.

16. A process as claimed in claim **15** in which said solution comprises a major amount of isopropyl alcohol.

17. A process as claimed in claim **12** in which said developing compound comprises oxalic acid.

18. A process as claimed in claim **12** in which said developing compound comprises a 10 percent solution of oxalic acid.

19. A process as claimed in claim **12** in which said developing agent is acetic acid.

20. A process as claimed in claim **12** in which said predetermined portion is a zone along a plurality of edges.

21. A process as claimed in claim **12** wherein said sensitizing agent comprises a higher molecular weight alkyl sodium sulfate.

22. A process as claimed in claim **12** wherein said sensitizing agent is sodium lauryl sulfate.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,816,213 Dated June 11, 1974

Inventor(s) NELSON WHITMAN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 5, cancel the comma (,) and substitute ---and---.

Column 2, line 5, cancel "and dodecyl".

Column 2, line 8, after "sulfate" insert ---which is a dodecyl compound and---.

Signed and sealed this 15th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.