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

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[*] Notice: The portion of the term of this patent subsequent to July 18, 1989, has been disclaimed.

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Related U.S. Application Data

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[52] **U.S. Cl.** **229/85,** 117/76, 117/154, 156/247, 53/281

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

[58] **Field of Search** ..... 229/51 WB, 66, 85; 117/44, 117/46, 154; 161/7; 156/247

[56] **References Cited**

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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.

4 Claims, No Drawings

PROCESS AND AGENTS FOR OPENING PAPER CONSTRUCTIONS

DESCRIPTION OF THE INVENTION

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

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 one-sixteenth 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 and hexyl compounds are preferred over the higher weights. One example of a useable higher molecular weight compound is sodium lauryl sulfate which is a dodecyl compound and 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% in an isopropyl alcohol solution which may also comprise about 10% 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 desireable to have 2% of a rewetting agent and a small amount of suitable viscosity control agents in the solution. A suitable rewetting agent is nonylphenol-10-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 one-eighth 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% 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 1300 ft. per minute upon the envelope edge at a 45° angle for 30 seconds. Exposures of up to 1 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. Expo-

sure for 10 seconds to infrared radiation by holding the edges 1 inch from a domestic stove heating element or 1 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. In a paper envelope of the type having opposed sheets folded relative to each other and connected together at a plurality of edges the improvement of which comprises at least a portion of the envelope adjacent at least one of said edges being impregnated with a chemical sensitizing agent consisting essentially of a higher molecular weight alkyl sodium sulfate, whereby treatment of at least one of said edges with a chemical developing agent subjects the paper of said edge to a controlled chemical degradation to affect the separation of the opposed sheets along said edge.

2. A paper envelope as claimed in claim **1** in which said sensitizing agent is impregnated along three coextensive edges.

3. A paper envelope as claimed in claim **1** wherein said edge has a first coating of said chemical sensitizing agent and a second coating of a chemical developing agent, said plural coatings being superimposed on each other.

4. A paper envelope as claimed in claim **1** wherein said sensitizing agent is sodium lauryl sulfate.

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